

## HANDOUT 2

### 1 Logistics

- Final Exam: 7/28 (Tuesday)
- Office hour meeting can be scheduled via *Calendly*.
- Any comments feel free to use the anonymous *Feedback Survey* (on my website).
- (Optional) For iPhone users, install *Pyto* via App Store. For Android users, install *QPython 3L* via Google Play.

#### Key Equations

- Slope ( $m$ ) =  $\frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x}$
- Expectation:  $\mathbb{E}(X) = \sum_{n=1}^t x_n p_n = x_1 p_1 + x_2 p_2 + \dots + x_t p_t$  and  $\sum_{n=1}^t p_n = 1$  ( $p_i$ : probabilities)  
↑  
outcome
- Variance:  $\text{Var}(X) \equiv \sigma^2 = \mathbb{E} \left[ (X - \mathbb{E}(X))^2 \right] = \mathbb{E}(X^2) - [\mathbb{E}(X)]^2$
- Standard deviation:  $\sigma = \sqrt{\text{Var}(X)}$
- Capital asset pricing model (CAPM):  $\mathbb{E}(R_i) = R_{free} + \left[ \mathbb{E}(R_{Market}) - R_{free} \right] \cdot \beta_i$
- Geometric Series:  $S_n = \sum_{n=1}^t a_n = a_1 + \underbrace{a_1 \beta}_{a_2} + \underbrace{a_1 \beta^2}_{a_3} + \dots + \underbrace{a_1 \beta^{t-1}}_{a_t} = \frac{a_1 - a_1 \beta^t}{1 - \beta} = a_1 \cdot \left( \frac{1 - \beta^t}{1 - \beta} \right)$
- (Optional) Newton-Raphson Method (root-finding algorithm):  $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$   
↑  
initial guess

### 2 Math Review

1. Suppose you toss a fair coin 3 times, what is the expected number of heads?
2. In a lottery, you pay \$1 to pick three different numbers between 1 and 12. If all three numbers are correct, you win \$100. What is your expected earnings?
3. When rolling a fair die, what is the variance of the number of dots on the side that comes up?

### 3 Exercise

- Consider two investments both cost \$50,000, investment A pays \$25,000 a year for three years while investment B pays \$20,000 a year for four years. If you required return is 12%, which investment should you choose?
  - B. It's IRR is greater than the required return.
  - B. It's NPV is higher than A's.
  - A. It's IRR is greater than the required return.
  - A. It's NPV is higher than B's.
  - A. Since it pays back sooner.
  
- An investment project initially costs \$7,800. However, for the next four years, the cash inflows from this project are \$1,100, \$1,640, \$3,800 and \$4,500 respectively. What is the payback period for this project?
  - 3.28
  - 4.28
  - 3.36
  - 3.21
  
- Asset W has an expected return of 11.8% and a beta of 1.15. If the risk-free rate is 3.7%, what is the slope of the security market line?
  
- Given the following information, what is the expected return on a portfolio that is 70% invested in A and 30% invested in B?

State	Probability	Return on A	Return on B
Boom	0.65	0.3	0.05
Bust	0.35	0.1	0.2

- 0.2247
  - 0.1918
  - 0.1413
  - 0.1592
- 
- What is the IRR of the following set of cash flows?

Year	0	1	2	3
Cash flow	-\$13,900	\$6,400	\$8,700	\$5,900

6. Standard deviation is a measure of which one of the following?
- real returns
  - risk premium
  - probability
  - volatility
  - average rate of return
7. Which one of the following statements is correct?
- The risk premium is unrelated to the average rate of return.
  - The risk premium is not affected by the volatility of returns.
  - The lower the volatility of returns, the greater the risk premium.
  - The lower the average return, the greater the risk premium.
  - The greater the volatility of returns, the greater the risk premium.
8. Suppose a stock had an initial price of \$79 per share, paid a dividend of \$1.45 per share during the year, and had an ending share price of \$88.  
 What is the percentage total return?  
 What is the dividend yield?  
 What is the capital gains yield?

9. Consider an investment with the following cash flows, the required payback and discounted payback are three and four years respectively. Given that the required return is 8%, should you take this investment?

Year	0	1	2	3	4	5
Cash flow	-\$50,000	\$20,000	\$20,000	\$20,000	\$20,000	-\$50,000

- Yes. Since the discounted payback is less than 4 years.
  - No. The project cash flows are not conventional.
  - Yes. The NPV is positive.
  - No. The NPV is negative.
  - Yes. Both the payback and the discounted payback are less than 2 years.
10. A stock has an expected return of 10.2%, the risk-free rate is 4.1%, and the market risk premium is 7.2%. What must the beta of this stock be?

11. Consider the following information:

State	Probability	Rate of return if state occurs		
		Stock A	Stock B	Stock C
Boom	0.75	0.06	0.15	0.25
Bust	0.25	0.11	-0.04	-0.08

What is the variance of a portfolio invested 20% each in A and B and 60% in C?

12. When the efficient markets is at it's strongest level which of the following is inconsistent?

- (a) It is not possible to earn excess abnormal returns by investing in the stock market.
- (b) Prices adjust quickly when reacting to new information.
- (c) One can not profit regularly from publicly available information.
- (d) Historical price trends give you a good idea of where prices are headed in the future.
- (e) On average, security prices are neither too high nor too low.

13. Which of the following describes a portfolio that plots above the security market line?

- (a) The security's beta is too high.
- (b) The security provides a return that is less than the average return on the market.
- (c) The security's reward-to-risk ratio is too high.
- (d) The security is overvalued.
- (e) The security is providing a return that is less than expected.

14. Given that the risk free rate is 5%, what is the expected market return if the expected return on asset A is 19% with a beta of 1.4?

- (a) 16%
- (b) 19%
- (c) 14%
- (d) 15%

15. A project that provides annual cash flows of \$15,400 for 9 years costs \$67,000 today.

If the required return is 8%, is this a good project?

What is the indifferent discount rate between accepting and rejecting the project?

16. You own a portfolio equally invested in a risk-free asset and two stocks. If one of the stocks has a beta of 1.32 and the total portfolio is equally as risky as the market, what must the beta be for the other stock in your portfolio?
17. Show that the ratio of the risk premiums on two assets is equal to the ratio of their betas.
18. A stock has a beta of 1.14 and an expected return of 10.5%. A risk-free asset currently earns 2.4%.  
 If a portfolio of the two assets has a beta of 0.92, what is the weight of the risk-free asset?  
 If a portfolio of the two assets has an expected return of 9%, what is its beta?  
 If a portfolio of the two assets has a beta of 2.28, what are the portfolio weights?
19. Which one of the following statements best defines the efficient market hypothesis?
- Efficient markets limit competition.
  - All securities in an efficient market are zero net present value investments.
  - Security prices in efficient markets remain steady as new information becomes available.
  - Profits are removed as a market incentive when markets become efficient.
  - Mispriced securities are common in efficient markets.
20. Consider the following information, assume these securities are correctly priced:

Security	Beta	Expected return
A Corp.	1.21	0.1079
B Co.	0.83	0.0843

What is the risk-free rate?

What is the expected return on the market?