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A Futures Trading Experiment: An Active Classroom Approach to Learning

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Abstract

This paper presents a classroom experiment where students participate in a simulated futures market. This experiment can be run in about an hour and allows students to interact, negotiate, try different strategies, see how their accounts are closed, and observe how spot and futures markets relate. After participating in the futures experiment, students participate in a debriefing session to help them solidify their learning. This experiment can be successfully adopted in undergraduate finance education.[§]

JEL Codes: A22, G13

Keywords: futures markets, closing, spot markets,

Introduction

Undergraduate finance students often struggle with the concept of futures markets. Students have difficulty because the futures market often parallels the spot price and at maturity the two prices must be equal. Until maturity, however, the two prices can deviate. If students could better understand the factors associated with futures markets, the students would know how and when to take short and long positions and would understand the causes of profits and losses more easily. This classroom experiment can be run easily in one class period and helps finance and economic students understand the simple and more complex concepts in futures markets. The directed discussion following the experiment links the results of the experiment to various finance theories. This pedagogy is similar to the methods for deeper learning suggested by Manzo and Manzo (1997) and Becker, Watts, and Becker (2006). The act of trading currency or other commodity futures gives students a hands-on approach to understanding the abstract idea of futures.

We provide a classroom experiment that can be used in undergraduate finance, undergraduate economics, and even introductory masters of business courses to help students better understand trading strategies and processes. The experiment is suitable for class sizes from ten to forty and takes about an hour, depending on the number of rounds and treatments chosen. Instructors can choose the commodity that is most appropriate for their specific course (currency, oil, agricultural, etc.) and concepts can easily be added to increase the complexity of the game.

This classroom experiment covers long and short positions as well as different strategies. We focus on the concepts of noise, spot markets versus futures markets, closing trades, and making the market, although more advanced classes can add hedging to teach the importance of basis risk. Instructors are welcome to discuss how speculators are valuable to hedgers by providing liquidity. The various treatments of the experiment emphasize price expectations, position trading versus day trading, open interest, and settlement at maturity. Applications to the real world are easy to bring into discussions.

In the experiment, students represent traders who can buy, sell, or buy and sell in the different rounds. Homogenous traders begin with no positions and have a goal of earning as much “money” as

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possible. The experiment consists of several rounds with new information occurring in each round. The contract (or the buy and sell position) is determined by negotiations between individual participants. The ongoing trades are projected onto the board at the front of the room, along with the ongoing futures and spot price. At the end of the experiment (maturity of the contract), traders must close their accounts as the futures price converges to the spot price. Then, students can be rewarded for their profits.

Teaching Points

The trading game provides many teaching points which can be used directly after the game and throughout the remainder of the term as more advanced futures topics are discussed. Below, we provide five topics for teaching points.

Price Expectations and Opening and Closing Long and Short Positions.

As the game begins, there is no expectation of which direction the futures contract may move, however, we do allow trading to occur. Thus, in the beginning, the market is quite thin as students have no pre-conceived notion on the future direction and trading is likened to a pure gamble. After a coin flip, we provide positive or negative “news” which will most likely lead to price changes in that direction. Students then begin the trading process again. Students start to learn that upon expectations of upward (downward) price movements that a long (short) position is desired so they can later sell (buy) at a higher (lower) price. One of the difficulties students tend to have in the classroom is the concept that the majority of contracts are not held to maturity and that it is not necessary to close out your position with your original trading partner. Participants quickly learn that closing a position involves entering into an opposite trade than the original contract opening trade. Some students in this round will seek out other traders to close a position and thereby profit, while some students hold their positions.

Open Interest

During the experiment, students can be provided with the number of contracts outstanding, and thereby learn how opening and closing positions affects the open interest. Thus, students get an idea of the liquidity risk of the contract and must consider how easy it will be to find a willing trader to close out their positions. The process even helps students understand if the day’s total volume of trading is greater than the ending open interest, then day trades must have occurred.

Daily Settlement Price, Contango, and Backwardation

After each “day’s” round of trading comes to an end, we post the final trade as the settlement price. Students are able to see if the asset’s spot price differs from the closing price of the future’s contract. Although our trading game does not involve marking to market, that concept can be incorporated into advancements of the game by calculation of the daily settlement. At this point, the instructor can introduce the terms contango (Futures price > Spot price) and backwardation (Futures price < Spot price).

Position Traders versus Day Trading

Day traders hold their position for less than a day, and are unwilling to allow adverse news to affect the value of their contracts overnight. Position traders, on the other hand, tend to keep contracts open for much longer periods of time and attempt to profit from major movements in the futures contract price. One of the most unique aspects of the game is watching the individual students execute their own strategies. One student may continually take long positions without closing out in hopes that the price will rise by the end of the game, others may continually take short positions. These participants define the position trader. Then, there are the “day” traders, the students who get a contract, and then quickly seek others to close out their position for a profit. At the end of the game, it makes for interesting conversation to compare strategies and discuss how the strategy relates to traders in the real world.

Lack of Liquidity and Convergence of the Futures Price to the Spot Price at Maturity

Futures markets depend on liquidity and frequent trading to provide efficient price discovery. Near the end of the game, the market typically thins out, and the ability to trade usually decreases as participants are forced to accept prices different than what they may have preferred. This adverse price occurs either through finding one of the few students willing to trade or waiting for settlement at maturity. At maturity,

participant's contracts are closed based on the spot price since the futures price and spot price will be equal. These events provide a great opportunity to discuss with students the importance of having willing traders and liquid markets, as well as the action of the law of one price which ensures the equality of the futures and spot price.

Possible Additions: Hedgers, Basis Issues, and Commission Charges

As a possible addition to the game, hedgers can be introduced. (The teacher, a graduate student, or even a student participant may play the role). The hedger can try to buy or sell a contract in an effort to lock in a price for either purchase or sale of the commodity. The hedger simply offers the price he/she is willing to buy or sell, and attempts to find a willing speculator (student participant) to take the other side of the contract. If the hedger closes out the position prior to maturity, this action can lead to the discussion after class of basis risk (risk due to differences in the timing of the contract and timing of the spot purchase or sale of the asset). Beyond that, the teacher can explain how an increase in the basis improves a short hedger's position while hurting a long hedger's position. If the hedger holds the position until maturity, and the spot sale or purchase were perfectly timed, a perfect hedge results, and the price is locked. It can be explained that the hedge may have been beneficial if the price moved as expected, or not if the futures price moved in the opposite direction. This situation provides a lot of opportunities to illustrate to students actual issues that can occur when companies hedge (such as Southwest Airlines' experience with the rising price of fuel in 2008 and the falling price in 2009). Finally, round trip commission charges can be added to provide slightly more realistic profit/loss positions.

The appendix includes the student instructional handout for the experiment, and a list of possible related discussion questions. For a class with little prior knowledge of derivatives, such as experimental methodology, we suggest chapter twenty of *Investments* by Charles P. Jones as additional reading (pp 552-564). We recommend Holt (1999 and 2006) for instructors wanting some background on experiments. Tables I and II provide our experimental results. Electronic copies of the materials for the experiment, including a record-keeping sheet for the instructor, can be obtained by contacting the authors.

Experiment Details

Our experience suggests that the optimal number of traders is between fifteen and twenty. Trading is thin with less than fifteen students. We did, however, run this experiment successfully with eleven traders. Beyond twenty students it is difficult to manage the recording of the results though an experienced instructor could handle more. For larger groups we suggest pairing students. This allows the experiment to be easily run with a class size of up to forty students.

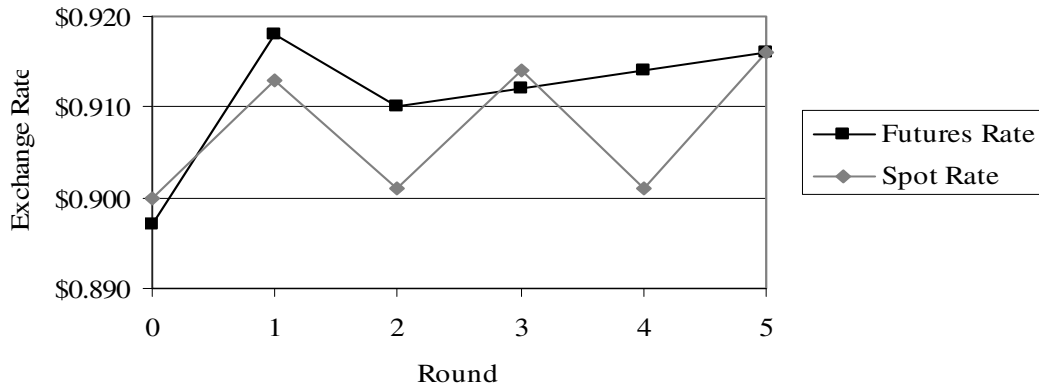
It is very important to go over the instructions with students. Students are provided with the instructions in the prior class (though not all students actually read). On the day of the experiment, in lieu of a trial run, we read the instructions aloud and go through the game example as provided in Appendix A. We also work through the three quick questions at the end of Appendix A.

Students start as commodity traders with no positions and almost no information. They only know the current spot price. A quick coin flip provides information on news and expectations. Heads means positive news and that the spot price is expected to go up. Tails suggests negative news and a likely decreasing spot price. Student traders move around the classroom and make futures trades: buying and/or selling as desired. These trades are recorded on an Excel spreadsheet that is projected to the front of the class. (It is very important that the data are easily viewable.) Then, a die roll determines if the earlier news (the coin flip) is correct. (A roll of 1 changes the direction, and a roll of 2 through 6 confirms the direction). Next, four dice are rolled to determine the change in the spot price. In our game with Australian dollar futures contracts, we have a roll of the four dice represent 1/1000 of a price move. For example, if the spot price is A\$ 0.900 and the total value of the dice rolled is twelve, then the new spot price would be A\$0.912 if the news were positive and A\$ 0.900 - 0.012 = A\$0.880 if the news were negative.

In addition to the trades being made public, we also show on a dry erase board the movement of the spot price and the last bid for the futures price. Table 1 shows an example for one of our sessions. Table 2 shows the trades. In the reported session we had sixteen student traders with a total of fifty-five trades. In all our sessions there seemed to be enough liquidity in the market for people to make desired trades.

Figure 1

Spot Rate Versus Futures Rate



Notes: This figure depicts the pattern of the spot rate and futures rate during the 5 rounds of the exercise. The direction of the spot rate change is dependent on the coin toss and the value change is dependent on the roll of the dice. The futures rate change is dependent on the first trade of the exercise for the beginning of round 1, the value of the last trades for rounds 1, 2, 3, 4, and the spot price for round 5.

Table 1: Panel A
Typical Trading Results from One Session

Round	Action	Trading Activity	Spot Rate	Futures Rate
1	Initial	9 Trades	\$0.900	\$0.897
	Coin Toss	6 Trades		
	Spot Change	11 Trades	\$0.913	\$0.918
2	Coin Toss	5 Trades		
	Spot Change	9 Trades	\$0.901	\$0.910
3	Coin Toss	6 Trades		
	Spot Change	3 Trades	\$0.914	\$0.912
4	Coin Toss	0 Trades		
	Spot Change	4 Trades	\$0.901	\$0.914
5	Coin Toss	2 Trades		
	Spot Change		\$0.916	\$0.916

Table 1 Panel B: All Trading Results

Student	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Buy	0.905	0.895	0.902	0.905	0.880	0.900	0.895	0.890	0.916	0.900	0.898	0.915	0.900	.0900	0.905	0.890
Sell	0.895	0.900	0.915	0.900	0.890	0.895	0.902	0.910	0.890	0.905	0.900	0.918	0.910	0.910	0.880	0.900
Buy	0.916	0.897	0.910	0.915	0.910	0.912	0.917	0.907	0.916	0.905	0.915	0.910	0.918	0.910	0.904	0.900
Sell	0.915	0.915	0.897	0.916	0.915	0.900	0.917	0.917	0.907	0.910	0.916	0.916	0.890	0.912	0.905	0.910
Buy	0.916	0.913	0.917		0.890		0.918	0.910	0.916	0.905	0.915	0.916	0.900	0.912	0.914	0.890
Sell	0.900	0.890	0.918		0.900		0.916	0.910	0.898	0.910	0.916	0.916	0.904	0.916	0.915	0.910
Buy	0.916	0.910	0.910		0.910			0.913	0.916		0.911		0.910		0.919	0.916
Sell	0.904	0.913	0.913		0.911			0.914	0.917		0.914		0.916		0.916	0.916
Buy	0.916	0.920	0.917		0.900			0.913	0.916		0.918					
Sell	0.905	0.916	0.918		0.912			0.915	0.905		0.919					
Buy			0.919		0.915			0.915	0.916		0.904					
Sell			0.920		0.916			0.912	0.910		0.905					
Buy			0.905		0.914			0.909	0.916							
Sell			0.905		0.916			0.916	0.913							
Buy					0.912				0.916							
Sell					0.916				0.919							
Buy					0.908				0.916							
Sell					0.916				0.908							
Buy									0.916							
Sell									0.909							
Profit	-\$1000	\$500	\$1300	-\$500	\$1000	-\$500	\$700	\$2000	-\$2600	\$500	\$200	\$300	\$1000	\$1000	-\$2500	\$1000
Profit	-\$100	\$1800	-\$1300	\$100	\$500	-\$1200	\$0	\$1000	-\$900	\$500	\$100	\$600	-\$2800	\$200	\$100	\$1000
Profit	-\$1600	-\$2300	\$100	\$0	\$1000	\$0	-\$200	\$0	-\$1800	\$500	\$100	\$0	\$400	\$400	\$100	\$2000
Profit	-\$1200	\$300	\$300	\$0	\$100	\$0	\$0	\$100	\$100	\$0	\$300	\$0	\$600	\$0	-\$300	\$0
Profit	-\$1100	-\$400	\$100	\$0	\$1200	\$0	\$0	\$200	-\$1100	\$0	\$100	\$0	\$0	\$0	\$0	\$0
Profit	\$0	\$0	\$100	\$0	\$100	\$0	\$0	-\$300	-\$600	\$0	\$100	\$0	\$0	\$0	\$0	\$0
Profit	\$0	\$0	\$0	\$0	\$200	\$0	\$0	\$700	-\$300	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Profit	\$0	\$0	\$0	\$0	\$400	\$0	\$0	\$0	\$300	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Profit	\$0	\$0	\$0	\$0	\$800	\$0	\$0	\$0	-\$800	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Profit	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	-\$700	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total	-\$5000	-\$100	\$600	-\$400	\$5300	-\$1700	\$500	\$3700	-\$8400	\$1500	\$900	\$900	-\$800	\$1600	-\$2600	\$4000
Sum Total	\$0															

Notes: Panel A provides descriptive statistics for the exercise. Listed are the rounds, action, trading activity, spot rate and futures rate. The spot and futures rate correspond to figure 1. There were a total of 16 student traders and a total of 55 trades. Panel B contains the trades and profits for each individual student.

The design of the experiment includes some theoretical limitations that should be discussed with the students. For example, there are no costs to carry. But the main objective of this experiment is to introduce students to futures markets; we, therefore, abstract from other factors, such as marking to market and holding costs. Second, the spot price is completely exogenous to the game. Students do not even know theoretically why the spot price changes other than the directional coin flip. However, these simplifications enable the experiment to be run in one class period and to be used later to facilitate discussion and teaching points.

The Importance of Payoffs

The way that the payoff is set can greatly impact the student strategies. We use a simple method. Whoever earns the most gets five bonus points added to his/her next exam grade. Whoever earns second most gets four points, and whoever earns third most gets three points. There are four exams in the class so those points can help a marginal student, but are not going to raise a C- student to a B. We do not penalize students with losses. Naturally, this grading process could encourage students to take big positions to try to win it all. This strategy would make sense since as there is no penalty for losses, but we find that students mix between taking large positions and attempting to make many small trades similar to day traders.

There are pay-off methods that do not imitate tournaments. Holt (1999) uses a different method in his experiments. He pays one randomly selected student a very small percentage of his/her earnings. In some classes, bragging rights alone would encourage students to actively participate. Alternatively, some students just enjoy learning so much that they want to trade. However, we find the pay-off technique we use provides us with different strategies by students which makes for great discussion at the end.

Conclusion

Students' first exposure to futures contracts, whether it is in an undergraduate finance course such as investments or in an introductory MBA class, often leaves them with many questions. These questions include but are not limited to: how markets operate, why liquidity is important, and even the basic strategy of short and long positions. To alleviate some of the initial confusion, we provide instructions for a one class period futures game which can be run by a single instructor and can include all students in the class either acting alone or in teams.

The game has many benefits for both teachers and students. Instructors may choose the underlying asset and contract based on the course - for example, currency for a multinational finance class, soybeans for an agricultural economics course, or even oil for an energy policy course. The game can be lengthened or shortened based on the teaching needs, and the only requirements are a coin, some dice, and an Excel spreadsheet. By allowing students to trade on their own or in teams, students quickly begin to understand the basic concepts of futures trading. Students learn the difference between long and short positions, how trades are opened and closed, and what happens if contracts are held until maturity. It helps students understand the difference between the spot price of an asset, and the settlement price of a futures contract, as well as the terms open interest, contango, and backwardation. Based on different actions taken by students, instructors can discuss the risks faced by different strategies such as day trading and position trading. In addition, since trading typically thins during some part of the game, the concept of liquidity and its importance to the futures market can be an important topic of conversation at the end of the game.

For students who are a little further along in their course and already have the basic understanding of futures contracts, we provide a few enhancements to increase the sophistication of the game such as introducing hedgers along with the speculators. This addition allows the instructor to use the game to discuss such areas as basis risk and the success of the hedge which can lead to conversations about the advantages and disadvantages of hedging.

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Appendix A

Instructions for Australian dollar currency futures game

In this experiment, we will be setting up a “pit market” for futures to trade Australian dollar currency futures in the amount of A\$100,000. In a pit market, you will have the opportunity to walk around the classroom looking for someone who will trade with you. There is no auctioneer. There will be five rounds and you may buy, sell, or hold in any of the rounds.

The starting spot price will be \$0.900/A\$ and your trading will determine the futures price. You may buy (go long) or sell (go short) at any price you like to 3 decimal places if you can find a willing trader. In each round you may buy or sell as many contracts as you like, but in each round you may only buy or sell one contract to each person. So you might have 3 contracts with 3 different people, but only one contract per person. You may not trade for prices below \$0 and you may only make 20 round trips (combined buys and sells) during the course of the game. We will not concern ourselves with brokerage fees, margin accounts and marking to market. Keep in mind that the principle of a futures contract is that if a speculator buys (sells) a futures contract, he/she is locking in the price at which he/she must buy (sell) that currency on the specified future date. Because we are not marking to market, “cash” will only be exchanged or “profit” calculated when positions are closed. We will occasionally get a phone call from a broker for a company which wishes to hedge its open positions in Australian dollars, and one person may trade with that company at the company’s desired price.

How will this process work?

Each student will be a trader, and we will allow anyone to trade before any news occurs at the beginning. Then we will flip a coin to let you know if the latest news is positive or negative for the price of the Australian dollar. Heads is positive news and tails is negative. You may now trade again. Then we will roll a die and if it lands on 2 through 6, the currency direction will follow the coin and expected news. If it lands on 1, the currency will move in the opposite direction. Finally, we will roll four six sided dice, and the sum of the dice will determine the amount of the price swing. (For example, if we have positive news, and the sum of the dice is 24, the new spot price will be $0.900 + 0.024 = 0.924$). You may trade again. To conduct a trade, you must bring your trading sheets to the recorder so we may enter them into the spreadsheet. Any offsetting position you take will close out the earliest contract.

Trading will take place in each round as shown below with about 5 minutes per trading session. Once the timer ends, only those in the recording line will be allowed to trade.

First round

Start – trading occurs.

Coin flip for expectations – trading occurs

Roll die for verification of expectations – no trading

Roll 4 dice for spot price change – trading occurs

2nd, 3rd, 4th, and 5th round

Coin flip for expectations – trading occurs

Roll die for verification of expectations – no trading

Roll 4 dice for spot price change – trading occurs.

The last round will only have trading after a coin flip. Then we will roll the die for verification of the direction and roll the 4 dice for the price change from the spot. *After that all positions will be closed out at the final price when the futures price equals the spot price.*

Example

Price starts at 0.900.

Kevin sells 1 contract and Mike buys 1 contract at 0.850. (Prices do not have to be 0.900 to start).

The coin is flipped and comes up heads. No one chooses to trade. The single roll of the die changes the direction (rolls a 1). Imagine the roll of the 4 dice sums to 18. The spot price falls to $0.900 - 0.018 = 0.882$. Trades can occur again.

Mike offsets by selling a contract to Dan who buys at 0.870. Kevin sells another contract to Julie who buys at 0.880. No more trading occurs and the futures settle (last price) is 0.880 and the current spot rate is 0.882.

(on the trading sheet)

Mike:

Buy at 0.850 from Ken

Sells at 0.870 to Dan

Cancels position:

Long Profit: $100,000 \times (0.870 - 0.850) = \2000

Kevin:

Sell at 0.850 to Mike

Sell at 0.880 to Julie

Dan:

Buy at 0.870 from Mike

Julie:

Buy at 0.880 from Kevin

Then, we would start the second round, and flip the coin. Suppose Kevin never made another trade to offset his second sell. At the end of the last round, suppose the spot rate ended up being 0.930. Kevin would close out at that position at:

Short profit/loss: $-100,000 (0.930 - 0.880) = -\$5,000$. (ouch!)

What is Dan's final profit/loss if he never closed out his position prior to maturity?

3 Quick Questions:

1. How do you calculate your overall profit or loss from futures positions?
2. Are futures markets a zero sum game for individual players or the market as a whole?
3. When does the futures price have to equal the spot price?

Your trading sheet will look as follows:

Name (Team) _____

Trade 1 _____

Trade 2 _____

.....

Trade 40 _____