COUNTER-PARTY RISK

An option buyer and seller may negotiate and transact directly with each other. One of the parties may be an options dealer. The parties may have found each other on their own, or they may have used the services of a broker to conduct a search.

In all these cases, the options buyer may understandably be worried that the seller may not be able to come up with the underlying asset (for a call option) or the money (for a put) if and when the option is exercised. Instead, an options buyer may transact on an organized options exchange, such as the CBOE – the Chicago Board Options Exchange. An exchange provides a central venue – physical or computer-based – for potential options contract counterparties to meet and effect a transaction.[[1]](#footnote-1) Although the contract is negotiated between the buyer and seller, the exchange becomes the legal counterparty to each transaction.[[2]](#footnote-2) From the perspective of the options buyer, the exchange is ultimately responsible for delivering the underlying asset or funds upon exercise. Then options buyer need only be concerned with the economics of the option itself, not with whether the contract will be honored. To appreciate the special nature of the risk faced by the option buyer when the writer cannot follow through on the contract and to understand the procedures instituted by the marketplace (including options exchanges) to handle it, we need to explore a number of interrelated concepts.

PERFORMANCE RISK

The possibility that the counterparty to a derivative contract may not follow through according to the terms of the contract is known as performance risk (or counterparty risk or, more generally, contract risk). Whereas the risk of non-performance generally applies to both counterparties to a derivative contract, this is not true with respect to options. The option writer is not worried that the buyer will abide by the contact; the writer has already received the premium. The buyer, on the other hand, is concerned about the writer’s ability (or willingness) to make good on his or her end.

Performance risk is a type of default risk, but is far different from, say, the risk of default on a loan. Suppose a bank makes a $1 million loan. The bank is at risk for the full $1 million. Should the borrower default, the bank stands to lose the difference between the full face amount of the loan - $1 million – and whatever it can recover, if anything. Suppose a buyer pays $1.50 each for 40,000 call options on GE stock with a strike of $25/share. The face amount of the contract is 40,000x$25 = $1 million. What is the buyer’s risk with respect to the seller’s possible non-performance?

* If GE is below (or equal to) $25 a share at expiration, the buyer would not exercise (but the writer would love to be exercised!), so non-performance is not an issue.[[3]](#footnote-3)
* If GE is above 25 at expiration, performance risk applies. Say, for example, GE hits 28. The call buyer is entitled to pay $25 each for 40,000 shares of GE. Suppose the writer does not own the shares. He must purchase the shares in the market for 28 and then sell them to the call owner for 25. But what if he does not have the resources to absorb this loss of $3/share? Unless compensation is otherwise forthcoming (as described below), the buyer will be forced to absorb the loss. She will need to pay 28/share in the market, hence lose ($28─$25)x40,000 = $120,000. Not the full $1,000,000.

We conclude the following:

Incidence of Non-Performance

An option buyer will only suffer a loss due to non-performance if the seller cannot perform when the underlying asset is above the strike at expiration. This significantly reduces the *probability* of a loss because two events must occur simultaneously: the writer defaults on his obligation and the underlying asset is above the strike. We know from elementary probability theory that, as long as the events are not perfectly correlated (and there is no reason to believe that there is any significant correlation between the financial health of the writer and the dynamics of GE’s stock price movements) the probability of two events occurring is much lower than that of a single event. Contrast this with the above loan. Only one event needs to occur in order for the lender to suffer a loss: default by the borrower, regardless of the value of any other market parameter.[[4]](#footnote-4)

Potential Loss Due to Non-Performance

The *amount* at risk in event of non-performance is the difference between the strike and the price of the underlying asset at expiration. In the above example, where GE is 28/share when the call expires, the call owner loses $3 a share, not $28 (the price at expiration) and not $25 (the exercise price) due to the writer’s non-performance. If GE’s cash price is currently, say, 25/share, there needs to be a *change* in its price before performance risk becomes at all relevant. Again, the contrast with the bank loan is clear: The entire face amount of the loan is at risk in case of default by the borrower. If the strike is 28 rather than 25, a larger change is necessary. In either case, the greater the change in GE’s price, the greater the potential loss from non-performance. Volatility, you see, is not only a key ingredient in the value of an option, it plays an important role in performance risk as well.

Note that performance risk is faced by *both* counterparties to derivative contracts other than options. With forwards, futures and swaps, neither party has a right, rather, both have future obligations which must be honored.

PUT OPTIONS PEFORMANCE RISK

Performance risk with respect to put options is analyzed similarly. The put writer need not be worried about potential lack of performance, as she has received her premium up front. The put buyer is concerned that the writer may not be able to come up with the cash should the buyer choose to exercise.[[5]](#footnote-5) This occur only if the underlying asset’s price is below the strike. Hence, the possibility of loss due to non-performance is relatively muted as the writer’s default must occur only when the underlying asset has fallen enough to create a potential net present value for the put. Further, the amount at risk is the difference between the strike and the asset’s price, again not the face value of the contract.[[6]](#footnote-6)

EXCHANGE-TRADED OPTIONS

As stated above, the exchange is the legal counterparty to all options contracts entered into under its auspices. The buyer of the option, therefore, faces the risk that the exchange might not perform. Compared to an entity such as a bank, dealer, corporation or an individual, this is surely a much lower order of risk, as we will presently see.

Suppose Abbot buys 100 call options on Apple, Inc. The calls expire in three months and are struck at 96/share.[[7]](#footnote-7) Apple is trading at 90/share in the cash market. Assume the premium is 3/share, which Abbot pays now. Initially, the calls were purchased from some counterparty, say Costello. The exchange, standing between Abbot and Costello, becomes the effective seller to the former and purchaser from the latter. Hence, the exchange faces risk of non-performance from Costello. This is handled in the following way: Even though Costello is entitled to the $3x100 = $300, the exchange holds it as collateral. Let’s ignore the dynamics between the initial transaction and expiration; we deal with that in a later section. Suppose Apple is 94/share at expiration. Abbot (hence the exchange) will not exercise, and Costello keeps his $300. Suppose instead Apple is 98/share at expiration. Abbot (i.e., the exchange) will exercise. If Costello does not own the shares, he will need to purchase it in the market at 98 and deliver it for 96. Suppose he cannot. The exchange remains obligated to deliver to Abbot. But there is no worry. The exchange has Costello’s $300 which, together with Abbot’s payment of $96x100 = $9600 is more than enough to pay the $98x100 = $9,800 cost for purchasing the shares in the market (Costello receives the remaining $100). The two scenarios ae summarized in Figure 1.

Figure I

Dynamics of Failure to Deliver

Call on 100 shares of Apple, Exercise Price = 96, Initial Premium = 3

Apple closes at 94 Apple closes at 98

Writer keeps $300 Buyer exercises, pays $9600 to exchange

Exchange takes $200 from collateral; Writer keeps $100

Exchange uses $9800 total to purchase Apple

Exchange delivers 100 shares to buyer

But what is Apple is 100/share at the call’s expiration? Abbot will surely exercise. The initial premium of 3/share plus the 96/share that Abbot pays is not enough to buy the Apple shares in the cash market in order to make delivery. The exchange loses 1/share, or $100! No. When Costello sold the calls, the exchange demanded collateral *in excess* of the premium. The exchange holds this collateral for precisely the possibility that Costello might default when Apple shares have risen above the exercise price. The total amount of collateral – the sum of the option premium plus the extra amount which we shall identify presently – is known as “margin.”[[8]](#footnote-8)

Every exchange (and every counterparty to an off-exchange option) is free to set its own margin requirements. Let’s work with the Chicago Board Options Exchange’s margin rules. The CBOE requires the seller to post collateral equal to the option’s premium plus 20% of the value of the underlying asset. The higher the price of the underlying today, the greater the likelihood of the buyer exercising the option in the future. By the same reasoning, the call writer’s loss is greater, hence the higher probability of default and, concomitantly, the loss to the buyer of the call due to default (all illustrated below). If the asset’s price is below the strike, the difference is subtracted. Why? Because the lower the underlying’s price, the less the chance that the call will be exercised, hence the lower the probability of loss due to non-performance by the writer.[[9]](#footnote-9) Figure II presents a number of examples (shown on a per-share basis, so multiply by 100 for the total dollar amount.) I include a number of different combinations because in addition to showing how the margin responds to changing parameters and market prices, they serve to highlight some fundamental ideas about options.

Figure II

Chicago Board Options Exchange Initial Margin Calculations

Call on 100 shares of Apple

Margin = option value + 20% of stock price, less excess of strike over stock price, subject to minimum

Apple exercise price call premium margin calculation

1. 90 90 3 3 + .2x90 = 21
2. 92 90 3 3 + .2x92 = 21.4
3. 90 88 3 3 + .2x90 = 21
4. 90 88 4 4 + .2x90 = 22
5. 90 92 3 3 + .2x90 − (92–90) = 19
6. 90 95 3 3 + .2x90 − (95−90) = 16
7. 91 96 3 3 + .2x91 − (96−91) = 16.2
8. 91 96 4 4 + .2x91 − (96−91) = 17.2
9. 88 98 1 1 + .2x88 − (98−88) = 8.6→9.8

An option whose exercise price is equal to the current market price of the asset is said to be “at-the-money.”[[10]](#footnote-10) Example 1 shows that with Apple priced at 90, writing an at-the-money call for a premium of 3 requires margin of 21 per option. If Apple were to remain at 90 until the call’s expiration, the CBOE would bear no risk from the writer’s possible non-performance. Were the buyer to exercise the call, the exchange would purchase Apple at 90 and receive the same from the buyer upon delivery of the stock. Why, then, is the margin necessary? Because of the possibility that Apple rises between now and expiration, in which case the collateral becomes necessary in event of non-performance.

Example 2 pertains to a situation where the stock’s price is above the strike. In particular, the call option in this case is said to be “in-the-money” by $2/share. Again, the exchange certainly has enough collateral should Apple remain at 92 and the writer defaults upon exercise at expiration: pay 92/share for the stock and deliver to the writer for 90, entailing a loss of 2/share while holding collateral of 21.4/share. The extra margin covers the possibility of Apple rising father.

Now look at situation 3. The call is in-the-money by the same 2/share as example 2. Yet, by the CBOE’s formula, less margin is demanded. The reason relates to volatility and the way we think about it. Volatility, as introduced in the last chapter, is obviously a major topic in options, as we will see in succeeding chapters. We think about asset price volatility in percentage (i.e., relative) terms. A 20% range, for example, around 92 is wider than a 20% range around 90. And because volatility gives a sense for the potential movement in Apple stock, Apple at 92 requires more margin than Apple at 90 even with the strike price correspondingly lower by 2.

Apple’s stock price and the call’s exercise price are the same in example 4 as in example 3. The margin, however, is greater in example 4. This is because of the greater premium. The reasoning again relates to volatility. Since the underlying and strike prices are the same, the greater premium must reflect greater volatility expected by market participants.[[11]](#footnote-11) Hence, by the reasoning of the previous paragraph, more collateral is called for.

Example 5 is a different situation entirely. The strike price is above Apple’s current market price – it is “out-of-the-money.” If Apple stays where it is, there will be no exercise at expiration (or earlier), hence no potential loss from non-performance. Recognizing this lower risk, the exchange subtracts the amount the call is out-of-the-money from what the formula would otherwise produce. In this example, 2 is subtracted from 21 (the margin in example 1 for the same cash price of Apple but not out-of-the-money). In example 6, 5 is subtracted. In example 7, 5 is subtracted as well, but the margin is greater than in example 6 because the cash price of Apple is higher, resulting in a greater potential future change in price. Similarly, example 8 requires more margin than example 7, despite both being out-of-the-money by the same amount. The larger premium means market participants expect greater volatility.

The final example in the table seems inconsistent with the formula. Because the call is so out-of-the-money, the formula would produce required margin of 8.6. The exchange, however, imposes a minimum margin requirement: the option value plus 10% of the underlying asset’s price.

In sum, the buyer of a call option faces the risk of non-performance by the option writer. By requiring the writer to deposit collateral into a margin account, the exchange ensures that there will be enough funds should the option owner exercise, thereby protecting itself and, ultimately, the option buyer from default risk.

Marking-to-Market and Exiting the Position

The effect of day-to-day movements in the price of an option on the option owner’s wealth is fundamentally similar to that of movements in other asset prices. An increase in the premium, regardless of its cause, increases her wealth and a decrease in the premium reduces her wealth. The change in value is not *realized* – with attendant potential tax and other implications – until the owner actually sells the option (or exercises or expires in-the-money). That is, there is no cash flow event until the position is liquidated.

Not so for the option writer. In order for the margin to serve its purpose – prevent losses to the counterparty should the writer not perform – the collateral needs to be updated along with the market. Look at Figure III, which displays the dynamics of the writer’s margin as Apple’s price and/or the call’s premium change over time. As we are dealing with a particular option, the strike price remains fixed, in this example at 90. On day 1, with Apple at 90 in the cash market, Chico pays $3 for an at-the-money call option ($300 in total for the contract). Groucho, the writer, deposits margin of $21 per option (or $2,100 per contract). This is known as “initial margin” (displayed with a negative sign in the table to denote a debit to the writer.) The next day, Apple rises to 92. New call contracts, with the same strike of 90 and expiration, are being established with a premium of 4. In particular, Harpo has purchased a call from Zeppo on the CBOE. Harpo pays the premium, and Zeppo puts up his initial margin of $22.40. Theoretically, Groucho and Chico’s contract initiated the previous day is not directly affected by the new contracts negotiated today. Groucho has paid, and Chico has received (albeit deposited with the exchange), the $3 premium hey agreed to and that’s that. Groucho’s wealth has risen, of course, as he now holds a security – a call option – worth 33% more than it was worth the day before. But there is no cash flow effect because Groucho still owns the call. For Chico, though, things are different. The exchange brings him “up to date.” He has sold something that today is worth more than yesterday, and the exchange forces him to “realize” that change in cash. Because margin for new positions for the very same option are now $22.40, Chico is debited (must come up with) an additional $1.40 per option, or $140. This brings his margin in line with Zeppo’s – Chico is “marked-to-market.”

Figure III

Chicago Board Options Exchange Margin Calculations

Call on 100 shares of Apple, exercise price of 90

Marking–to–Market of Writer’s Margin

Day Apple call premium margin calculation mark-to-market

1. 90 3 3 + .2x90 = 21 ─ 21
2. 92 4 4 + .2x92 = 22.4 ─ 1.4
3. 93 4 4 + .2x93 = 22.6 ─ 0.2
4. 90 3.5 3.5 + .2x90 = 21.5 + 1.1
5. 89 3.5 3.5 + .2x89 − (90−89) = 20.3 + 1.2

A day later, Apple increases by another $1 per share. New call option prices, however, are unchanged (due likely to a combination of low expected volatility and one day closer to expiration). Groucho’s position is not worth any more than it was the day before. Yet, interestingly, Chico’s position is debited by another 0.20 per option to bring him in line with the market. The higher cash price for Apple presents a greater risk of loss due to non-performance, as explained above.

On day 3, Apple recedes by 3/share, and the call drops by half a point. Chico’s margin account is credited by 1.1 per option due to both factors, which Chico may withdraw. On day 4, Apple falls by another point. Despite no change in the option price, required margin declines 1.2: 0.2 due to the decline in Apple, plus an additional 1.0 because the call is now out-of-the-money by a point. This is credited to the margin account.

Exiting Exchange-Traded Options

The fact that the exchange is the effective counter-party to options enters into under its auspices makes exiting a contract quick and easy. Suppose you purchase a call option outside an options exchange. Prior to expiration you might wish to sell that call. The options contract may state that you need permission from the writer to do so. Her agreement is with you, which cannot be changed without her consent. Not so with exchange-traded options. Suppose in the example in Figure III Abbot chooses to sell his option on day 2, when the call has appreciated by $1 from his original purchase price. Abbot simply enters into a new call contract as a seller of the call at the going price of 4 with a counterparty other than Costello. Because the CBOE is the effective counterparty in this new contract as the buyer, and remains the counterparty of the original contract as the seller, the two contracts cancel. Of course, from Abbot’s perspective the contracts cancel as well. Because he paid $3 per option and now sold at $4 he has a realized (i.e., cash) profit of $1 per contract, or $100 in total. Had you done the same thing outside of an exchange, you would have two contracts outstanding, one as an owner and one as a writer (with counterparty risk from the writer).

What about the writer exiting? She simply does the opposite trade as well. On day 2, her margin account shows a balance of 22.4 ($2,240 per 100 contracts) the cumulative total of her initial margin plus the marking-to-market margin of day 1. Worried about further increases in the option’s price, she now purchases 10 calls at a price of 4 per call ($400). As the exchange is the counterparty to both her initial and offsetting transactions, her two positions cancel, and she has exited the position. What is her net cash flow? Having purchased the option, she must pay 4. The exchange has 22.4 in margin. So she withdraws the remaining 18.4. This makes sense. Out of the 22.4 in the margin account, her “own” money is 19.4, because 3 represents the original sale price of the call. Her loss, therefore, is 19.4−18.4=1 ($100), which equals the loss in her short call position: she sold at 3 and bought at 4. Had she waited until day 3 to exit, her loss would have been only 0.5 per option. If the call price drops below 3 at her exit, she walks away with a profit of 0.5.

Note the ease of exit for the call writer. She need not search for and buy back the option from the counterparty she originally sold it to. She buys the option from any counterparty via the exchange and, because the exchange becomes the effective counterparty, her positions offset one another. Furthermore, all writers of this call, regardless of when they initiated their sale – hence, with different prices – should they choose to exit on that same day, pay the same premium, 4, which is subtracted from their margin accounts. And because their margin accounts have been marked-to-market, they all exit with the same 18.4! This is proved in an exercise following the section.

EXERCISES / QUESTIONS

1. Continue with the call writer in Figure III. Suppose she exits during day 3. What is her cash flow on that day? Show that her loss is 0.5 per option, or $50.
2. Consider a call writer who sells the call on day 1 rather than day 0. What is his initial margin? What is his marking-to-market for day 2? Suppose he exits during day 3 as well. Show that his cash flow for that is the same as that of the previous writer, yet he makes a net profit of 0.5 instead of a loss.

Position Maintained Until Expiration

Suppose you, the call buyer, do not offset, or close out, your position prior to the option’s expiration date. At that point you must either exercise or allow the call to expire. If Apple is below 90/share, say 88, you will not exercise. The premium has fallen to zero, and your position is worthless (i.e., your loss is equal to the premium you paid). If Apple is above 90/share at that point, say 95, you will exercise. That is, you pay 90/share and receive 100 shares from a call seller who has been “assigned” (see below). You can hold on to the shares, or sell them in the cash market for 95/share.[[12]](#footnote-12) If the options contract is cash settled, you simply receive $5/share.

What about the writer? If Apple finishes below 90, the call is worth nothing. She simply withdraws all the funds in her margin account, which include the original premium and additional margin, plus any net marking-to-market. Because the original premium was not her money, that is her profit. Suppose, instead, Apple is at 95 at expiration. The writer will be exercised (known as an “assignment;” see the next section). That is, she will be required to deliver (100) Apple shares to you, the call owner, in exchange for 90 per share. If she does not own the shares, she will pay the cash price of 95, for a loss of 5/share. (If she does own Apple shares, she will lose 5/share because she is receiving $90 for an asset worth $95.) Her *net* loss is $5 less the original premium received when the call was written. [[13]](#footnote-13) In practice, the exchange takes the exercise price, 90, paid by the call buyer, plus the amount in the writer’s margin account and purchases Apple in the cash market. The remaining amount is returned to the writer, which produces a net loss of $5 less the original premium.[[14]](#footnote-14) If the contract is cash settled, the exchange returns the writer’s margin less the amount the call is in the money, in this case $5/share.

Early Exercise

American style options allow the option holder to exercise prior to the expiration date. Needless to say, the owner of the call will exercise only if, in our example, Apple’s cash price exceeds 90, the strike. [[15]](#footnote-15) Suppose he does. At any point, only a fraction of, if any, call owners exercise.[[16]](#footnote-16) The exchange will choose which call writers must respond to the exercise. This is known as “assignment,” with rules determined by the exchange. The assigned writer must deliver the chares to the exerciser, with the resultant dynamics just as described in the previous section.

Failure to Meet Margin

Suppose an increase in margin is required of the call writer which he cannot (or will not) meet. The additional margin may be due to an increase in the price of the underlying asset and/or a rise in the option premium (as occurred in Table III between day 0 and day 1). The exchange “closes out” the writer’s position. It purchases call options (with the specific exercise price and expiration) on behalf of the writer, who exits the position just as described in the earlier section on exiting.

Writer in Possession of Shares

Should the writer own the shares, no margin would be necessary. The buyer’s, hence the exchange’s, risk of the writer’s non-performance vanishes. Recall that the risk faced by the buyer due to the potential lack of performance on the part of the writer is the excess of the asset’s price at expiration above the call’s exercise price. If the writer posts the shares as collateral, the buyer will not need to make a cash market purchase should the writer not perform. The risk is said to be “covered.” The call owner exercises and the exchange simply delivers the shares.[[17]](#footnote-17)

PUT MARGIN CALCULATIONS

The buyer of a put option faces the risk that the counterparty may not be able to honor his obligation at exercise. Consider a put on Apple exercisable at 90/share. Suppose Apple is 88/share at the put’s expiration.[[18]](#footnote-18) The buyer will surely wish to exercise. The writer will be forced to pay 90 for the number of Apple shares covered by the contract, but can only sell them for 88 per share. He may not be in a position to absorb the loss and, as a result, defaults on the contract. If the option buyer owns the Apple shares, she needs to sell them in the market, and loses 90 – 88 = 2/share because she thought she had the 90/share “locked in.” If she does not own the underlying shares, rather speculated on a decline in Apple price, she gives up her profit of 2/share from her “winning” position that she otherwise would have received if not for the default.

Just as is the case with calls, the exchange is the legal counterparty to the call buyer. After the initial transaction, the exchange is effectively the seller to the put buyer, and the buyer of the out from the put writer. Hence the exchange faces the performance risk from the writer. To prevent losses in the case of non-performance, the CBOE requires put writers to post collateral in a manner similar to that of calls. Required margin equals the put premium plus 20% of the underlying asset’s value. If the option is out-of-the-money, that amount is subtracted. Figure IV provides representative calculations for puts on Apple shares.

Figure IV

Chicago Board Options Exchange Initial Margin Calculations

Put on 100 shares of Apple

Margin = option value + 20% of stock price, less excess of stock price over exercise price,

subject to minimum

Apple exercise price put premium margin calculation

1. 90 90 3 3 + .2x90 = 21
2. 88 90 3 3 + .2x88 = 20.6
3. 88 90 4 4 + .2x88 = 21.6
4. 90 88 3 3 + .2x90 − (90–88) = 19
5. 92 90 3 3 + .2x92 − (92−90) = 19.4
6. 92 90 4 4 + .2x92 − (92−90) = 20.4
7. 102 90 1 1 + .2x102 − (102−90) = 9.4→10

Example 1 presents the at-the-money situation. The required margin is the same as for the at-the-money call. Suppose Apple is at 88, yet the put premium is the same 3/share, as in example 2. The put is now in-the-money, but the margin is lower! This is unlike the call margin (see example 2 of Figure II) which increases due to the call moving into-the-money despite the same premium. What’s the difference? As mentioned above, asset price volatility is a relative concept. A 20% range around 88 is narrower than a 20% range around 90. The potential future movement in Apple stock, hence the potential loss due to writer non-performance, is lower. A higher premium, however, will increase required margin, as in example 3. This is because the higher premium reveals market participants’ expectations of increased volaoltity, hence risk of non-performance.

In example 4 the put is out-of-the-money. The risk of non-performance is lower, so the CBOE gives a credit equal to the amount out-of-the-money. In example 5, the put is out-of-the-money to the same degree as in example 4. But the margin requirement is greater because Apple is at 92, so that the same parentage volaioltity portends a greater potential price change. The margin is higher in example 6 because of the greater premium, reflecting greater expected volatility on the part of market participants. Example 7 is the CBOE’s exception to its rule: the put writer’s margin cannot be less than the premium plus 10% of the exercise price (compared to 10% of the underlying *asset’s* price in the case of a call.)

The initial margin at the establishment of a written put position and the subsequent markings-to-market follow the procedure outlined above for written calls. An example is left for an end-of-chapter exercise. Exiting a put is straightforward as well. The put buyer sells a put which, because the exchange is the counterparty to both the original and offsetting transactions, cancels the position. A profit or loss is realized depending upon the put premium at exit compared to that at entry. The put writer similarly exits via an opposite trade, and withdraws whatever is remaining in her margin account. This will be more (hence a profit) or les (a loss) than the sum of the initial margin and net markings-to-market depending upon whether the put premium at exit is below or above, respectively, the premium at entry.

Suppose the buyer remains until expiration. If the put expires out-of (or at) -the-money, the buyer does nothing, but loses the premium which the writer earns. Suppose it expires in-the-money – i.e., Apple is 87/share. The buyer exercises. If he has Apple in possession, he delivers the shares and receives the strike, or 90/share. If he does not own it, he purchases it at 88 and delivers for 90. If the put is cash settled, he receives $2/share. The writer will lose the ITM value of the option, either by a cash debit from his margin account or by purchasing Apple at the strike price and selling it at the lower market price.[[19]](#footnote-19) The put buyer’s *net* gain is the ITM value at expiration less the premium paid; this is the writer’s net loss.

MORE ON PUT MARGIN: EARLY EXERCISE, FAILURE TO POST AND COVERED SHORT

* If a put option is in-the-money, then assuming the option is American style (as CBOE options are), some put holders may exercise prior to expiration.[[20]](#footnote-20) In those cases, the exchange “assigns” the exercise to put writers, who will be required to purchase the underlying asset at the exercise price.
* What if a writer fails to meet margin? As is the case with calls, the exchange closes out the offending writer’s position. It purchases puts on behalf of the writer, who then exits the contract in the manner described above.
* Suppose the call writer has sold Apple short.[[21]](#footnote-21) The put buyer’s risk of the writer’s non-performance is essentially absent. For should Apple’s price decline below the strike and the buyer exercises, the proceeds of the short sale, held as collateral, will be used to pay the put owner.

INDEX OPTIONS

The Chicago Board Options Exchange sponsors trading in options on equity indices. An index is not a security. It is a weighted average of prices of the assets which the index comprises. Well known examples are the Dow Jones Industrial Average of 30 (equally weighted) stocks and the Standard & Poor’s 500 Index of (capitalization weighted) the largest US stocks.[[22]](#footnote-22) You cannot *buy* or *sell* an index in the traditional sense – there is no asset to deliver. However, you *can* purchase and write options on an index as long as settlement is in cash rather than physical.[[23]](#footnote-23)

The mechanics of CBOE index options are similar to those of single stocks, as illustrated above. Because the components of the index are imperfectly correlated, indices display lower volatility that individual stock prices. Recognizing this, the CBOE’s margin requirements are lower: the option premium plus 15% (rather than 20%) of the underlying index value.

SUMMARY

An options exchange is the legal counterparty to options contracts entered into under its auspices. The exchange require margin from option writers in order to ensure that the exchange (hence, ultimately, the option buyer) will not lose money should the writer default, or fail to perform. The amount of initial margin, and then its daily marking-to-market, are calculated to cover the situation where the underlying asset’s price at expiration is the same as today, plus an additional amount for the possibility that the price may move (in an adverse direction). The exchange’s position as the counterparty also allows for easy exit from an options contract: an opposite trade erases the position.

Before we leave this section it is worthwhile pointing out that collateral/margin/marking-to-market are not unique to exchange traded options. (Options entered into and traded outside off exchanges are referred to as “over-the-counter,” or OTC, options.) Dealers as well as individual counterparties commonly request margin. The amount of collateral demanded (and whether they do or not) will depend on the relationship they have with the counterparty and their assessment of its credit worthiness, and the volatility of the particular un underlying asset. Furthermore, marking-to-market may be less frequent than daily (if at all) and might only be triggered by a change in price of the underlying asset and/or the option premium above a given size. The CBOE’s rules, on the other hand, are uniform.[[24]](#footnote-24)

A WORD ON LIQUIDTY OF EXCHABGE-TRADED OPTIONS

The attraction of trading options on organized exchanges lies not only in the performance guarantee (remember: option writers have no need for a guarantee) an exchange offers. A centralized trading venue provides greater liquidity than searching for best prices among dealers and other counter-parties. This is manifested in narrower bid-asked spreads and smaller market impact (a sizable transaction pushing out the trading price). Of course, the performance guarantee, along with the uniform collateral requirements, attract options market participants which brings the liquidity, which makes for a virtuous circle. Transactions costs are, therefore, lower. The downside is the standardization of parameters imposed by the exchange:

* underlying asset
* strike prices
* size of contact
* expiration month/day cycle

The choice between exchange-traded and OTC options, other than the performance risk differences, therefore, comes down to enhanced liquidity versus reduced flexibility. One result of the reduction in flexibility is the potentially imperfect correspondence between the asset and the option employed to hedge it, a situation termed “basis risk.” This will be addressed in chapter xxx.

CHAPTER HIGHLIGHTS

REVIEW QUESTIONS

How do the three prices – cash, strike and premium – interact. For example, compare two writers – bank or fund with individual.

Complete an mtm Table for put.

Prove that put writer’s margin always has enough funds for exercise. And that the gain/loss is the cumulative mtm + premium.

1. An options contract entered into outside of an exchange is known as an “over-the-counter” (OTC), or off-exchange, option. [↑](#footnote-ref-1)
2. Technically, the Options Clearing Corporation is the guarantor. [↑](#footnote-ref-2)
3. Of course, the option buyer has lost the premium, or $1.5x40,000. But this is not the result of non-performance on the part of the writer. [↑](#footnote-ref-3)
4. If the option is American style the conclusion still holds, but with a modest extension. Exercise is possible anytime prior to expiration (although, as explained earlier in the text, it happens rarely). Whenever exercise is optimal, the option buyer is subject to performance risk on the part of the writer. But the likelihood of loss due to this risk is relatively low for the reasons explained in point 1, and the loss in event of non-performance is limited by the following point 2. [↑](#footnote-ref-4)
5. For a European style put, this can only occur at expiration. For an American style, early exercise is possible, and the analysis applies then. Chapter qqq explores the economics of early exercise. [↑](#footnote-ref-5)
6. Unlike a call, this amount is capped by strike price, because the asset can at most fall to 0. [↑](#footnote-ref-6)
7. Typically, the “size” of 1 contract on an options exchange is 100 shares of the underlying asset. [↑](#footnote-ref-7)
8. Readers familiar with leverage and short positions in the cash markets (stocks, bonds, foreign exchange, etc.) will readily see the correspondence between margin for options and its marking-to-market (see below) and margin for cash transactions and associated margin calls. [↑](#footnote-ref-8)
9. Said another way, since the price of Apple shares is below the call’s strike, if nothing changes, the buyer would incur no loss from the writer’s possible failure to perform. Apple would need to rise by at the least the difference between its current price and the strike by expiration for performance risk to be relevant. This difference, therefore, is a credit to – or subtracted from – the collateral portion. [↑](#footnote-ref-9)
10. This terminology and those which follow are explained and applied at length in the next chapter. [↑](#footnote-ref-10)
11. Alternatively, the situation in example 4 may be one where there is more time to expiration. As we will learn in chapter xxx, this works same way as volatility, so the reasoning is the same. [↑](#footnote-ref-11)
12. If the call is cash-settled, you simply receive $5/share in cash ($95−$90). See chapter 1 on “Cash Settlement.” [↑](#footnote-ref-12)
13. There will always be enough funds to cover the purchase of the stock. This can be proved as follows:

    S = price of share in the cash market at expiration

    K = strike price of call

    Prem = call premium on exercise date

    We need to show that the available funds are at least equal to S.

    By the marking-to-market rules explained in the text, the net margin in the writer’s account are:

    Prem + 0.2xS

    Upon exercise, therefore, the exchange has available to it:

    K + net margin

    Since the stock’s price exceeds the strike, and the option is expiring, the premium on this expiration date is:

    Prem = S − K

    Combining, the exchange’s available funds are:

    K + net margin = K + Prem + 0.2xS = K + (S − K) + 0.2xS = 1.2xS > S [↑](#footnote-ref-13)
14. By the previous footnote, after the exchange spends S to acquire the stock, the remaining funds in the margin account are 1.2xS − S = .2xS. The marking-to-market required the writer to put into her margin account .2xS + (expiration premium − original premium). But expiration premium = S − K. Therefore,

    Net loss = [.2xS + (expiration premium − original premium)] − .2xS = .2xS + (S − K − original premium)] − .2xS = (S − K − original premium)]. [↑](#footnote-ref-14)
15. This is a necessary, but not sufficient, condition for early exercise. See the following footnote. [↑](#footnote-ref-15)
16. The choice depends on the upcoming divided to holders of the stock, and the holder’s expectations regarding the volatility of the stock price. We explore this further in chapter zzz. [↑](#footnote-ref-16)
17. Owning the shares and writing a call is a “buy-write” combination (or “covered call” strategy), which you will recognize as such in the following chapter. [↑](#footnote-ref-17)
18. At a price of 90 or below, the buyer will not exercise, hence faces no risk of non-performance. [↑](#footnote-ref-18)
19. A pair of end-of-chapter problems proves that the margin account will always have enough funds to ensure the buyer’s exercise, and that the writer’s loss from the cumulative markings-to-market equals the ITM value less initial premium. [↑](#footnote-ref-19)
20. This will depend upon the level of short term interest rates and the put owner’s expectations of the underlying stock’s volatility until the next dividend date. We will analyze this decision in chapter qqq. [↑](#footnote-ref-20)
21. Selling short involves borrowing the shares and selling (then delivering) them in the cash market. The proceeds from the sale typically serve as the collateral provided to the lender of shares. The borrower/short seller adds additional funds. This is the “margin.” [↑](#footnote-ref-21)
22. Indices are not restricted to equities. For example, the Goldman Sachs/S&P Commodity Index is a (production weighted) average of commodity futures contracts. [↑](#footnote-ref-22)
23. See the previous chapter’s explanation of cash settlement, and how its economics is similar to that of physical delivery contracts. [↑](#footnote-ref-23)
24. The rules do change based on the strategy: uncovered call or put, buy-write, spread trade, etc. But they do not depend on the underlying asset (except in the case of index options, as e3xplkaioned earlier in the text(, nor on the particular counterparty.

    The North American Derivatives Exchange (NADEX) sponsors trading in binary options. Because the potential losses from lack of performance are much different from ordinary options, margin rules are different as well (see the next chapter). [↑](#footnote-ref-24)