

Midterm exam #2
Investments (FIN 323), Fall 2023
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Please print your name on the line below:

- This test has 25 questions. Each question counts for one point.
- You have 75 minutes to take the test (3 minutes per question).
- There are 15 multiple choice questions. These have only one answer.
Mark your answer clearly in the box next to the question.
- There are 10 free-answer questions. **Their answer is always a number, a dollar amount, or a percentage return or growth rate.** Write your answer in the line under the question. I will only grade the answer, not the calculations that you did.
For these questions, **do not round your answer** unless I tell you to.
- You can bring one page of notes, front and back.
- You should bring a calculator, but it should not have wireless capability.

I. Portfolio optimization

Suppose you forecast the following about the annual **excess** returns of three funds:

Fund	Average excess return	Volatility of excess return
Risk-free	0%	0%
Fund #1	5%	30%
Fund #2	10%	40%

Assume each pair of funds has **zero** correlation. Assume that the risk-free rate is 3%. Use this information to answer questions 1 through 5:

Question 1: If you forecast the *geometric average* return of each fund, using our approximation from class, what would be your highest forecast across the three funds?

Question 2: What is the volatility of a portfolio that is 50% risk-free, 50% Fund #2?

Question 3: What is the volatility of a portfolio that is 50% Fund #1, 50% Fund #2?

Question 4: Suppose a mean-variance investor with $A=5$ can hold the risk-free fund, and just *one* of the risky funds. What percent of their wealth should be in the risky fund?

Question 5: Suppose instead that the investor can hold any combination of the funds. Is there any fund that they would give **zero** weight to? (*No calculations are necessary!*)

- ☐ A) They would **definitely not** allocate any money to the risk-free fund.
- ☐ B) They would **definitely not** allocate any money to fund #1.
- ☐ C) They would **definitely not** allocate any money to fund #2.
- ☐ D) No, they would allocate a positive amount to **all** of the funds.

Question 6: Many advisors recommend that risk-averse people should avoid growth stocks, and seek out stocks with low volatility and high dividends. The portfolio optimization model does *not* support that advice. What does it suggest instead?

Answer: Someone who is more risk-averse than the average person should hold...

- ☐ A) ...a **less-diversified** portfolio of stocks than the average person.
- ☐ B) ...a **more-diversified** portfolio of stocks than the average person.
- ☐ C) ...**the same** portfolio of stocks as the average person, but invest **less** in it.
- ☐ D) ...**the same** portfolio of stocks as the average person, but invest **more** in it.

Question 7: Suppose an investor's risky investments deliver a Sharpe ratio of 0.2, and the investor will only accept a 40% volatility of her overall wealth. Then, what is the highest excess return that this investor can expect to earn?

Question 8: Suppose that there are two risky investments, and for every portfolio that you build from them, the portfolio volatility is a weighted average of each investment's volatility. What is the correlation of the investment returns?

- ☐ A) $\rho = -1$
- ☐ B) $\rho = 0$
- ☐ C) $\rho = 0.5$
- ☐ D) $\rho = 1$

Question 9: Suppose that there are two risky investments, and you find a way to build a portfolio of them that has *zero* volatility. What is the correlation between their returns?

- ☐ A) $\rho = -1$
- ☐ B) $\rho = 0$
- ☐ C) $\rho = 0.5$
- ☐ D) $\rho = 1$

Question 10: Suppose there are many risky investments. You plot all possible portfolios of them as we did in class, with volatility of excess return on the horizontal axis and average excess return on the vertical axis. The possible portfolios trace out a curve that points left. But, many of these portfolios will never be used by a risk-averse investor. What can we say about any portfolio that **is actually held** by a risk-averse investor?

- ☐ A) It must be **inside** the curve.
- ☐ B) It must be **outside** the curve.
- ☐ C) It must be **on the upper edge** of the curve.
- ☐ D) It must be **on the bottom edge** of the curve.

II. Portfolio statistics and the CAPM

For questions 11 through 16, use the table below, which gives some historical data about the annual excess returns for a specific investment strategy, and for the market portfolio.

Market beta of the strategy's annual excess return	0.8
Average of the strategy's annual excess return	10%
Volatility of the strategy's annual excess return	40%
Information ratio of the strategy with respect to the market portfolio	0.117
Average of the market portfolio's annual excess return	8%
Volatility of the market portfolio's annual excess return	32%

Question 11: Suppose an investor holds just the market portfolio. What hurdle rate do they set for the above strategy's excess return, according to modern portfolio theory? Assume that they forecast the future to look similar to the historical data above.

Question 12: If an investor decides to invest a small amount in the strategy described above, with the rest of her wealth in the market portfolio, what can we say about the volatility of her resulting portfolio? (*No calculations are necessary to answer this!*)

- ☐ A) Less than 32%.
- ☐ B) Between 32% and 40%
- ☐ C) Greater than 40%.

Question 13: What is the **correlation** ρ (rho) between the annual excess return of this strategy, and the annual excess return of the market?

Question 14: What is the **intercept** α (alpha) in the regression that calculates beta?

Question 15: What is the standard deviation of the residuals from that regression, $\sigma(\epsilon)$? Round to the nearest percent.

Question 16: What is the maximum Sharpe ratio that the investor can achieve, using just the market portfolio and this new strategy? Round to three decimal places.

Question 17: Suppose you forecast that a risky investment will deliver a higher Sharpe ratio than your current portfolio of risky investments. In what situation would you **not** be able to increase your portfolio's Sharpe ratio by using this investment?

- ☐ A) If the investment has a **high correlation** with your existing portfolio.
- ☐ B) If the investment has a **lower excess return** than your existing portfolio.
- ☐ C) If the investment has **higher return volatility** than your existing portfolio.
- ☐ D) None of the above: You can definitely increase your Sharpe ratio.

Question 18: The CAPM says that investors might be willing to hold an investment, even if it is very volatile and barely outperforms the risk-free rate. (An example of this was gold, as we discussed in class.) Which part of the CAPM explains this behavior?

- ☐ A) Investors only care about non-diversifiable (systematic) risk
- ☐ B) Investors only care about diversifiable (idiosyncratic, non-systematic) risk
- ☐ C) Investors only care about the Sharpe ratio of each individual investment
- ☐ D) Investors only care about the average return on their overall portfolio

Question 19: All of the concepts listed below are part of the CAPM. Which of them is also part of portfolio optimization more generally, and is not *specific* to the CAPM?

- ☐ A) Recognizing that the average investor holds the market portfolio.
- ☐ B) Making predictions about what will actually happen in financial markets.
- ☐ C) Analyzing investments with a regression slope (beta) and intercept (alpha).
- ☐ D) Assuming that all other investors are also following portfolio optimization.

Question 20: Which of these is *not* part of the ideal CAPM “market portfolio”?

- ☐ A) Corporate bonds.
- ☐ B) Real estate.
- ☐ C) Commodities.
- ☐ D) All of them are part of the ideal market portfolio.

III. Investment styles and the CAPM

In class, we analyzed several basic strategies by building portfolios of stocks, and plotting them in figures of average excess return (vertical) against beta (horizontal). Questions 21 through 25 ask about how we built these figures and what they show:

Question 21: Which of the following was *not* one of the strategies that we looked at?

- ☐ A) Investing in stocks with small market capitalization.
- ☐ B) Investing in stocks with high book-to-market ratios.
- ☐ C) Investing in stocks with high momentum (recent price increase).
- ☐ D) Investing in stocks with high dividend yields.

Question 22: Based on the figures we saw in class, which strategy appeared *least* useful for improving the Sharpe ratio of an investor who starts with the market portfolio?

- ☐ A) Investing in stocks with small market capitalization.
- ☐ B) Investing in stocks with high book-to-market ratios.
- ☐ C) Investing in stocks with high momentum (recent price increase).
- ☐ D) Investing in stocks with high dividend yields.

Question 23: What did we see in the figure that sorted stocks on their book-to-market ratio, focusing only on the time period since 1950? Value stocks have earned...

- ☐ A) ...**higher** average returns than growth stocks, with **similar** betas.
- ☐ B) ...**lower** average returns than growth stocks, with **similar** betas.
- ☐ C) ...**higher** average returns than growth stocks, with **much higher** betas.
- ☐ D) ...**lower** average returns than growth stocks, with **much lower** betas.

Question 24: We drew a line in these figures that connected the risk-free investment with the market portfolio. What can we say about the other portfolios in the figure?

- ☐ A) Anything to the left of the market portfolio has β greater than 1.
- ☐ B) Anything to the left of the market portfolio has β less than 1.
- ☐ C) Anything to the left of the market portfolio has α greater than 0.
- ☐ D) Anything to the left of the market portfolio has α less than 0.

Question 25: Which of the following was an important *limitation* of these figures?

- ☐ A) They avoid survivorship bias.
- ☐ B) They reflect portfolios that investors could have formed in the past.
- ☐ C) They use many years of data.
- ☐ D) They can only tell us about the past, not the future.

END OF THE EXAM

Make sure your name is on the front page!