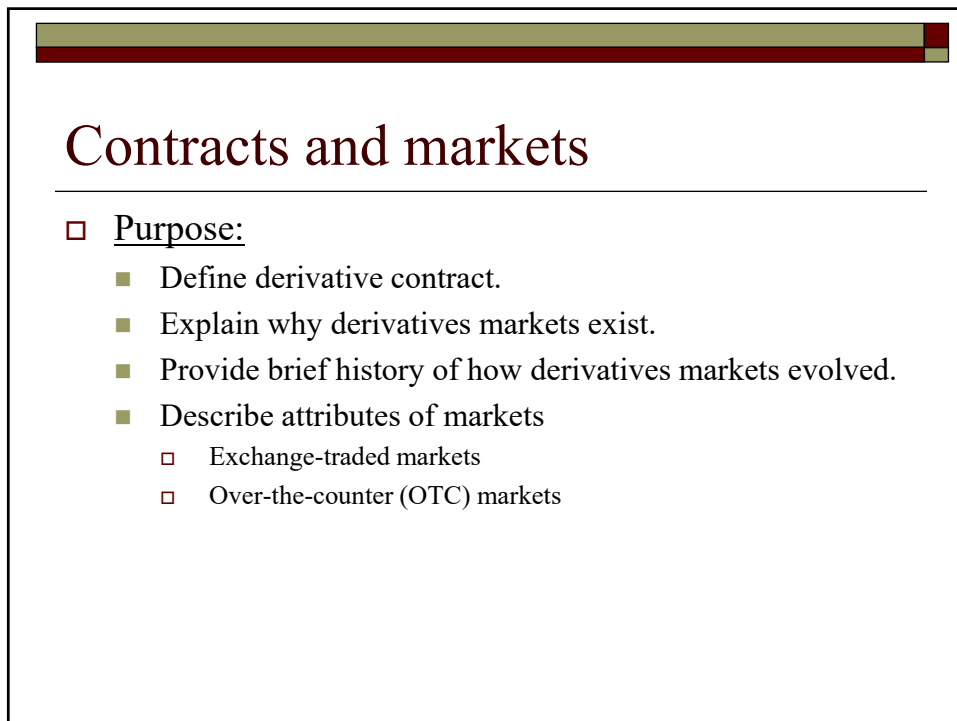


DER 01

Contracts and markets

1



Contracts and markets

□ Purpose:

- Define derivative contract.
- Explain why derivatives markets exist.
- Provide brief history of how derivatives markets evolved.
- Describe attributes of markets
 - Exchange-traded markets
 - Over-the-counter (OTC) markets

2

Contracts

- “Derivative contract” or “derivative”
 - Derives its value from underlying asset
 - Stock index futures derives its value from stock portfolio
 - Currency option derives its value from exchange rate

3

Contracts

- Only two basic types of derivative contracts:
 - forward
 - option
- Everything else is either:
 - variation of forward or option
 - portfolio of forwards (i.e., swap) and/or options

4

Forward contracts

- Forward contract
 - Contract to buy or sell asset on specified future date at price specified today.
 - no payment made today
 - payment occurs at expiration when asset is delivered
 - asset may be anything
 - E.g., wine <http://www.wine-searcher.com/futures.lml>

5

Forward contracts

- Illustration:
 - Consider two-day forward contract on wheat. Assume current price is \$5.50 per bushel.
 - If you buy forward today and hold it to maturity, what is your profit?
 - You bought forward, so you are long wheat.
 - You agreed to buy bushel of wheat in 2 days for \$5.50.

$$f = f_0 = 5.50$$

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Forward contracts

□ Illustration:

■ Cash flows:

Day	0	1	2
Long forward	0		$\tilde{f}_2 - 5.50$ $= \tilde{S}_2 - 5.50$

At inception, no money changes hands.

At expiration, uncertain forward price must equal uncertain asset price.

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Forward contracts

□ Illustration:

■ Cash flows:

Day	0	1	2
Long forward	0		6.00 - 5.50 = .50

If asset price is \$6.00, profit from long (short) forward contract is \$.50 (-\$.50).

Buyer makes \$0.50. Seller loses \$0.50.

Derivatives trades are zero sum game.

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Forward payoffs

- Forward payoffs at time T :

$$\text{Profit on long forward}_T = \tilde{f}_T - f = \tilde{S}_T - f$$

$$\text{Profit on short forward}_T = -(\tilde{f}_T - f) = -(\tilde{S}_T - f)$$

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Contract settlement

- Upon expiration, derivatives contracts are settled in two ways.
 - Delivery settlement
 - Cash settlement

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Delivery settlement

Day	0	1	2
Long forward	0		$6.00 - 5.50$ $= .50$

Delivery settlement: At settlement, long:

- (a) Pays \$5.50.
- (b) Takes physical delivery of wheat.
- (c) Sells wheat in cash market at \$6.00.
- (d) Realizes gain of \$0.50 profit.

Delivery settlement: At settlement, short:

- (a) Receives \$5.50.
- (b) Physically delivers wheat.
- (c) Deliver wheat in cash market at \$6.00.
- (d) Realizes loss of \$0.50.

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Cash settlement

Day	0	1	2
Long forward	0		$6.00 - 5.50$ $= .50$

Cash settlement: At settlement, long:

- (a) Receives \$0.50.

Cash settlement: At settlement, short:

- (a) Pays \$5.50.

Eliminates costs (and uncertainties) of physical delivery.

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Trade motivation

Day	0	1	2
Long forward	0		$6.00 - 5.50$ $= .50$

Is buyer hedging or speculating? (Derivatives contracts are often characterized as bets.)

It depends.

Does buyer have another price exposure to wheat?

Speculating if no other exposure (e.g., meteorologist predicting great weather).
 Hedging if short wheat (e.g., breakfast cereal producer).

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Trade motivation

Day	0	1	2
Long forward	0		$6.00 - 5.50$ $= .50$

Is seller hedging or speculating?

It depends.

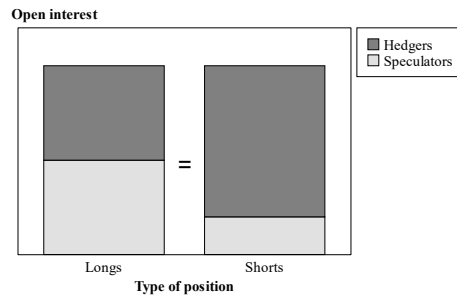
Does seller have another price exposure to wheat?

Speculating if no other exposure (e.g., meteorologist predicting dry summer).
 Hedging if long wheat (e.g., farmer waiting for his crop to grow).

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Open interest

- Can trader motivations be identified?
 - In some exchange-traded markets, yes.
- Open interest is number of contracts outstanding at given point in time.



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Market participants

- How to identify futures market participants.
- Go to website www.cftc.gov.
 - Choose “Market Data and Economic Analysis” menu and then “Commitments of Traders.”



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Market participants

- ❑ How to identify futures market participants.
 - Scroll down Commitments of Traders to find “Current Disaggregated Reports”.
 - Futures are arranged by category. Choose “Long Format” to see report for agricultural products.

Reports Dated October 03, 2023 - Current Disaggregated Reports:

	Disaggregated Futures Only		Disaggregated Futures-and-Options -Combined	
	Long Format	Short Format	Long Format	Short Format
Agriculture	Long Format	Short Format	Long Format	Short Format
Petroleum and Products	Long Format	Short Format	Long Format	Short Format
Natural Gas and Products	Long Format	Short Format	Long Format	Short Format
Electricity	Long Format	Short Format	Long Format	Short Format
Metals and Other	Long Format	Short Format	Long Format	Short Format

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Market participants

- ❑ How to identify futures market participants.
- ❑ Report appears.

WHEAT-SRW - CHICAGO BOARD OF TRADE Code-001602
 Disaggregated Commitments of Traders - Futures Only, October 03, 2023

	Reportable Positions												Nonreportable Positions	
	Producer/Merchant/Processor/User			Swap Dealers			Managed Money			Other Reportables				
Interest	Long	Short	Long	Short	:Spreading	Long	Short	:Spreading	Long	Short	:Spreading	Long	Short	
:(CONTRACTS OF 5,000 BUSHELS)														
: Positions														
All	429,933:	70,555	69,552	57,661	422	16,691	66,128	171,752	95,355	56,685	12,328	27,686:	38,732	35,627
Old	378,938:	63,240	59,426	44,523	1,184	15,422	68,891	168,337	74,981	61,479	14,512	15,370:	35,052	29,706
Other:	50,995:	7,315	10,126	13,959	59	448	14,274	20,452	3,337	3,210	5,900	4,152:	3,700	5,921

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Market participants

- ❑ “Commercial” is someone who hedges.
 - “Producer/Merchant/Processor/User”, “Swap Dealers”
- ❑ “Non-commercial” is generally someone who speculates.
 - “Managed Money”, “Other Reportables”
- ❑ “Spreading” is net of trader who is both long and short.

WHEAT-SRW - CHICAGO BOARD OF TRADE Code-001602
 Disaggregated Commitments of Traders - Futures Only, October 03, 2023

	Reportable Positions											Nonreportable Positions		
	Producer/Merchant/Processor/User			Swap Dealers			Managed Money			Other Reportables		Long	Short	
Open	Long	Short	Long	Short	Spreading	Long	Short	Spreading	Long	Short	Spreading	Long	Short	
:(CONTRACTS OF 5,000 BUSHELS)														
All	429,333	70,555	69,552	57,661	422	16,691	66,128	171,752	95,355	56,605	12,328	27,606	38,732	35,627
Old	378,938	63,240	59,426	44,523	1,184	15,422	68,891	168,337	74,981	61,479	14,512	15,370	35,032	29,706
Other	50,395	7,315	10,126	13,959	59	448	14,274	20,452	3,337	3,210	5,900	4,152	3,700	5,921

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Market participants

WHEAT-SRW - CHICAGO BOARD OF TRADE Code-001602
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	Producer/Merchant/Processor/User			Swap Dealers			Managed Money			Other Reportables		Long	Short	
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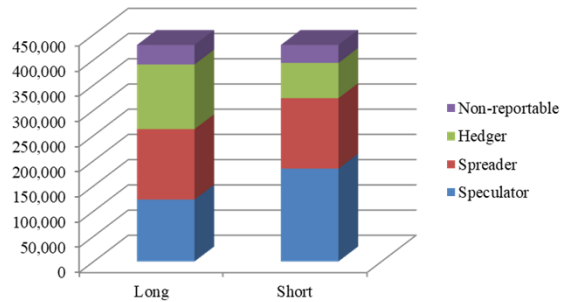
- ❑ [Supporting file: Breakdown of open interest.xlsx.](#)
- ❑ [Supporting file: Disaggregated COT report.pdf](#)

Participant	Long	Short
Speculator	122,733	184,080
Spreader	139,652	139,652
Hedger	128,216	69,974
Non-reportable	38,732	35,627
Total	429,333	429,333

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Market participants

- Supporting file: Breakdown of open interest.xlsx.



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Option contracts

- Option contract is right to buy or sell asset at specified price, X , by or on specified date T .
 - Call is right to buy at X .

$$\text{Profit on long call}_T = \max(0, \tilde{S}_T - X)$$

$$\text{Profit on short call}_T = -\max(0, \tilde{S}_T - X)$$

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Option contracts

- Option contract is right to buy or sell asset at specified price, X , by or on specified date T .
 - Put is right to sell at X .

$$\text{Profit on long put}_T = \max(0, X - \tilde{S}_T)$$

$$\text{Profit on short put}_T = -\max(0, X - \tilde{S}_T)$$

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Valuation-by-replication

- Long forward has same value as portfolio consisting of long call and short put.
 - Buy call and sell put with exercise price equal to forward price.

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Valuation-by-replication

- Long forward has same value as long call and short put.
 - Buy call and sell put with exercise price equal to current forward price.

$$\text{Option portfolio profit}_T = \max(0, \tilde{S}_T - f) - \max(0, f - \tilde{S}_T)$$

$$= \tilde{S}_T - f$$

↙
↖

Terminal value of long call
Terminal value of short put

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Valuation-by-replication

- Long forward has same value as long call and short put.
 - Buy call and sell put with exercise price equal to current forward price.

$$\text{Option portfolio profit}_T = \max(0, \tilde{S}_T - f) - \max(0, f - \tilde{S}_T)$$

$$= \tilde{S}_T - f$$

$$\text{Long forward profit}_T = \tilde{S}_T - f$$

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Valuation-by-replication

- What does this imply?
 - Buying forward costs you nothing today and, at time T , you receive

$$\tilde{S}_T - f$$

- Buying call at current price, c , and selling put at current price, p , entitles you to receive at time T

$$\tilde{S}_T - f$$

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Valuation-by-replication

- What does this imply?
 - Terminal values are same so cost at inception must be same (otherwise free money can be made).
 - Current cost of forward must equal $-c + p$. Hence,

$$0 = -c + p \quad \text{or} \quad c = p$$

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Why do derivatives markets exist?

- Trading costs/trading restrictions in asset/spot market.
 - Example 1: Active mutual fund manager believes that U.S. stock market will fall over next month.
 - Manager's skill is "stock-picking."
 - Does not want to liquidate portfolio of winners, but does want stock market risk.
 - Sell stock index (S&P 500) futures.
 - Costs about 5% of selling portfolio stocks.

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Why do derivatives markets exist?

- Trading costs/trading restrictions in asset market.
 - Example 2: Fund manager believes that South African stock market is underpriced.
 - Foreigners cannot buy South African stocks but can buy stock index futures.
 - Circumvents regulatory constraint (i.e., foreign investors cannot hold south African stocks) and is less expensive.

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Why do derivatives markets exist?

- Trading costs/trading restrictions in asset market.
 - Example 3: Firm wants to eliminate interest rate risk of its floating-rate debt but does not want to pay huge flotation costs of issuing fixed-rate debt.
 - Enter “floating-for-fixed” rate swap agreement.
 - Costs about 1/50th.

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Why do derivatives markets exist?

- Trading costs/trading restrictions in asset market.
 - Example 4: Farmer wants to lock-in price at which he can sell his wheat crop in fall.
 - Sell wheat futures contracts.
 - Has no ability to sell crop that has not yet been harvested.

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Evolution of derivatives markets

- Derivatives have been traded since ancient Greeks (350 BC)
 - options on olive presses
 - over-the-counter (OTC) contracts
- Key attributes of OTC derivatives:
 - Trades between consenting parties
 - Limitless contract flexibility
 - Lack transparency
 - Unregulated
 - Risk of default

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Evolution of derivatives markets

- Certain catastrophic events caused OTC derivatives to default (e.g., tulip bulb crisis in Holland in 1637).
 - Defaults resulted in:
 - reputational damage
 - prohibition

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Evolution of derivatives markets

- Chicago Board of Trade (CBT) created first *futures exchange* in 1865.
- Key features of derivatives exchange markets:
 - To promote *market depth* and *liquidity*:
 - Centralized markets
 - Standardized contracts
 - To promote *market integrity*:
 - Clearinghouse
 - System of margins or performance bonds
 - Transparency
 - Regulated

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Evolution of derivatives markets

- 1865-1933: Other *agricultural* futures exchanges are created.
 - 1870: New York Cotton Exchange
 - 1882: Coffee Exchange
 - 1878: London Corn Trade Association
 - 1904: Winnipeg Commodity Exchange

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Evolution of derivatives markets

- 1933-1972: Futures contracts on other *physical* commodities are introduced.
 - 1933: Commodity Exchange (silver)
 - 1952: London Metal Exchange (lead)
 - 1961: Chicago Mercantile Exchange (pork bellies)

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Evolution of derivatives markets

- 1970s: First decade of major innovation.
 - 1972: First futures on *financial* asset.
 - CME lists currency futures.
 - 1973: First *exchange-traded* options.
 - CBT forms CBOE to list call options on stocks.
 - 1975: First *interest rate* futures.
 - CBT lists GNMA futures.

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Evolution of derivatives markets

- 1980s: Second decade of major innovation.
 - 1981: First futures *cash-settlement* futures.
 - CME lists Eurodollar futures.
 - 1982: First *stock index* futures.
 - KCBT lists Value Line index futures.
 - CME lists S&P 500 futures.
 - 1982-83: First exchanged-traded options on assets other than stocks.
 - Stock indexes, bonds, currencies, and futures.

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Evolution of derivatives markets

- 1980s saw re-emergence of OTC derivatives markets.
 - Emphasis on financial assets.
 - Banks are actively involved in cash markets for stocks, bond, and currencies.
 - Banks understand customer needs and can design contracts to fit needs without regulatory consent.
 - Technology (e.g., high-speed communication and computers) reduce need for centralized markets.

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Evolution of derivatives markets

- 2000s: VIX – Last major derivatives innovation.
 - VIX index reported on real basis since January 1993.
 - VIX derivatives not launched until 10 years later.
 - VIX futures by CBOE Futures Exchange in March 2004.
 - VIX options in February 2006.
 - Markets have been spectacularly successful.
 - VIX futures now trade 24 hours a day.
 - VIX options often trade more than million contracts daily.
 - VIX derivatives now account for about 40% of CBOE annual revenue.

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Evolution of derivatives markets

- Growth in OTC derivatives trading has been phenomenal.
 - Virtually no trading in early 1980s.
 - Same notional amount outstanding as exchanges at end of 1991.
 - USD 618 trillion in June 2022.
 - See <https://stats.bis.org/statx/toc/DER.html>
<https://www.isda.org/2019/10/16/isda-smart-contracts/>

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Lesson summary

- Only two basic types of derivatives
 - forward
 - option
- All other derivatives are:
 - variations of forward or options
 - portfolios of forwards and/or options

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Lesson summary

- Derivatives are used to risk allocation.
 - Hedging: Return/risk reduction.
 - Reducing commodity, equity, interest rate, or currency price risk by taking opposite position in derivatives market
 - Speculating: Return/risk enhancement.
 - Taking on price risk to profit from directional view
- Why do derivatives markets exist?
 - Trading costs/restrictions in asset market.

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Lesson summary

- Evolution of derivatives markets.
 - Started OTC thousands of years ago.
 - Derivatives fiascos caused reputational damage and prohibition.
 - Organized as exchange markets in 1800s.
 - Significant innovation in 1970s and 1980s.
 - Return to significant OTC trading in 1990s.

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Lesson summary

- Exchange markets
 - standardized contracts
 - clearinghouse and margins
 - transparency
 - regulated
- OTC markets
 - limitless flexibility in contract design (ISDA standards)
 - unregulated
 - lack transparency
 - credit risk

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