U.S. Business Law Academy

David Schizer

**Problem Set # 8: Derivatives**

I. ***Basic Concepts, Forward Contracts and Swaps***

1. What is a derivative?

2. What is the difference between a “long” and “short” position?

3. What is a forward?

4. Suppose the price of gold is $1,800 per ounce on June 1, 2022, and Debbie enters into the following contract. She agrees that in two years (*i.e.*, June 1, 2024), she will buy one ounce of gold from Larry. When she receives the gold in June of 2024, she will pay $1,900.

A. Who is “long” under this contract? Who is “short”?

B. If the price of gold in June of 2024 is $2,100 per ounce, what are Debbie’s economic consequences from entering into this contract? What are Larry’s consequences? (For simplicity’s sake, assume Larry did not own the gold upon entering into this contract; instead, he buys it in June of 2024, in order to deliver it to Debbie.)

C. What if instead the price of gold in June 2024 is $1,500?

D. What would it mean for the parties to “cash settle” this contract? How is that different from “physical settlement”?

5. On the forward contract in the prior question, please note that Debbie does not have to pay the purchase price for two years.

1. Why do you think the price is $1,900, even though the current market price is $1,800? Is the “forward” price higher than the “spot” price (the current market price) because the parties predict that the price will rise?
2. What is “leverage”?
3. Which is a more “leveraged” investment – buying the stock today, or entering into a forward contract to buy it at a fixed price in the future?

6. Other derivatives share the same economic properties as a forward contract.

1. What is a futures contract?
2. What is a swap? Are they “cash settled” or “physically settled”? Are they settled all at once or periodically?
3. Suppose Debbie and Larry want to change the above arrangement in two respects. First, Larry will not make physical delivery of the gold. Second, Debbie and Larry will not wait the whole two years (*i.e.*, until June of 2024) to settle up their bet on the price of gold. Instead, they want to make two one-year bets. Suggest a derivative they can use to achieve this goal. What kind of derivative is this?

II. ***Options***

7. When an ounce of Gold is trading at $1,800 per ounce, Debbie pays Larry $40 for an option to buy gold from him at $1,850 at any time in the next year.

A. What is Debbie’s option called? Is Debbie’s option American or European style?

B. What is Larry’s position called? What is the term for the payment he receives?

C. What is the economic result for Debbie and Larry if Gold is trading at $1,950 in one year?

D. What is the economic result for Debbie and Larry if Gold is trading at $1,750 in one year?

E. How would your answer change if, instead of buying an option, Debbie had entered into a forward contract to buy an ounce of gold from Larry at $1,850 in one year? (Review: Why would the forward price be $1,850, even though the current price is $1,800?)

8. Assume that Larry believes the price of gold is going to decline below its current $1,800 level. What option should he buy from Debbie (assuming she is willing to sell it)?

9. Rank from most leveraged to least leveraged: a) a direct investment in gold; b) a forward contract to buy gold; and c) a call option to buy gold.

10. Assume that Debbie believes the price of gold will rise from $1,800 to $2,000 – but will go no higher. She wants to make a profit on this prediction, but she wants to minimize her risk of being wrong, and she wants to pay as little money as possible to place this bet. How can she do it? (Hint -- she buys one option and sells another.)

11. When the price of gold is $1,800, Larry will charge Debbie $40 for an option to buy gold at $1,850 at any time in the next year. Will he increase or decrease the price, if the option changes as follows? Why?

A. Debbie is allowed to use the option at any time in the next three years.

B. The price of gold falls to $1,799. Will the price of the option change by more or less than a dollar? Alternatively, what if the price rises to $1,801?

12. Debbie and Mimi have different predictions about the price of gold in one year. Debbie believes there is a 50% chance that Gold will trade at $1,900, and a 50% chance that it will trade at $1,700. In contrast, Mimi believes there is a 50% chance that Gold will trade at $2,300 and a 50% chance that gold will trade at $1,300.

1. Who will be willing to pay more for gold today – or would they both pay the same price?
2. Who would be willing to pay more for a call option to buy gold at $1,800 – or would they both pay the same price?

III. ***Hedging***

13. What is the difference between hedging and speculation?

14. Issuer, a corporation, needs to borrow money for two years. If it issued a typical fixed rate debt instrument, Issuer would pay a coupon of 6% every year. Instead, Issuer offers something a bit fancier. Investors pay $100, and receive their $100 back after two years. In addition, instead of receiving $6 of interest each year, the interest they receive varies, depending on the level of hurricane damage in Fort Lauderdale, Florida during that year. Specifically, if the dollar value of the hurricane damage (as measured by a federal agency) is less than $1 billion, the Issuer pays $12. But if the dollar value of the hurricane exceeds $1 billion, the Issuer pays no coupon for that year.

A. Why might an investor want to buy this kind of bond?

B. Why might an issuer want to raise money with this bond, instead of a more traditional one? Do you expect that this bond would be an especially attractive source of funding for issuers in a particular business?

15. Jane makes fine jewelry for sale over the Internet. Her father taught her the trade, and her “value added” is that of an artist. She has an eye for beauty, and can turn molten metal into works of art. But Jane has never liked the business world and, in particular, she has no idea which way the price of gold will go. Her problem is that gold and other precious metals are essential ingredients, and they make her profit margin hard to predict. What should Jane do?

16. Oilco has a new well that its geologists believe is very promising. If Oilco invests $34 million now, it will be able to bring 1 million barrels of oil to market in one year – something that would be profitable at today’s $65 per barrel price of oil. Yet Oilco is worried that the price of oil might decline below $65. Indeed, Oilco is considering abandoning the project as too risky, given the volatility in the spot oil markets.

1. Suggest various solutions to this problem.
2. You are a diversified shareholder of Oilco, which is a public company. Why might you oppose the use of derivatives by management to hedge the above risk? Why might you favor such hedging?

IV. ***Tax Deferral (time permitting)***

17. Assume that interest rates are 10%. (This obviously is not the case, but it’s helpful to use round numbers.) What is it worth if someone lends you $100 for a year and charges you no interest?

18. If you have to pay someone $100 in one year, and interest rates are 10%, how much do you have to set aside now in order to pay $100 in one year? This amount is called the present value of your obligation.

19. Assume interest rates are 10%, and that you owe $100 of tax this year. If you are able to pay the tax next year instead (and don’t have to pay any interest in putting off your tax), do you save any money by delaying the tax? If so, how much?

20. True or false: By delaying (or “deferring”) your tax, you reduce its present value.

21. To see an example of basic tax planning, you will need to know the following four rules:

A. If you make money on a derivative, you have to pay tax on the amount of your profit. Let’s assume you make $1000 and the tax rate is 50%. You keep $500 and the government receives $500.

B. If you lose money on a derivative, you can use the loss to reduce your tax bill. This means the government will also lose money when you lose money. If you lose $1000 and the tax rate is 50%, you lose $500 and the government loses $500 (because you pay $500 less in taxes).

C. Assume that you don’t have to pay tax (and cannot claim a loss) until you settle the derivative. That can happen when the derivative reaches its “maturity date (so that it is scheduled to expire), or it can happen you can choose to settle it early.

D. Finally, assume that you compute how much tax you owe every year. Money you earn before midnight on December 31 is taxed this year, while money earned after midnight is taxed next year.

22. Ellen earns $100,000 each year in her job and pays a 50% tax on what she earns, so that she ends up keeping only $50,000. She would like to keep more of her money. So she tries the following tax planning strategy, which is called a “straddle.” She enters into a forward contract to buy an amount of a commodity (“Commodity”) on January 1, 2023 for $100,000 (“the long forward”). At the same time, she enters into a second forward contract, obligating her to sell exactly the same amount of Commodity on January 1, 2023 for $100,000 (“the short forward”).

A. Can she make any money on these contracts? For example, let’s say Commodity is worth $120,000 on January 1, 2023. How much money does she earn (pretax) on the long? How much does she lose (pretax) on the short? What is the effect of the two together?

B. Let’s say Commodity is worth $70,000 on January 1, 2023. How much money does she lose (pretax) on the long forward? How much does she earn (pretax) on the short forward? What is the effect of the two together?

C. Assume that Commodity prices are $120,000 at 11:59pm on December 31, 2022, so Ellen cancels her short contract, and pays $20,000 to settle it a day early (on December 31). Then at 12:01am on January 1, 2023, she cancels the long contract, receiving $20,000. When you look at both the long and the short forwards combined, how much money (pretax) has she earned or lost?

D. Remember that Ellen can subtract her losses from her taxable income. In 2022, she earned $100,000 in her job, but lost $20,000 in cancelling her short forward (a day early on December 31). What is her taxable income? If she pays a 50% tax, how much tax does she owe? If instead she earned $100,000 and had no losses on derivatives, how much would her taxable income be and how much tax would she pay? How much (if any) tax does she save in 2022 by entering into this straddle?

E. Ellen again earns $100,000 in her job in 2023. In addition, she receives $20,000 in settling her long forward. What’s her total taxable income? What’s her total tax (at a 50% rate)?

F. What was the effect of this tax planning strategy? Why is it valuable to Ellen?

G. By the way, the U.S. tax system now has a rule, called “the straddle rules,” that denies people the tax benefit they used to claim from doing this sort of transaction. But the basic idea of accelerating losses and deferring gains remains an important tax planning goal.