Problem Set IV: Foundations of Finance

Foundations of Finance

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Due before or on the day of the Final

1. Chapter 20, Problems 16, 18, 23.


3. MSFX stock is currently selling at $100 per share. I want to invest in MSFX, subject to the following restrictions:
   (a) I don’t want the value of my portfolio one year from now to fall below $90.
   (b) As I don’t think that MSFX will go above 115, I am willing to forego (give up) my rights to any price appreciation above 115.

The interest rate is 10% (continuously compounded). The prices of one-year call options are:

<table>
<thead>
<tr>
<th>X</th>
<th>Call Price</th>
</tr>
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<tbody>
<tr>
<td>90</td>
<td>25.48</td>
</tr>
<tr>
<td>95</td>
<td>22.78</td>
</tr>
<tr>
<td>100</td>
<td>20.32</td>
</tr>
<tr>
<td>105</td>
<td>18.08</td>
</tr>
<tr>
<td>110</td>
<td>16.05</td>
</tr>
<tr>
<td>115</td>
<td>14.22</td>
</tr>
</tbody>
</table>

a. Graph the payoff structure that is most consistent with my stated preferences.

b. If you were building a portfolio from scratch, what would be the cheapest portfolio consistent with the desired payoff structure, if no put options are traded on the stock? (Give the composition and cost of the portfolio.)

c. Suppose that you are advising another investor on how to achieve the same payoff structure. But she already owns the stock, and wants to keep it in the portfolio. What are the composition and cost of her portfolio. For this part, assume that put options are available, and that put-call parity holds.
4. The MarketWide stock index is currently at 100. The Westco Bank is marketing an account that is designed to be attractive to people who want to invest in stock, but are nervous about the downside risk. Their ad reads:

*Play the market with limited risk of loss! Put $100 in our one-year SafeStock account. At the end of the year, you get $95, plus the appreciation (if any) of the MarketWide Index above 100. Here’s what your account will be worth:*

<table>
<thead>
<tr>
<th>If the year-end index is:</th>
<th>You get:</th>
</tr>
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<tbody>
<tr>
<td>50</td>
<td>95</td>
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<td>95</td>
<td>95</td>
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<tr>
<td>100</td>
<td>95</td>
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<td>110</td>
<td>105</td>
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<td>150</td>
<td>145</td>
</tr>
</tbody>
</table>

*You always get at least $95, but there’s no limit to how much you can make!*

The annual interest rate is 10% (compounded annually). A one year (European) put option on the index with an exercise price (X) of 100 is currently selling at 4; a put with X=95 is selling at 2. Assume that put-call parity holds.

a. What is the value of a European call option with an exercise price of 95?
b. What is the value of a European call option with an exercise price of 100?
c. If you were to duplicate the SafeStock account described in the ad with a portfolio of stocks, bonds (possibly borrowing), puts and calls, what would the portfolio look like?
d. If I put $100 in this account, how should the bank invest the money in order to remove all its risk?
e. If the bank follows your suggestion in part (d), what will be the bank’s profit on the account at the end of one year?

5. Chapter 22, Problems 9, 10, 11.

6. Chapter 23, Problems 1, 2.

7. The current interest rate is 10% compounded annually. The spot price of Kryptonite is $10/gram, and the forward price for delivery in one year is $12. Storage costs are 3% per year. Is there an arbitrage here? If so, how would you exploit it? What is the arbitrage profit (amount and time of realization)?

8. Suppose that the Japanese yen is at ¥105 per $ for immediate delivery, ¥103 per $ for delivery in one year, r_{US}=5\% and r_{Japan}=1\%.

a. Are these data consistent with forward-spot parity?
b. A U.S. money manager with dollars to invest is considering investing in Japanese yen. If the fund customers care only about their return in dollars, is the yen investment attractive?
c. If the manager can freely borrow and invest in either currency, what should she do?
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9. A stock split means that at the close of trading an owner of one share of stock gets another share of stock and price of a share is split.
   a. If stocks show, on average, consistently positive abnormal returns (measured using market model residuals) prior to stock-split announcements, does this violate the “semi-strong” form of the efficient market hypothesis? Why or why not?
   b. If stocks show, on average, consistently positive abnormal returns after the announcement of stock splits, does this violate the efficient market hypothesis? Why or why not?

Additional, SUGGESTED, Problems

S1. XYZ is currently selling at $100 per share. One year from now it will be trading at either 75 or 110. The market believes that the probability of the “up” movement is 80%; you believe the probability of the “up” movement is only 50%. The interest rate is 6% (compounded annually).
   a. What is the market price today of a call with an exercise price of 85?
   b. Suppose that you wish to set up a portfolio that will be worth 110 if the stock price goes up, but will only decline to 85 if the stock price goes down. What is the composition of this portfolio? What will it cost?

S2. Microsoft is currently trading at $110 per share. You purchased 100 shares some time ago at $95 and want to avoid having the value of your portfolio drop below $10,000. You are considering
   (A) Buying a 3-month put option with an exercise price of $100. The cost of the put will be $2 per share.
   (B) Leaving a stop-loss sell order with your broker, to be triggered at $100 per share.
   Compare and contrast the costs and benefits of these two strategies.

S3. Suppose that the interest rate in the US is \( r_{US} = 4\% \) and in Australia, \( r_{AU} = 8\% \). The spot exchange rate is $US 0.80 per $AU and the forward price for delivery in one year is $US 0.78 per $AU.
   a. Where should you borrow?
   b. Where should you invest?
   c. How would you arbitrage?

S4. A corporation has issued a $10 million issue of floating rate bonds on which it pays an interest rate 1% over the LIBOR rate. The bonds are selling at par value. The firm is worried that interest rates will rise and would like to lock in a fixed interest rate on its borrowings. The firm sees that dealers in the swap market are offering swaps of LIBOR for 7%. What interest rate swap will convert the firm’s interest obligation into one resembling a synthetic fixed-rate loan? What interest rate will it pay on the synthetic fixed-rate loan?