

# Chapter 1

## Introduction

Agricultural producers operate amidst uncertainty. Planning decisions are often made without full knowledge of where prices and yields will be for harvest. For example, grains are planted in the spring without knowing how much the harvested grain will be worth. Additionally, weather is also uncertain. This means that yields are also unknown. With this kind of uncertainty, risk management is a crucial component to every farm operation.

### 1.1 Where does risk come from in agriculture?

Risks generally originate in three different areas of production:

1. Output price
  - Domestic and global supplies are uncertain
  - Domestic demand is unknown and can change with new information about commodity (eg, BSE outbreak, food recalls)
  - Often global demand depends on supplies from major trading partners (eg, TB in Australia could lead to increased demand for US Beef)

in South Korea)

2. Input price

- Many inputs are tied to energy markets which are very uncertain (eg, fertilizer, corn)

3. Productive efficiency or yields

- Weather is a major reason for uncertain yield outcomes

## 1.2 Why is uncertainty undesirable?

1. If outcomes were certain, then plans would be more efficient

- Producers would know exactly which crop to plant
- Producers would know exactly when to sell and when to store
- Since outcomes are uncertain, plans are usually sub-optimal (when outcome is known)
- Analogous to smoothed consumption hypothesis in macroeconomics

2. Producers (and people, in general) are mostly risk averse

- A risk averse agent prefers a certain outcome to an uncertain outcome, when expected outcomes are identical.
- Pay me \$10 and I will flip a coin.
  - If Heads, you get \$20 + original \$10 (\$30 total).
  - If Tails, lose your \$10 and win nothing (\$0 total).
  - Or, I could just pay you \$5 and you also keep your \$10.
  - How many would prefer to play? If so, you are not risk averse

### 1.3 How can risk be managed in farm operations?

- Futures and options market to hedge output and input price risk
- Forward contracts to lock in output and input prices
- Existing farm programs (decoupled payments and disaster relief)
- Crop insurance products offer subsidized products that shield against price and yield risk
- Weather derivatives used to hedge against uncertain yield outcomes

We will go over all of these topics except existing farm programs. Given the high prices for most commodities at the current time, there is likely to be a lack of concern for producers who have higher incomes, on average, than the rest of the U.S.. What does this mean for agriculture? High commodity prices mean the stakes are much higher, meaning appropriate risk management will be more valuable to producers and agribusinesses.

Futures and options markets provide the most longstanding method of mitigating price risk. Unfortunately, it is a market that is underutilized by most agricultural producers due to a lack of understanding. This course will focus on allowing all of you to effectively utilize the available tools to manage risk and also understand the other players in the commodity trading market, including speculators and arbitrators.

Derivatives are also beginning to play a more important role in business, finance, and agriculture. A better understanding of some basic derivative concepts will help clarify what went wrong in the last 5 years.

## 1.4 Futures Contracts

A *futures contract* is an agreement to buy or sell an asset at a certain time in the future for a certain price.

An example of how futures contract work

- In March, a trader in New York instructs broker to **buy** 5,000 bushels of corn with a July delivery
  - This is a **long futures position**
- At the same time, a trader in Kansas instructs a broker to **sell** 5,000 bushels
  - This is a **short futures position**
- Both brokers communicate the instructions to the CME
- The agreed upon price is the **futures price**
- The futures price is determined based on supply and demand
- Trader in New York has agreed to purchase 5,000 bushels of corn in July from the Kansas trader for the futures price

The *spot price* is similar to the futures price, except it is for immediate or almost immediate delivery.

Another example

- Assume an investor enters into a long futures contract to buy 100 oz of gold at \$1,050 in April
- When April comes around the price of gold is \$1,065 per oz
- The investor has profited by  $(\$1,065 - \$1,050) * 100 = \$1,500$

## 1.5 The Over-the-counter market

Not all trading is done on exchanges, where contracts are defined by an exchange such as the Chicago Board of Trade. An increasing number of trades are made in an important alternative market known as the **over-the-counter** market.

- Trades are often over telephone conversations that are taped or done electronically
- Financial markets use the OTC market along with non-financial and hedge managers
- The OTC market grew to be 10 times the size of electronic exchanges in 2008 (see figure 1.2)
- For example, a bank might agree to buy \$100 Million (US Dollars) with British Pounds at a predetermined exchange rate in one year

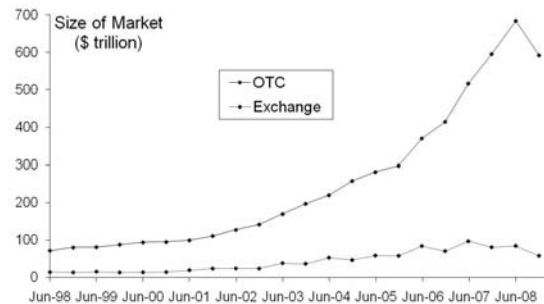
## 1.6 Options

Options are traded both on exchanges and in the OTC markets. There are two main types of options:

1. A *call option* gives the holder the right to **buy an asset at a certain date for a specified price**
  2. A *put option* gives the holder the right to **sell an asset at a certain date for a specified price**
- The price of the contract is known as the *strike price* or *exercise price*
  - An American option can be exercised at any time during the life of the contract

## Size of OTC and Exchange Markets

(Figure 1.2, Page 4)



Source: Bank for International Settlements. Chart shows total principal amounts for OTC market and value of underlying assets for exchange market

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- With an option, the holder *has the right* to do something, distinguishing it from futures (or forward) contracts
- The up-front price of an option is known as the *options premium*
- The price of a call option decreases as the strike price increases
  - Remember, a call is used to establish a price ceiling
  - The higher the ceiling, the less likely the option will be exercised
  - Also, the lower value it has when it is exercised
- The price of a put option increases as the strike price increases
  - Remember, a put is used to establish a price floor
  - The higher the floor, the more likely the option will be exercised

– Also, the lower value it has when it is exercised

- These two concepts can be illustrated using current options quotes

## Google Option Prices (July 17, 2009; Stock Price=430.25); See page 6



| Strike price<br>(\$) | Calls       |              |             | Puts        |              |             |
|----------------------|-------------|--------------|-------------|-------------|--------------|-------------|
|                      | Aug<br>2009 | Sept<br>2009 | Dec<br>2009 | Aug<br>2009 | Sept<br>2009 | Dec<br>2009 |
| 380                  | 51.55       | 54.60        | 65.00       | 1.52        | 4.40         | 15.00       |
| 400                  | 34.10       | 38.30        | 51.25       | 4.05        | 8.30         | 21.15       |
| 420                  | 19.60       | 24.80        | 39.05       | 9.55        | 14.70        | 28.70       |
| 440                  | 9.25        | 14.45        | 28.75       | 19.20       | 24.25        | 38.35       |
| 460                  | 3.55        | 7.45         | 20.40       | 33.50       | 37.20        | 49.90       |
| 480                  | 1.12        | 3.40         | 13.75       | 51.10       | 53.10        | 63.40       |

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For example

- Assume an investor wants to buy a December put option on Google with a strike price of \$400 (Table 1.2, pg. 6)
- Broker relays the instruction to CME
- Trader finds another trader who wants to sell
- Cost of the contract would be  $100 \times 21.15$ , or \$2,115.
- The investor now has the right to sell 100 Google shares for \$400 per share prior to December 19th

- If the Google price stays above \$400, then the option has no value and is not exercised
- If the price falls to \$350 and it is exercised, then the investor makes \$5,000  
[100 \* 50]

## 1.7 Types of Traders

Futures, forward, and options markets are used by three types of traders

1. Hedgers - reduce risk from potential future movements in uncertain prices  
Ex. Rancher purchases a put on feeder cattle prices to limit downside output price risk
2. Speculators - bet on future directions of uncertain prices  
Ex. Investor who believes feeder cattle prices will increase, takes a long position in feeder cattle prices
3. Arbitrageurs - attempts to profit from price inefficiencies in the market by making simultaneous trades that offset each other and capturing risk-free profits  
Ex. An investor identifies that the futures price is higher than the spot price



## Chapter 2

# Mechanics of the Futures

## Markets

This chapter provides the details concerning the workings of the futures market.

### 2.1 Opening and Closing of Futures Positions

- Most futures contracts do not lead to actual delivery
- Most investors choose to close out their positions prior to the delivery period in the contract
- Actual delivery is inconvenient and often quite expensive
- Closing a position involves entertaining the opposite trade to the original
  - For example, an investor buys five July corn futures contracts in May
  - The position is closed when the buyer sells the contracts in June
- The total gain or loss is determined when the position is closed

## 2.2 Specification of the Futures Contract

- The asset or commodity
- The contract size - amount of the asset
- Delivery arrangements (eg, where)
- Delivery months
- Price quotes
- Price limits - Trade ceases if price is *limit up* or *limit down*
- Position limits - to avoid large movements in price from speculation

## 2.3 Convergence of Futures and Spot Prices

As the delivery period for a futures contract is approached, the futures price converges to the spot price of the underlying asset. When the delivery period is reached, the two should be very close to equal. This convergence must occur because traders have a clear arbitrage opportunity if it doesn't. To illustrate, consider the following example,

- Assume the futures price is above the spot price during the delivery period
- Traders can sell (ie, short) a futures contract, buy the asset, then make a delivery for a profit
- As this opportunity is exploited, the futures price will fall

## 2.4 Margins and Margin Calls

The main function of the exchange is to provide an organized trading environment so that contract defaults are avoided. For example, assume two individuals

contract each other directly and make an exchange agreement. What happens when one individual regrets the deal and backs out? The exchange is set up to avoid this scenario. This section details how the exchange avoids individuals from backing out.

- Brokers require the investor to deposit funds in a *margin account*
- The initial deposit into account is called the *initial margin*
- The margin account is settled at the end of each trading day in order to reflect the most recent settlement
  - In the case of a long position, a price drop will result in a reduction of the margin account (see table 2.1, pg. 27)
- Money is transfer from from one margin account to the opposing trader to reflect current values
- If the balance falls below the *maintenance margin*, the investor receives a *margin call*
  - Investor is expected to increase margin account to the initial margin level the next day
  - If the margin call cannot be made, the position is closed
- See Table 2.1 to illustrate how maintenance margins are utilized
- Brokers often allow investors to earn interest on the balance in a margin account
- Minimum maintenance margins are specified by the exchange

An important distinction here is made between the futures and forward contract prices. Forward contracts are settled at the end of the contracts life, while the futures contract is settled at the end of each day.

## A Possible Outcome

Table 2.1, Page 27



| Day    | Futures Price (US\$) | Daily              | Cumulative         | Margin                 |                    |
|--------|----------------------|--------------------|--------------------|------------------------|--------------------|
|        |                      | Gain (Loss) (US\$) | Gain (Loss) (US\$) | Account Balance (US\$) | Margin Call (US\$) |
|        | 900.00               |                    |                    | 4,000                  |                    |
| 5-Jun  | 897.00               | (600)              | (600)              | 3,400                  | 0                  |
| ⋮      | ⋮                    | ⋮                  | ⋮                  | ⋮                      | ⋮                  |
| 13-Jun | 893.30               | (420)              | (1,340)            | 2,660                  | + 1,340 = 4,000    |
| ⋮      | ⋮                    | ⋮                  | ⋮                  | ⋮                      | ⋮                  |
| 19-Jun | 887.00               | (1,140)            | (2,600)            | 2,740                  | + 1,260 = 4,000    |
| ⋮      | ⋮                    | ⋮                  | ⋮                  | ⋮                      | ⋮                  |
| 26-Jun | 892.30               | 260                | (1,540)            | 5,060                  | 0                  |

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## 2.5 Quote Definitions

- Open - Opening price
- High - Highest price achieved in the trading during the day
- Low - Lowest price achieved in the trading during the day
- Settlement - Usually calculated as the price of the last contract traded before the end of the trading day
  - used in calculating daily gains/losses and margin requirements
- Open Interest - Total number of outstanding (or open) contracts

## 2.6 Types of Orders

Given that prices move throughout the day, different ordering strategies can also be used which include

- Market Order - Requests that a trade be carried out immediately at the best price available in the market. This is the simplest type of order.
- Limit Order - Specifies a limit price at which the transaction can be made. For example, if the limit price is \$30 for a long position, the order will only be executed if the price is \$30 or less. This type of a transaction might not be reached.
- Stop Order - Specifies a target price where the transaction is made immediately upon hitting the target price
- Market-if-touched (MIT) Order - Basically becomes a Market Order once a target price is reached.

## 2.7 Some Regulatory Issues

- Futures markets in the U.S. are regulated by Commodity Futures Trading Company (CFTC)
- Efforts to 'corner the market' can be regulated through stricter margin requirements or trading limits

## 2.8 Forward vs. Futures Contracts

The basic differences between forward and futures contracts will help to illuminate the ability of using each market strategically

- Futures contracts are settled on a daily basis and are usually closed out before delivery
- Forward contracts are settled at the end of the contract
- While futures contracts are sold on an exchange, forward contracts are sold over-the-counter