

Walking Through Some Examples of Futures and Options Contracts – Speculation and Hedging

As Dr. Cogley said in class the other day, sometimes futures contracts and options are hard to wrap your head around until you see them a few times. So I've written up some examples similar to those Dr. Cogley did in lecture, with a little more explanation about how we get the results that we do. But before we jump into that, we need to revisit our terms.

1. Forward contract: A buyer and a seller agree to a specific price/quantity exchange sometime in the future. Forward contracts are done between individuals (no intermediary), so all financial risk is born by those in the contract, which may result in some sort of risk premium factor being included.
2. Futures contract: Similar to forward contracts, but sold via exchange markets which act as intermediaries. By charging small transaction costs, the intermediaries cover possible default by either party, meaning those in the transaction no longer have to concern themselves with default risk.
3. Options contract: Similar to futures contracts, but without the binding effect – you pay a premium now to have the *right* to buy or sell in the future, but you don't have to if you decide you don't want to.
 - a. Call vs. put: call is the option to buy a security in the future at a set price, whereas a put is an option to sell at a set price.
 - b. European vs. American: European options specify a particular date of transaction, whereas American options can be exercised at any time up to the termination date.
 - c. “In the money”: an option is “in the money” when the price on the market is above the strike price for a call, or below the strike price for a put. Note that we *don't* take into consideration the premium paid for the option when we talk about being “in the money”. All we care about is the price.
 - i. Strike price = the predetermined price for the transaction (also called the exercise price)

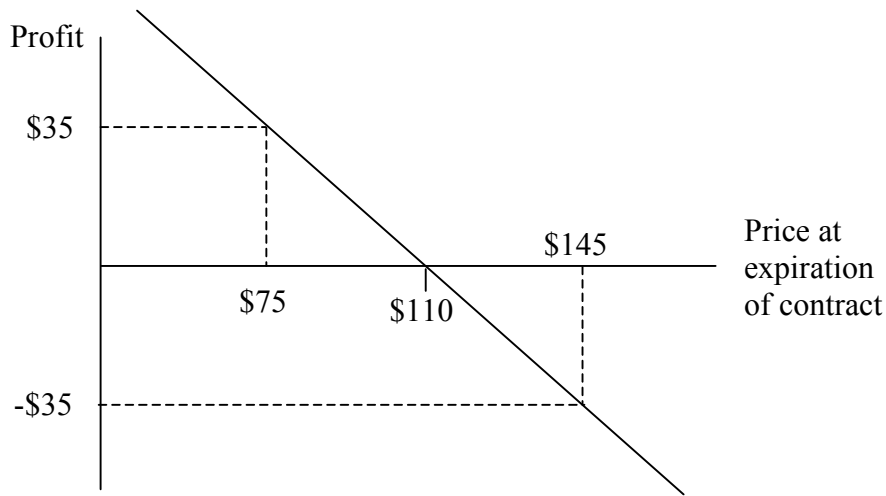
Now that that's out of the way, let's look at some examples.

Futures Contracts

CONTRACT 1: Agree to sell \$100 in face value of long-term treasuries for a price of \$110 in a year

Why would you make this kind of contract? You're betting on the fact that in a year, the price of the treasuries you're looking to sell is going to be lower than \$110. If that's true, you can buy the treasuries for the market price and then turn right around and sell for the agreed price of \$110, making a nice little profit. On the other hand, if the price ends up being more than \$110, you've locked yourself in for a loss. Buying the future is a form of speculation, and it allows people to do large-scale speculation at a lower cost. We can

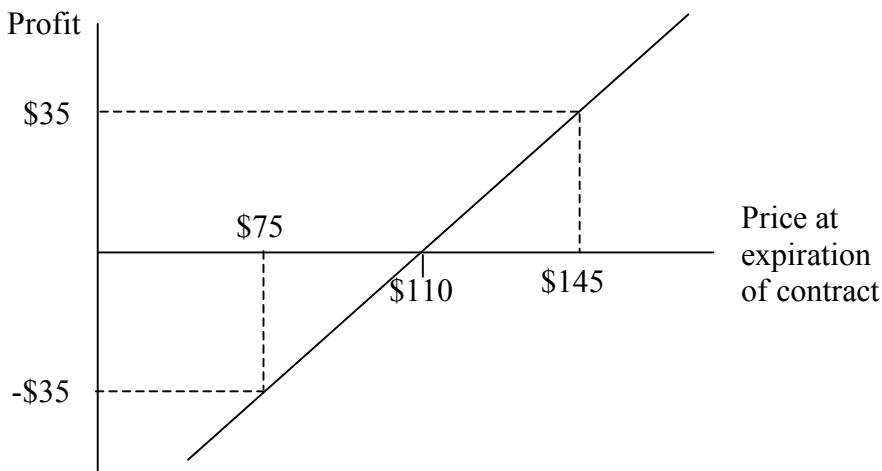
graph the potential return/profit of this particular contract, with the exercise price on the x-axis and profit on the y-axis.



The graph shows us that for all prices at expiration below \$110, profit is positive. The slope of the line is 1 (or it would be if I could actually draw), since every dollar below the agreed upon sell price is an extra dollar in profit, and every dollar above it is loss. For example, if the price ends up being \$75 in a year, you can buy for \$75 and sell for \$110, giving you a profit of \$35. On the other hand, if the price shoots up to \$145, you lose \$35.

CONTRACT 2: Agree to buy \$100 in face value of long-term treasuries for a price of \$110 in a year

Now we're on the other side of the contract. We're betting that the price of the investment will be *higher* than \$110 in a year. If that's true, we buy at our locked in price of \$110, turn around and sell, and make a profit. Then again, if the price is below \$110, we lose (speculation again). The graph looks a lot like the other one, but with the profit curve going in the other direction.



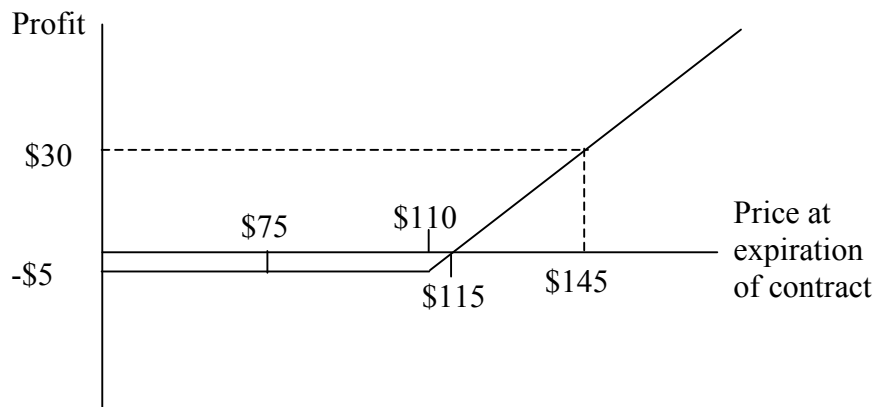
Options Contracts

CONTRACT 3: Pay \$5 to get the option to buy \$100 in face value of long-term treasuries for a price of \$110 in a year

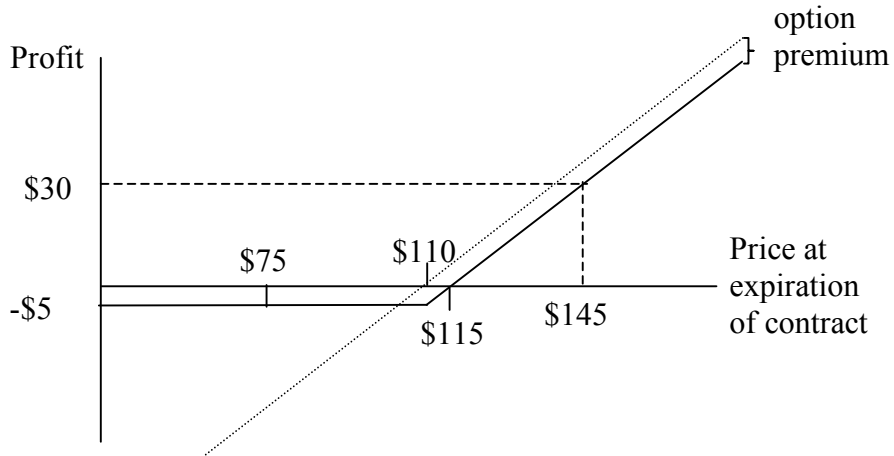
The fact that we're getting the *right* and not the *obligation* to buy at \$110 tells us that this is an option and not a future. Of course, you don't get anything for free – if you could lock in this option without having to pay anything for it up front, everyone would choose options over futures. So we have to pay \$5 now to get that future right to purchase, even if we don't end up using it. It's like Disneyland . . . you have to pay to get in to the park, even if once you're in there you decide not to go on any rides . . . sort of.

Now, if the price in one year turns out higher than the \$110 at which you have the option, it makes sense to buy up and then turn around and sell again. But if the price is below \$110, then we can just walk away and not have to take the loss. Remember, either way, we've still paid our \$5 to "get in", but that shouldn't influence our final decision about buying in the future.

As Dr. Cogley showed in class, we now have a two-part profit function. If the price is above \$110, then our profit is $(P_{+1} - \$110 - \$5)$, where P_{+1} is the price of the treasury in the period of sale. On the other hand, if price is below \$110, then we decide not to use our option, and our profit is $-\$5$ (the cost of buying in to the option). That gives us a profit function similar to the one in Contract 2, but with a lower bound placed at $-\$5$.



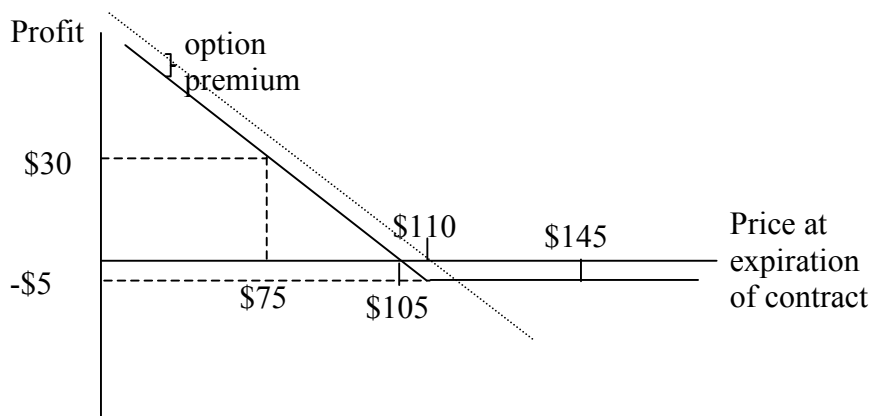
A few of things are worthy of note here. First, no matter how far below \$110 the price might fall, we never face a loss greater than \$5, because we can just walk away (leave Disneyland without going on any rides). Second, if the price jumps up to \$145, our profit is now just \$30, because we still had to pay that \$5 to get this option. Third, once we get to \$110, the profit line goes back to having a slope of 1. Fourth, this kind of looks like a roller coaster track, so maybe my Disneyland analogy wasn't so bad after all.



We can throw in the future contract profit line for a point of comparison. The dotted line represents the profit line of a futures contract to buy at \$110. The vertical distance between the two lines (at least for any price above \$110) is the premium paid to get into the options contract. Comparing the two lines, we can see that at any given price above \$105, the futures contract yields a higher profit, and for any price below \$105, the futures contract gives a greater loss.

CONTRACT 4: Pay \$5 to get the option to sell \$100 in face value of long-term treasuries for a price of \$110 in a year

We're back on the other side of the coin again, as the seller rather than the buyer. For \$5, we get the chance to sell at \$110 if we want to, or we can just walk away and eat our \$5 loss. Our profit function is in two parts: if price goes above \$110, then profit is $(\$110 - P_{+1} - \$5)$, but if it's below \$110, our profit is again $-\$5$. Here the futures contract gives a higher profit for any price below \$115, and a greater loss for any price above \$115.



Futures, Options and Hedging

So far we've seen examples of how futures and options can be used for speculation. But futures and options are also a handy form of hedging. Someone using a call option is insuring themselves against future possible increases in the price of assets they might need. For example, if a cattle rancher knows that next year he'll need 20 tons of grain, he might want to use a call option just in case the price of grain skyrockets. Similarly, a grain farmer might use a put option to protect himself against future price drops. In both cases, the purchaser of the option is making sure that they won't face substantial unexpected costs/losses in the future, i.e. "hedging".

You can also use futures and options to hedge against losses on investments you already hold, like the example Dr. Cogley did in class. If you hold an n period bond, and you're worried that the yield might go up (driving price down), then you can buy a put option on an $n-1$ period bond for next year. That way, if the yield increases and the price of your bond drops, you have yourself a guaranteed price at which you can sell. But if the yield ends up going down, driving the price of your bond up, then you can sell at the higher market price and let the option lapse (i.e. don't exercise it). You could do a similar deal with a futures contract, but then you'd be locked in and forced to sell the bond even if the deal wasn't in your favor.