

Answer Key

1. A
2. E
3. C
4. B
5. E
6. B
7. D
8. A
9. B
10. E
11. A
12. C
13. B
14. A
15. A
16. A
17. B
18. E
19. C
20. D
21. D
22. C
23. B
24. B
25. D
26. A
27. D
28. B
29. A
30. D
31. D
32. D
33. E
34. B
35. E
36. C
37. E
38. D
39. E
40. C
41. C
42. C
43. D
44. A
45. B
46. A
47. E
48. A
49. B
50. B
51. B

- 52. A
- 53. E
- 54. A
- 55. B
- 56. E
- 57. A
- 58. E
- 59. A
- 60. C

Question 1 (40 points)

(i) (30 points) Choose three investment strategies based on options and describe how to construct them, calculate their payoff and profit, and graph the payoff and profit functions.

Answer: You could choose any three of the five investment strategies we discussed in class. For example, you could have chosen covered call, protective put and straddle.

A covered call is constructed by buying stock and selling call options for the same number of shares bought. The payoff and the profit from a covered call (per share) are shown in the table below and are plotted in figure 1(a):

	$S_T \leq X$	$S_T > X$
Payoff of stock holding	S_T	S_T
Payoff of call writing	0	$X - S_T$
Payoff of covered call	S_T	X
Profit of covered call	$S_T + C$	$X + C$

To create a protective put, an investor needs to buy stock and sell put options for the same number of shares. The payoff and the profit from a protective put are shown in the table below and are plotted in figure 1(b):

	$S_T \leq X$	$S_T > X$
Payoff of stock holding	S_T	S_T
Payoff of put holding	$X - S_T$	0
Payoff of protective put	X	S_T
Profit of protective put	$X - P$	$S_T - P$

A straddle is constructed by buying a call and a put option on the same stock, with the same strike price and the same expiration date. Its payoff and profit are shown in the table below and are plotted in figure 1(c):

	$S_T \leq X$	$S_T > X$
Payoff of call holding	0	$S_T - X$
Payoff of put holding	$X - S_T$	0
Payoff of straddle	$X - S_T$	$S_T - X$
Profit of straddle	$X - S_T - (P + C)$	$S_T - X - (P + C)$

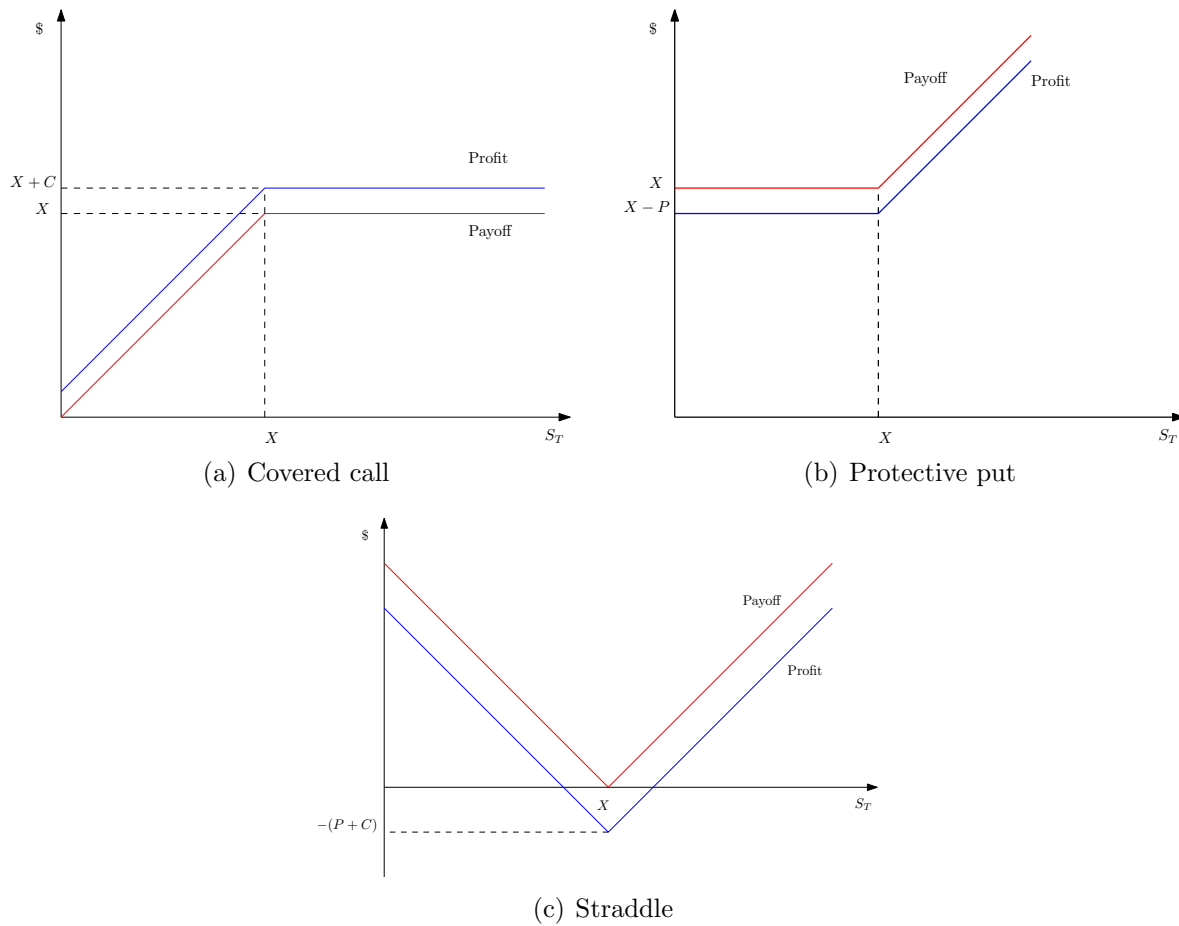


Figure 1: Payoffs and profits (per share) of three investment strategies.

(ii) (10 points) The evolution of the stock market is shown in the table below:

	Year 0		Year 1	
	Price	No. of shares	Price	No. of shares
Stock A	15	150	14	150
Stock B	21	100	8	300
Stock C	24	230	20	230

Calculate the price-weighted index for years 0 and 1 (notice that there is a 3-for-1 stock split for stock B).

Answer: The price-weighted index for period 0 is

$$I_0 = \frac{15 + 21 + 24}{3} = \frac{60}{3} \Rightarrow \boxed{I_0 = 20.}$$

In order to calculate the price-weighted index for period 1, we first need to calculate the divisor:

$$d = \frac{15 + \frac{21}{3} + 24}{20} = \frac{15 + 7 + 24}{20} = \frac{46}{20} \Rightarrow \boxed{d = 2.30.}$$

Now we can calculate the price-weighted index for period 1:

$$I_1 = \frac{14 + 8 + 20}{2.30} = \frac{42}{2.30} \Rightarrow \boxed{I_1 = 18.26.}$$

Question 2 (*extra credit – 15 points*)

Enumerate and describe the market anomalies discussed in class and the way they violate the Efficient Market Hypothesis (that is, which version of the hypothesis is violated – don't forget to define this version of the EMH).

Answer: The efficient market hypothesis holds that stock prices reflect all available information. Its three versions differ in their interpretation of “all available information”. The weak form considers only past trading information (prices, volumes etc.); the semi-strong form adds fundamental data on the firm (dividend prospects, quality of management etc.); and the strong form adds on top of these insider information and *any* other information about the company or the stock.

The market anomalies discussed in class are:

- (1) the “small firm in January” effect—the (adjusted) returns on portfolios of small firms are higher than expected, especially during the first two weeks of January. Since this effect is consistent over time, it is included in the past performance of the stock, and hence violates even the weak form of the EMH (and hence the other two forms as well).
- (2) the “neglected firm” and liquidity effects—the returns on small and illiquid firms are higher than expected, especially in January. Similar to the case above, this violates all three forms of the EMH.
- (3) book-to-market ratios—firms with high book-to-market ratios tend to have higher-than-expected returns (after adjusting for risk as captured by beta). Since this is part of the fundamental information on a firm, this situation violates the semi-strong (and the strong) form of the EMH, but not the weak form.
- (4) the post-earnings-announcement price drift—prices adjust in response to the new information gradually, rather than instantaneously. This violates the weak form (and the other two as well), since past trading data should show that the earnings information should be embodied immediately into stock prices for the returns to adjust to their “normal” level.