Solution to *Derivatives Markets*: for Exam FM

Yufeng Guo

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Preface

This is Guo's solution to Derivatives Markets (2nd edition ISBN 0-321-28030-X) for Exam FM. Unlike the official solution manual published by Addison-Wesley, this solution manual provides solutions to both the even-numbered and odd-numbered problems for the chapters that are on the Exam FM syllabus. Problems that are out of the scope of the FM syllabus are excluded.

Please report any errors to `yufeng.guo.actuary@gmail.com`.

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Introduction

Recommendations on using this solution manual:

1. Obviously, you'll need to buy Derivatives Markets (2nd edition) to see the problems.

2. Make sure you download the textbook errata from `http://www.kellogg.northwestern.edu/faculty/mcdonald/htm/typos2e_01.html`

Chapter 1

Introduction to derivatives

Problem 1.1.

Derivatives on weather are not as farfetched as it might appear. Visit `http://www.cme.com/trading/` and you'll find more than a dozen weather derivatives currently traded at CME such as "CME U.S. Monthly Weather Heating Degree Day Futures" and "CME U.S. Monthly Weather Cooling Degree Day Futures."

a. Soft drink sales greatly depend on weather. Generally, warm weather boosts soft drink sales and cold weather reduces sales. A soft drink producer can use weather futures contracts to reduce the revenue swing caused by weather and smooth its earnings. Shareholders of a company generally want the earnings to be steady. They don't want the management to use weather as an excuse for poor earnings or wild fluctuations of earnings.

b. The recreational skiing industry greatly dependents on weather. A ski resort can lose money due to warm temperatures, bitterly cold temperatures, no snow, too little snow, or too much snow. A resort can use weather derivatives to reduce its revenue risk.

c. Extremely hot or cold weather will result in greater demand for electricity. An electric utility company faces the risk that it may have to buy electricity at a higher spot price.

d. Fewer people will visit an amusement park under extreme weather conditions. An amusement park can use weather derivatives to manage its revenue risk.

How can we buy or sell weather? No one can accurately predict weather. No one can deliver weather. For people to trade on weather derivatives, weather indexes need to be invented and agreed upon. Once we have weather indexes, we can link the payoff of a weather derivative to a weather index. For more information on weather derivatives, visit:

- `http://hometown.aol.com/gml1000/wrms.htm`

- `http://www.investopedia.com`

Problem 1.2.

- Anyone (such as speculators and investors) who wants to earn a profit can enter weather futures. If you can better predict a weather index than does the market maker, you can enter weather futures and make a profit. Of course, it's hard to predict a weather index and hence loss may occur.

- Two companies with opposite risks may enter weather futures as counter parties. For example, a soft drink company and a ski-resort operator have opposite hedging needs and can enter a futures contract. The soft drink company can have a positive payoff if the weather is too cold and a negative payoff if warm. This way, when the weather is too cold, the soft drink company can use the gain from the weather futures to offset its loss in sales. Since the soft drink company makes good money when the weather is warm, it doesn't mind a negative payoff when the weather is cold. On the other hand, the ski resort can have a negative payoff if the weather is too cold and a positive payoff if too warm. The ski resort can use the gain from the futures to offset its loss in sales.

Problem 1.3.

a. $100 \times 41.05 + 20 = 4125$

b. $100 \times 40.95 - 20 = 4075$

c. For each stock, you buy at $41.05 and sell it an instant later for $40.95. The total loss due to the ask-bid spread: $100(41.05 - 40.95) = 10$. In addition, you pay $20 twice. Your total transaction cost is $100(41.05 - 40.95) + 2(20) = 50$

Problem 1.4.

a. $100 \times 41.05 + 100 \times 41.05 \times 0.003 = 4117.315$

b. $100 \times 40.95 - 100 \times 40.95 \times 0.003 = 4082.715$

c. For each stock, you buy at $41.05 and sell it an instant later for $40.95. The total loss due to the ask-bid spread: $100(41.05 - 40.95) = 10$. In addition, your pay commission $100 \times 41.05 \times 0.003 + 100 \times 40.95 \times 0.003 = 24.6$. Your total transaction cost is $10 + 24.6 = 34.6$

Problem 1.5.

The market maker buys a security for $100 and sells it for $100.12. If the market maker buys 100 securities and immediately sells them, his profit is
$100(100.12 - 100) = 12$

Problem 1.6.

Your sales proceeds: $300 (30.19) - 300 (30.19) (0.005) = 9011.715$

Your cost of buying 300 shares from the market to close your short position is:

$300 (29.87) + 300 (29.87) (0.005) = 9005.805$

Your profit: $9011.715 - 9005.805 = 5.91$

Problem 1.7.

a. Consider the bid-ask spread but ignore commission and interest.

Your sales proceeds: $400 (25.12) = 10048$

Your cost of buying back: $400 (23.06) = 9224$

Your profit: $10048 - 9224 = 824$

b. If the bid-ask spread and 0.3% commission

Your sales proceeds: $400 (25.12) - 400 (25.12) (0.003) = 10017.856$

Your cost of buying back: $400 (23.06) + 400 (23.06) (0.003) = 9251.672$

Your profit: $10017.856 - 9251.672 = 766.184$

Profit drops by: $824 - 766.184 = 57.816$

c. Your sales proceeds stay in your margin account, serving as a collateral. Since you earn zero interest on the collateral, your lost interest is

If ignore commission: $10048 (0.03) = 301.44$

If consider commission: $10017.856 (0.03) = 300.54$

Problem 1.8.

By signing the agreement, you allow your broker to act as a bank, who lends your stocks to someone else and possibly earns interest on the lent stocks.

Short sellers typically leave the short sale proceeds on deposit with the broker, along with additional capital called a haircut. The short sale proceeds and the haircut serve as a collateral. The short seller earns interest on this collateral. This interest is called the short rebate in the stock market.

The rebate rate is often equal to the prevailing market interest rate. However, if a stock is scarce, the broker will pay far less than the prevailing interest rate, in which case the broker earns the difference between the short rate and the prevailing interest rate.

This arrangement makes short selling easy. Also short selling can be used to hedge financial risks, which is good for the economy. By the way, you are not hurt in any way by allowing your broker to lend your shares to short sellers.

Problem 1.9.

According to `http://www.investorwords.com`, the ex-dividend date was created to allow all pending transactions to be completed before the record date. If an investor does not own the stock before the ex-dividend date, he or she will

be ineligible for the dividend payout. Further, for all pending transactions that have not been completed by the ex-dividend date, the exchanges automatically reduce the price of the stock by the amount of the dividend. This is done because a dividend payout automatically reduces the value of the company (it comes from the company's cash reserves), and the investor would have to absorb that reduction in value (because neither the buyer nor the seller are eligible for the dividend).

If you borrow stock to make a short sale, you'll need to pay the lender the dividend distributed while you maintain your short position. According to the IRS, you can deduct these payments on your tax return only if you hold the short sale open for a minimum period (such as 46 days) and you itemize your deductions.

In a perfect market, if a stock pays $5 dividend, after the ex-dividend date, the stock price will be reduced by $5. Then you could buy back stocks from the market at a reduced price to close your short position. So you don't need to worry whether the dividend is $3 or $5.

However, in the real world, a big increase in the dividend is a sign that a company is doing better than expected. If a company pays a $5 dividend instead of the expected $3 dividend, the company's stock price may go up after the announcement that more dividend will be paid. If the stock price goes up, you have to buy back stocks at a higher price to close your short position. So an unexpected increase of the dividend may hurt you.

In addition, if a higher dividend is distributed, you need to pay the lender the dividend while you maintain your short position. This requires you to have more capital on hand.

In the real world, as a short seller, you need to watch out for unexpected increases of dividend payout.

Problem 1.10.

`http://www.investopedia.com/articles/01/082201.asp` offers a good explanation of short interest:

Short Interest
Short interest is the total number of shares of a particular stock that have been sold short by investors but have not yet been covered or closed out. This can be expressed as a number or as a percentage.

When expressed as a percentage, short interest is the number of shorted shares divided by the number of shares outstanding. For example, a stock with 1.5 million shares sold short and 10 million shares outstanding has a short interest of 15% (1.5 million/10 million = 15%).

Most stock exchanges track the short interest in each stock and issue reports at month's end. These reports are great because by showing what short sellers are doing, they allow investors to gauge overall market sentiment surrounding a particular stock. Or alternatively, most exchanges provide an online tool to calculate short interest for a particular security.

Reading Short Interest

A large increase or decrease in a stock's short interest from the previous month can be a very telling indicator of investor sentiment. Let's say that Microsoft's (MSFT) short interest increased by 10% in one month. This means that there was a 10% increase in the amount of people who believe the stock will decrease. Such a significant shift provides good cause for us to find out more. We would need to check the current research and any recent news reports to see what is happening with the company and why more investors are selling its stock.

A high short-interest stock should be approached for buying with extreme caution but not necessarily avoided at all costs. Short sellers (like all investors) aren't perfect and have been known to be wrong from time to time.

In fact, many contrarian investors use short interest as a tool to determine the direction of the market. The rationale is that if everyone is selling, then the stock is already at its low and can only move up. Thus, contrarians feel that a high short-interest ratio (which we will discuss below) is bullish - because eventually there will be significant upward pressure on the stock's price as short sellers cover their short positions (i.e. buy back the stocks they borrowed to return to the lender).

The more likely that investors can speculate on the stock, the higher the demand for the stock and the higher the short interest.

A broker can short sell more than his existing inventory. For example, if a broker has 500 shares of IBM stocks, he can short sell 600 shares of IBM stocks as long as he knows where to find the additional 100 shares of IBM stocks. If all the brokers simultaneously lend out more than what they have in their stock inventories, then the number of stocks sold short might exceed the total number of the stocks outstanding.

NASDAQ short interest is available by issue for a rolling twelve months and is based on a mid-month settlement date. For more information, visit `http://www.nasdaqtrader.com/asp/short_interest.asp`.

Problem 1.11.

You go to a bank. The bank uses its customers' deposits and lends you an asset worth $100. Then 90 days later you buy back the asset at $102 from the open market (i.e. you come up with $102 from whatever sources) and return $102 to the bank. Now your short position is closed.

Problem 1.12.

We need to borrow an asset called money from a bank (the asset owner) to pay for a new house. The asset owner faces credit risk (the risk that we may not be able to repay the loan). To protect itself, the bank needs collateral.

The house is collateral. If we don't pay back our loan, the bank can foreclose the house.

To protect against the credit risk, the bank requires a haircut (i.e. requires that the collateral is greater than the loan). Typically, a bank lends only 80% of the purchase price of the house, requiring the borrower to pay a 20% down payment.