

# *Learning from a Simple Options Trading Game*

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## **Abstract**

We present a structured real-time classroom options trading game for students who are being exposed to options for the first time and for students who are acquainted with textbook discussions of options markets, but lack any tangible experience related to options markets. The game can be played in one 50-minute class period using blackboard space or a computer display and photocopied handouts. Sample handouts are included, the trading rounds of a call-option game are described in detail, and other versions of the game suggested. We conclude by commenting on benefits of employing active-learning techniques in finance courses.

In this article we describe a simple, structured, real-time, options trading game that we use to demonstrate the workings of options market and basic aspects of options pricing, as well as to increase student engagement. We have found the game a very useful learning tool for students learning about options for the first time and for students acquainted only with textbook discussions who lack direct experience in financial markets. To play the game one only need prepare and distribute copies of forms to students (see Appendices 1 and 3), have some blackboard space in the classroom or a computer and data projector, and be willing to conduct a very interactive class. Please note carefully that this is more a game of action than a game of reflection. As a result, only limited aspects of options pricing are introduced at any one time.

While the game was created primarily to increase active learning<sup>3</sup> and student engagement in introductory investments, derivatives and markets classes, its actual play has revealed a number of ancillary benefits. Most notably, the game reveals students' actual working knowledge of securities market and options basics. While the game may seem simplistic, you may be surprised how difficult it is for your students. For example, when the game was played by students who had previously taken corporate finance and investments, we found that many of the students had not internalized the concepts of short selling, liquidity, or arbitrage sufficiently well to play the game without difficulty.

Further benefits of play include helping the instructor get to know the students and in providing students the opportunity to make decisions under pressure. In addition, the game helps students become more comfortable with basic options and market-related concepts before they are introduced to theoretical option pricing models such as Black-Scholes (Cooper and Grinder 1997). Finally, students both enjoy the game and benefit from its play.

In the next section we provide an overview of how the game is played. Then we describe a typical session of the game and discuss student behavior during play.

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<sup>3</sup> Educators know that traditional lectures without student engagement provide a suboptimal learning environment for most students. See, for example, Brightman, Hand and Hightower (1989), Marbach-Ad, Seal and Sokolove (2001), and Franklin, Peat and Lewis (2003). Unfortunately, finance classes, particularly non-case-based undergraduate classes, lend themselves more readily to the lecture format and not as readily to more active learning formats. This game has been an easy and pedagogically useful way to increase active learning in some of our finance classes.

### **The Game Overview**

The game can be completed in one 50-minute period, provided the students understand the rules of the game prior to its start. Its play, as described below, involves the trading of call options on a single stock for nine trading ‘rounds’ over five ‘days.’ Although the call-based game is described below, materials to play the game with puts are provided in Appendix 2. Prior to the start of trading, students receive individual trading instructions that inform them of the details regarding their initial transactions. Because the students are required to place bids or offers, some of the common student reticence to participate is overcome.

Each round begins with the instructor displaying a price for the underlying stock. The price can be displayed on the board or in a table in PowerPoint, Excel or Word. The method of displaying the price and subsequent data is up to the instructor within the limits of the display technology available to them and the instructor’s preference as which medium to employ. Note, however, that once student participation begins, the instructor must rapidly record bids, offers, size, last prices and, perhaps, student names for the students to see. We prefer using a large blackboard, because many, if not all, of the prices and transactions can remain displayed in view of the class for the duration of the game. In any case, the game can be played with any technology that will enable students to see the relevant data.

After the stock price is displayed two or more students must make bids or offers on the call option based on their trading tab instructions. Aside from price changes and time passage, what distinguishes one trading round from another is level of structure imposed on student behavior and the number of students involved in the process. In the first round, for example, one student is given instructions to go long 10 contracts at a particular price, and another student is given instructions to go short 10 contracts at the same price. By design, the early rounds have more structure and fewer participants. In subsequent rounds, the restrictions regarding student order entry are gradually relaxed and the number of students participating is increased until each member of the class has placed at least one order. (Note that the form in Appendix 3 enables instructors to monitor student participation if desired.)

Upon completion, each trading round provides an opportunity to briefly discuss salient features of options pricing, options trading, and auction markets. The description of a typical trading session that follows presents option-related discussion topics in the sequence we normally follow; however, the game design lends itself to other topic discussions. Because the game design allows for a number of price changes for the stock over time, we have found it especially useful in illustrating phenomena such as time value and time decay. However, at the instructor’s discretion, other aspects of option trading such as volatility or the importance of delta could be introduced instead of or in addition to focusing on time value and decay. We would caution that introducing too many features of option trading in an introductory game may overwhelm many introductory students’ ability to comprehend the lessons.

### **A Game Session**

Below we describe a typical introductory session of the game. For ease of exposition, assume a class of 20 students. The game can be easily adapted for more students by distributing more trading tabs or by creating two-person teams. We highly recommend that there be few participants in the early rounds. We describe the game using an IBM \_\_\_ 70 call for the option being traded.

After their exposure to introductory lectures and readings, we have students come to class ready to trade. Before the game begins each student receives two handouts—one “Trading Tab”, which contains their initial trading instructions, and a “Trading Card” for recording their transactions and, if they wish, price information for each round. Appendix 1 contains the set of initial instructions (Trading Tabs) for the IBM call game that we will use in our example. Appendix 3 displays a sample Trading Card. After the handouts have been distributed, students are advised, but not required, to conceal the instructions on their Trading Tabs. Note that these Tabs must have been prepared and organized prior to class.

After distributing the handouts, we partition the blackboard into five columns and two rows, allowing enough space to record initial stock prices and option trading activity for all days and rounds. At the top left side of the first column, labeled ‘Day 1, Round 1,’ we record the stock symbol and price, e.g., IBM 70 call. Below the stock price we write in a format to record bids and offers on the blackboard such as:

\_\_\_\_\_ bid for \_\_\_\_\_ contracts by \_\_\_\_\_  
 \_\_\_\_\_ offered for \_\_\_\_\_ contracts by \_\_\_\_\_.

Students are then instructed that they are to call out their bids and offers for the appropriate number of IBM calls on their designated day and round. They are also told that after their initial transaction they may use either market or limit orders. If there are no questions, trading begins.

### ***Day 1, Round 1***

If you have not done so, please refer to Appendix 1 before proceeding. We begin the round by posting a \$70 price for IBM and then asking for bids and offers. One student in the class has been instructed to buy 10 IBM call contracts at \$1.50, another to short 10 contracts at \$1.50. Once the students place their orders, the orders are written on the board:

1.50 bid for 10 contracts by Sally  
1.50 offered for 10 contracts by Bill.

Since the prices and quantities match, a trade takes place and both orders are filled. We remind students that the consummation of the trade has “created” 10 new contracts. (By design, only two of the 20 students have participated at this point but all students have been introduced to the basic order entry procedures.) At this point, we ask why someone would pay a premium for a \$70 option when the stock is trading at \$70. This question engenders discussions of the concepts of time value and intrinsic value (being in, at, or out of the money). Whether to introduce volatility into the discussion of time value is your choice, but we tend not to do so in an initial game. We then ask what the open interest is (10 contracts) and discuss the concept of open interest. Total game and discussion time runs from four to eight minutes.

### ***Day 2, Round 1***

We post a price of 71 for IBM under Day 2, Round 1. The first day’s participants hold their positions. Other students have instructions participate. In a class of 20, two new students are required to buy 20 contracts each at \$2.00, and two students to short 20 contracts. The round ends, we note that time has passed and, as a result, we discuss time decay. The stock price had increased by \$1 but the option only by \$.50. In other words, the time premium had declined from \$1.50 to \$1.00. This aspect of option prices and option price changes creates varying amounts of discussion. Sometimes students have difficulty absorbing the idea that unlike the underlying securities, options have pending expiration dates that influence their prices. Depending upon the instructor’s priors as to what is important and upon the students’ level of sophistication, the option’s delta could also be discussed as could volatility. We again tally open interest (50 contracts). Assume four to eight minutes for the round and discussion.

### ***Day 2, Round 2***

For the duration of the game, students will be choosing their own prices for the option. At this point, the instructors may choose to use their own predetermined prices or to introduce some randomness into the determination of the stock price or price change. We prefer to pre-select prices, because it enables us to have more control over the play of the game and to better anticipate what complications or issues can arise in the course of play. However, the Excel function RANDBETWEEN allows randomness to be introduced while allowing the instructor to determine the direction of change and to limit the amount of stock price change and, hence, volatility. The function only returns integer answers, so a sample use of the function might be @RANDBETWEEN (7100, 7250).

At the beginning of this round, we post a price of 72. Up to this point six of the 20 students have positions. Two new students on each side of the market now must establish positions of 10 contracts each. Some students estimate time decay from the first two rounds and bid or offer at, say, \$2.50 to \$2.75. More commonly, however, bids or offers come in at \$3. In other words, students tend not to allow for time value decay and the decrease in delta despite the passage of time. In the debriefing, students have stated that they were implicitly assigning less importance to time decay and more to the trend and trying to out-guess the instructor’s chosen price path. The round and debriefing should have taken another four to ten minutes. Note that open interest is at 70 contracts.

**Day 3, Round 1**

IBM's price is posted at 73. Four more students are forced to trade 10 contracts each and everyone who has an existing position is now free to trade at will. Since trading is now relatively unrestricted and students have the rhythm of the game, volume increases dramatically. When the session ends—at a point at which no new bids or offers are entered—we tabulate open interest. If the number of long and short contracts does not balance, we backtrack to find the error (interestingly, errors are a rare occurrence; having occurred only once is six plays of the game). Prior to this round, all transactions had been opening transactions, and, as a result, open interest had increased one-to-one with trading volume. In the current round, students are able to enter closing transactions, so open interest can only be determined at the end of the round. This provides an opportunity for discussing changes in open interest as well as of opening and closing transactions. Class time is about 10 minutes.

**Day 3, Round 2**

IBM is set at 73.50. In a sample class of 20, 14 students should have participated thus far. Two more pairs are forced in now. This round's length can vary substantially depending on the stock price change. Using 73.50, students still see an established uptrend in price involving a relatively small price change. Trading is active in this round; however, since no new concepts are introduced, there is limited discussion. Class time is four to eight minutes.

At about this round in the game, a student's bid or offer may provide an arbitrage opportunity. Usually, only one or two other students recognize the opportunity. For example, suppose IBM is at \$73.50 and someone offers to sell 10 contracts at \$3 (\$.50 under intrinsic value). The first student who says "I'll buy them" owns them. Occasionally the student buying the undervalued options will not carry out the other side of the arbitrage. At other times the student will ask if he or she can immediately exercise the call option and sell the stock (the answer for American options is yes). So as not to squelch other arbitrage opportunities, we wait until the game's final debriefing to discuss how options prices are determined by arbitrage.

**Days 4 and 5**

Two rounds each 'day,' with IBM at 73, 72, 72 and 71 at the beginning of each round. The final pair is forced in at the start of Day 4 Round 1. Although these two days could be collapsed into one, we've found that some students need the extra rounds to become more comfortable with the workings of the market. We do notice more students "getting it" with each round, so we've retained the additional trading day, at least for the first game of the semester. We continue to calculate open interest and time decay at the end of each round. At some point during Day 4, and continuing more rapidly during Day 5, students notice that open interest is declining. Each of these rounds is typically short – two to four minutes.

**Expiration**

IBM's final price is set at 70. We then ask if anyone has any open positions and we tabulate remaining open interest. Despite the students' inexperience in this sort of activity and the sometimes frenzied pace of trading, only once in six iterations of the game have we found that longs and shorts out of balance. After tallying the final open interest, we focus on how different positions fared over the course of the game. In a 50-minute class, some of the final discussion may need to be continued during the next class.

Recall that IBM started at 70, rose to 73.50, and then ended at 70. Given this price pattern, any students who entered only long call positions and who held them until expiration lost all of their investment. Any students who entered only short call positions and who held them until expiration had profits. Students who established only long positions had the opportunity to make money only if they traded out of their positions prior to expiration. Those who shorted will have necessarily made money, provided they never closed out prior to expiration.

We have continued introducing the game which holding a short sale to expiration was profitable, because we have observed that many students new to securities markets have difficulty believing that you can sell what you don't own and can profit when prices fall or remain unchanged. In this game, it is a revelation to many that it is possible to go short calls without owning the underlying asset. It is also a

revelation that, in the aggregate, the shorts made the money and the longs lost. Aside from enabling us to discuss short selling, the price sequence we use also enables us to discuss this wealth transfer from the longs to the shorts, the zero sum nature of derivatives markets, the importance of an option’s time premium, and the differing risks assumed by longs and shorts in option trading. Please note that the game can be used to focus on different aspects of option pricing and trading from those which we chose to emphasize by merely changing the stock price sequence or time frame in which the trading occurs.

As a final observation on the playing of the game as described, we’ve found in the expiration debriefing that many students had not internalized the fact that options trade in stand-alone markets, where one can buy or sell calls and puts without having to hold the positions until expiration. Prior to playing the game many students had difficulty with the notion of exiting a position early. By being actively engaged in an activity in which positions were being closed prior to expiration students better understand closing transactions and the importance of liquidity.

### Discussion

Active learning exercises are increasingly popular in business classes (Strempek, Burbridge and Paul 2003), and the options game just presented is one way to add such a component to a finance class. Two or more versions of the game can be played during the semester by selecting different price paths for the underlying stock, incorporating other concepts like volatility, or by adding the put game (for which we have included a set of Trading Tabs in Exhibit 2).

Many traditional undergraduate students have difficulty in finance classes because they lack personal investment experience and, consequently, a cognitive framework from which to refer as they read and attend to lectures about securities and derivatives (Krueger 1997). We are continually surprised at how little students actually understand about the basic workings of securities markets as well as concepts like liquidity and the bid-ask spread. Active, real-time games provide students a set of experiences that can help them internalize what they are exposed to in textbook readings and lectures. In practice, the game contrasts well with lectures, can build students’ confidence and can help you learn more about your students and their level of knowledge of securities markets. Lastly, the game is fun for the students and, hopefully, for you.<sup>4</sup>

### References

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<sup>4</sup> To assess student response to playing the game, a brief questionnaire was administered to a class of 18 advanced managerial finance students, all of whom had either taken or were enrolled in an investments class. The students were asked to select responses ranging from (5) Strongly Agree to (1) Strongly Disagree. The statements students responded to and their mean responses appear below.

Playing the game was fun.	Knowledge of options and of the functioning of financial markets was needed to play the game.	Playing the game increased my knowledge of options.	Playing the game increased my knowledge of how live markets work.
4.22	4.39	4.33	4.56

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**Appendix 1: Trading Tabs for Call Option Game**

[The table cells/tabs below contain instructions to students for their initial trades. Each student is given only one of the instruction tabs. On Day 1 and on Day 2 Round 1, it is important that the number of tabs distributed for purchases equal to the number of tabs distributed for sales. After that we recommend that the number of buy and cell tabs are approximately equal, unless the instructor wants to portray some sort of market disequilibrium. We also recommend that the number of transactions on Day 1 and on Day 2 Round 1 be kept low and that the instructor accommodate larger class sizes by distributing additional trading tabs for Day 2 Round 2 and later rounds. The blanks in tabs are for option expiration months.]

<u>Day and Round</u>	<u>OPENING PURCHASES (LONGS)</u>	<u>OPENING SALES (SHORTS)</u>
<b>Day 1 (only Round)</b>	<b>On Day 1, you must buy 10 IBM ___ 70 calls at 1.50. After Day 2 Round 2, you may trade as you wish.</b>	<b>On Day 1, you must short 10 IBM ___ 70 calls at 1.50. After Day 2 Round 2, you may trade as you wish.</b>
<b>Day 2 Round 1</b>	<b>On Day 2 round 1, you must buy 20 IBM ___ 70 calls at 2. After Day 2 Round 2, you may trade as you wish.</b>	<b>On Day 2 round 1, you must short 20 IBM ___ 70 calls at 2. After Day 2 Round 2, you may trade as you wish.</b>
<b>Day 2 Round 2</b>	<b>You are initially bullish on IBM. On Day 2 Round 2, you want to buy 10 IBM ___ 70 calls. After that you may trade as you wish.</b>	<b>You are initially neutral to bearish on IBM. On Day 2 Round 2 you want to short 10 IBM ___ 70 calls. After that you may trade as you wish.</b>
<b>Day 3 Rounds 1 and 2</b>	<b>You are initially bullish on IBM. In either round on Day 3, you want to buy 10 IBM ___ 70 calls. After that you may trade as you wish.</b>	<b>You are initially neutral to bearish on IBM. In either round on Day 3, you want to short 10 IBM ___ 70 calls. After that you may trade as you wish.</b>
<b>Day 4 Round 1</b>	<b>You are initially bullish on IBM. On Day 4, round 1, you want to buy 10 IBM ___ 70 calls. After that you may trade as you wish.</b>	<b>You are initially neutral to bearish on IBM. On Day 4 round 1, you want to short 10 IBM ___ 70 calls. After that you may trade as you wish.</b>

**Appendix 2: Trading Tabs for a Put Option Game**

<u>Day and Round</u>	<u>OPENING PURCHASES (LONGS)</u>	<u>OPENING SALES (SHORTS)</u>
<b>Day 1 (only Round)</b>	<b>On Day 1, you must buy 10 IBM ___ 70 puts at 1. After Day 2 Round 2, you may trade as you wish.</b>	<b>On Day 1, you must short 10 IBM ___ 70 puts at 1. After Day 2 Round 2, you may trade as you wish.</b>
<b>Day 2 Round 1</b>	<b>On Day 2 Round 1, you want to buy 20 IBM ___ 70 puts at .80. After Day 2 Round 2, you may trade as you wish.</b>	<b>On Day 2 Round 1, you want to short 20 IBM ___ 70 puts at .80. After Day 2 Round 2, you may trade as you wish.</b>
<b>Day 2 Round 2</b>	<b>You are bearish on IBM. On Day 2 Round 2, you want to buy 10 IBM ___ 70 puts. After that you may trade as you wish.</b>	<b>You are neutral to bullish on IBM. On Day 2 Round 2, you want to short 10 IBM ___ 70 puts. After that you may trade as you wish.</b>
<b>Day 3 Rounds 1 and 2</b>	<b>You are bearish on IBM. On Day 3 you want to buy 10 IBM ___ 70 puts. After that you may trade as you wish.</b>	<b>You are neutral to bullish on IBM. On Day 3 you want to short 10 IBM ___ 70 puts. After that you may trade as you wish.</b>
<b>Day 4 Round 1</b>	<b>You are bearish on IBM. On Day 4 you want to buy 10 IBM ___ 70 puts. After that you may trade as you wish.</b>	<b>You are neutral to bullish on IBM. On Day 4 you want to short 10 IBM ___ 70 puts. After that you may trade as you wish.</b>



### Appendix 3: Student Trading Card

Name \_\_\_\_\_

#### TRADING CARD

<b>Traded With</b>	<b>Bought</b>	<b>Sold</b>
	# Contracts @ Price	# Contracts @ Price
- _____	# _____ @ _____	# _____ @ _____
- _____	# _____ @ _____	# _____ @ _____
- _____	# _____ @ _____	# _____ @ _____
- _____	# _____ @ _____	# _____ @ _____
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- _____	# _____ @ _____	# _____ @ _____

#### Market Price Histories:

<b>Day and Round</b>	<b>Stock Price</b>	<b>Option Prices</b>
Day 1		
Day 2 Round 1		
Day 2 Round 2		
Day 3 Round 1		
Day 3 Round 2		
Day 4 Round 1		
Day 4 Round 2		
Day 5 Round 1		
Day 5 Round 2		
Expiration		