FINANCIAL DERIVATIVES

Topic 1 Introduction

LIGANG ZHOU

School of Business

Macau University of Science and Technology

Preliminaries

Textbook & Reference Book

- John C. Hull, Fundamentals of Futures and Options Market (9th Ed.), Pearson, 2017.
- John C. Hull, Options, Futures, and Other Derivatives (9th Ed.), Pearson, 2015.
- Robert L. McDonald, Fundamentals of Derivative Markets (2nd Ed.), Pearson, 2006.
- Rangarajan K. Sundaram, Sanjiv R. Das, Derivatives: Principles and Practice (2nd Ed.), McGraw Hill, 2016.

Assessment Method

Class Participation	10%
Assignments	10%
Projects	20%
Quiz	10%
Final Examination	50%

Contact Information

- Office Hours: Mon 15:00–17:00, other time can be negotiated.
- Venue: Wechat or Moodle Forum
- Email: drlgzhou@gmail.com
- Course teaching materials and assignments: moodle.must.edu.mo

Topic 1 Introduction

What are derivatives?

- An example

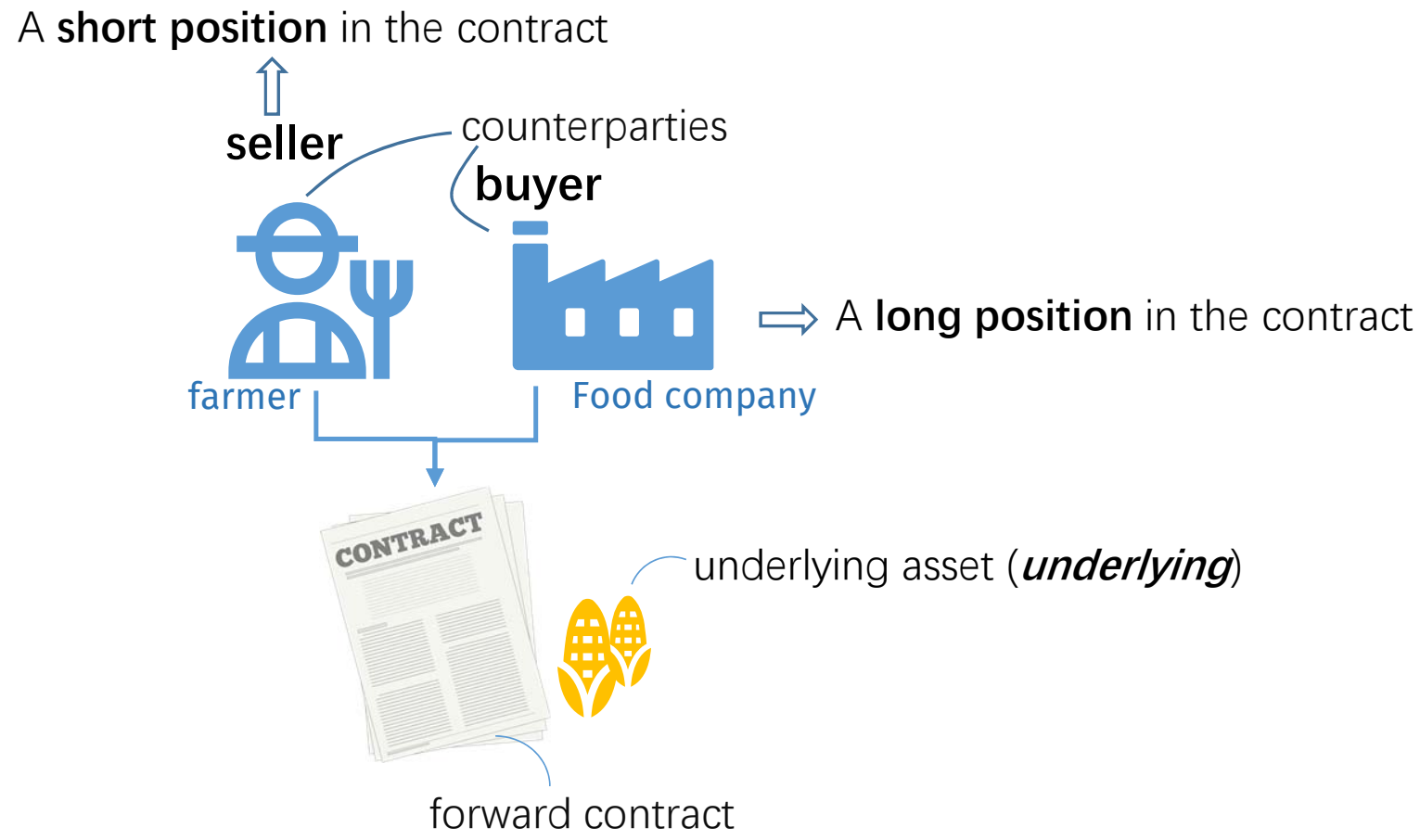
A derivative is a financial instrument (or more simply, an agreement between two parties) that has a value determined by the price of something else.

- Classifying derivatives

By the underlying	By the nature of the instrument	By the nature of the market
• Equity • Interest rate • Currency • Commodity • …	• Forwards • Futures • Options • Swaps • …	• OTC (over-the-counter) • Exchange-traded

Forward Contracts

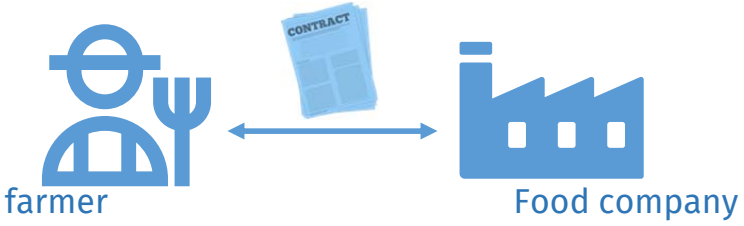
□ A Forward Contract is an agreement between two parties to buy or sell an asset at a certain time in the future for a certain price.



Future Contracts

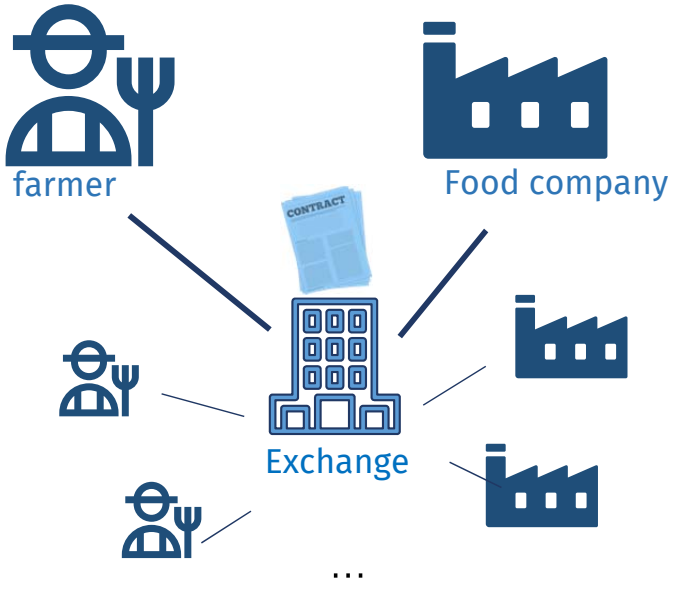
- A Future Contract is functionally similar to a forward contract.
- Forwards vs. Futures

Forward Contracts



OTC

Future Contracts

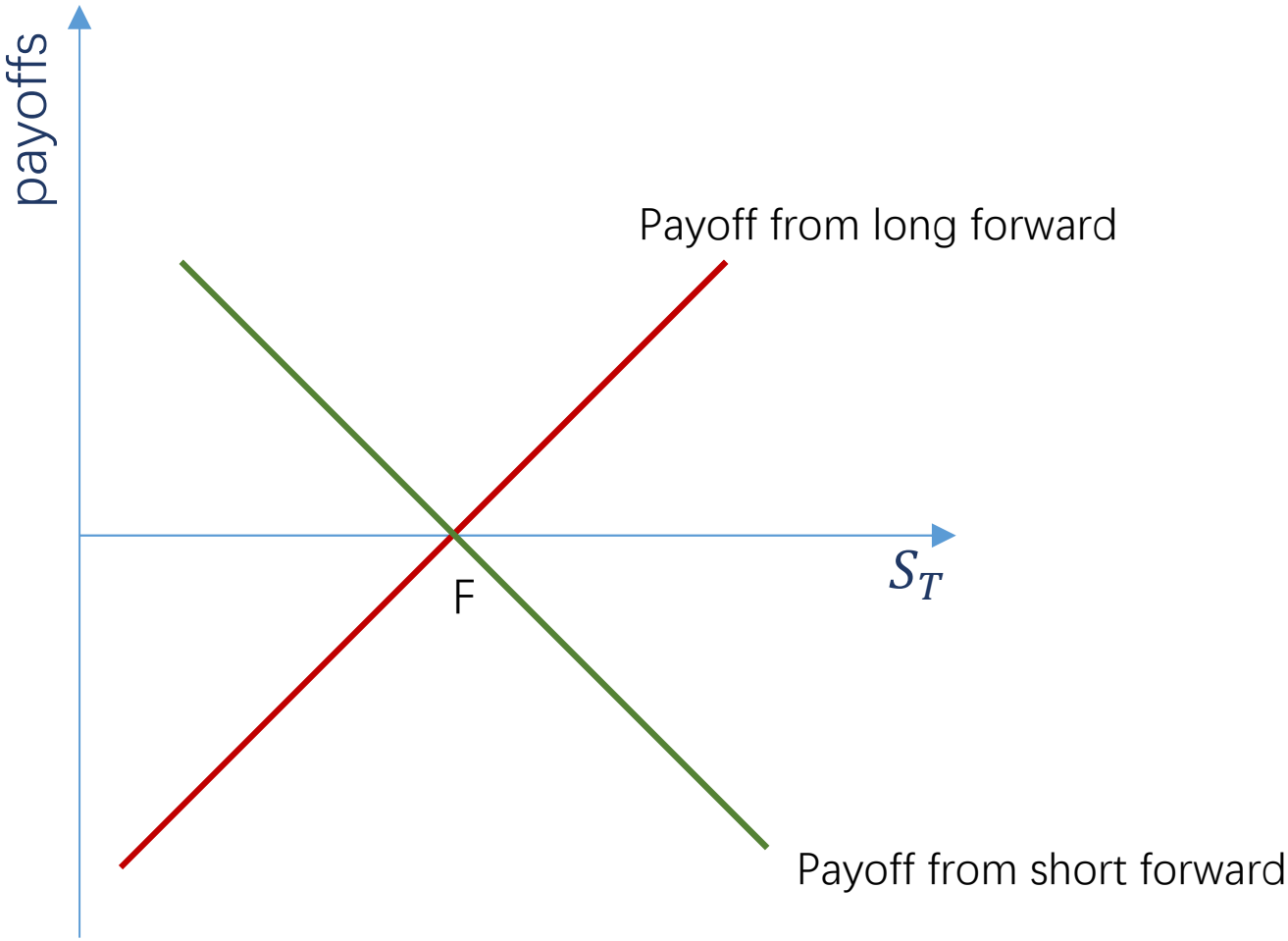


Payoff from forwards & futures

The long and short positions on the maturity date T of a forward contract with a delivery price of \$1000/ton. S_T is the price of the underlying asset on date T.

Price S_T	Payoff to Long	Payoff to Short
⋮	⋮	⋮
800	-200	+200
900	-100	+100
1000	–	–
1100	+100	-100
1200	+200	-200
⋮	⋮	⋮

- long position: $S_T - 1000$
- short position: $1000 - S_T$



Options

- An Option is a financial security that gives its holder the right to buy or sell a specified quantity of a specified underlying asset at a specified price on or before a specified date.
- Options are traded both on exchange and OTC markets.
- Classifying options

Option

By the right — Call option — Put option

By the exercising time — American — European

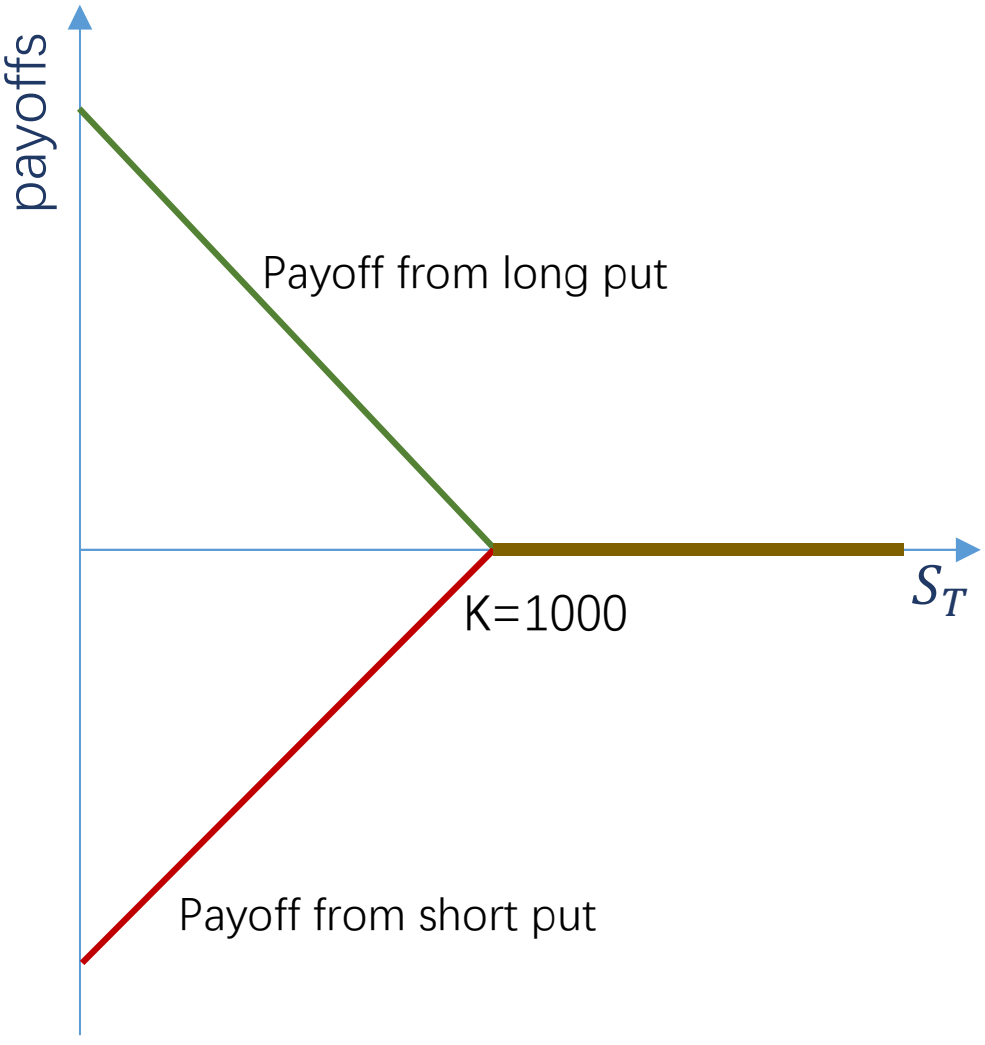
- What type of option should the farmer hold?
- What is the payoff from the option for the farmer?

Payoff from options

The long and short positions on the maturity date T of a put option contract with a delivery price of \$1000/ton. S_T is the price of the underlying asset on date T.

Price S_T	Payoff to Long	Payoff to Short
⋮	⋮	⋮
800	+200	-200
900	+100	-100
1000	0	0
1100	0	0
1200	0	0
⋮	⋮	⋮

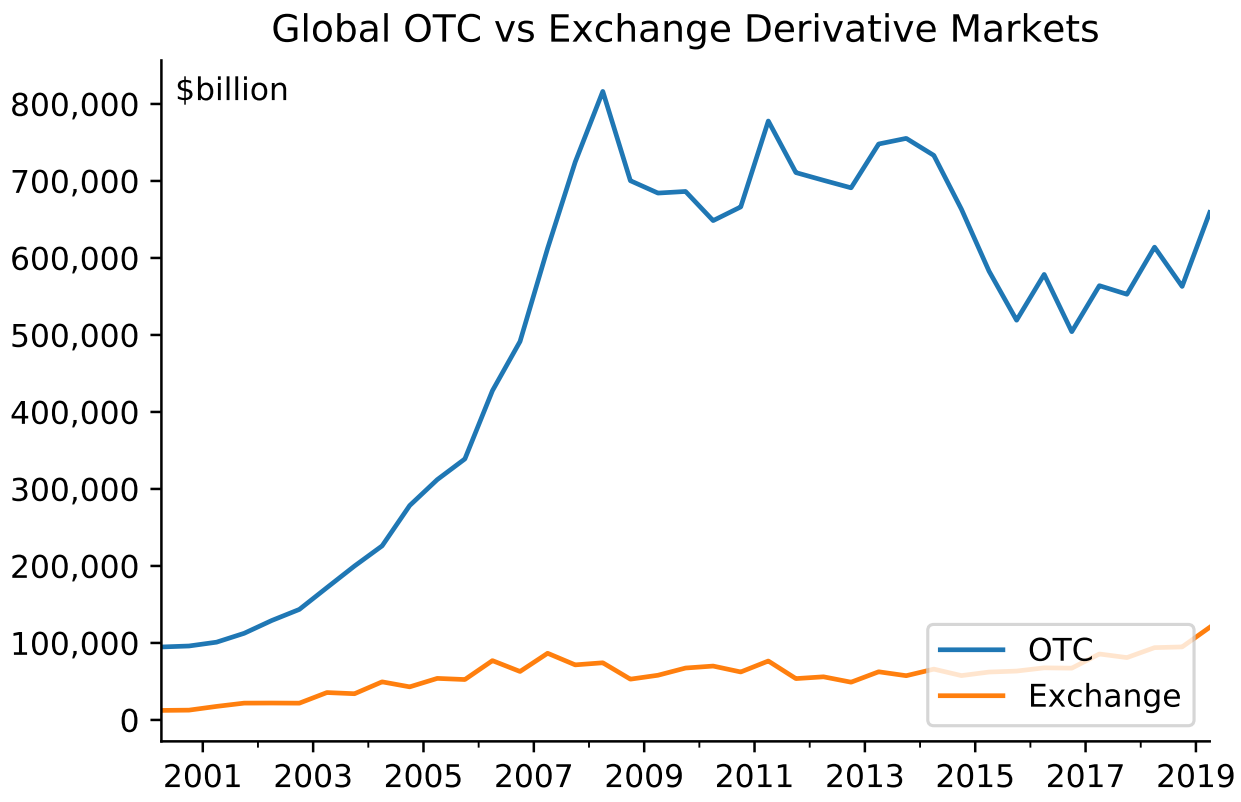
- Payoffs from put positions



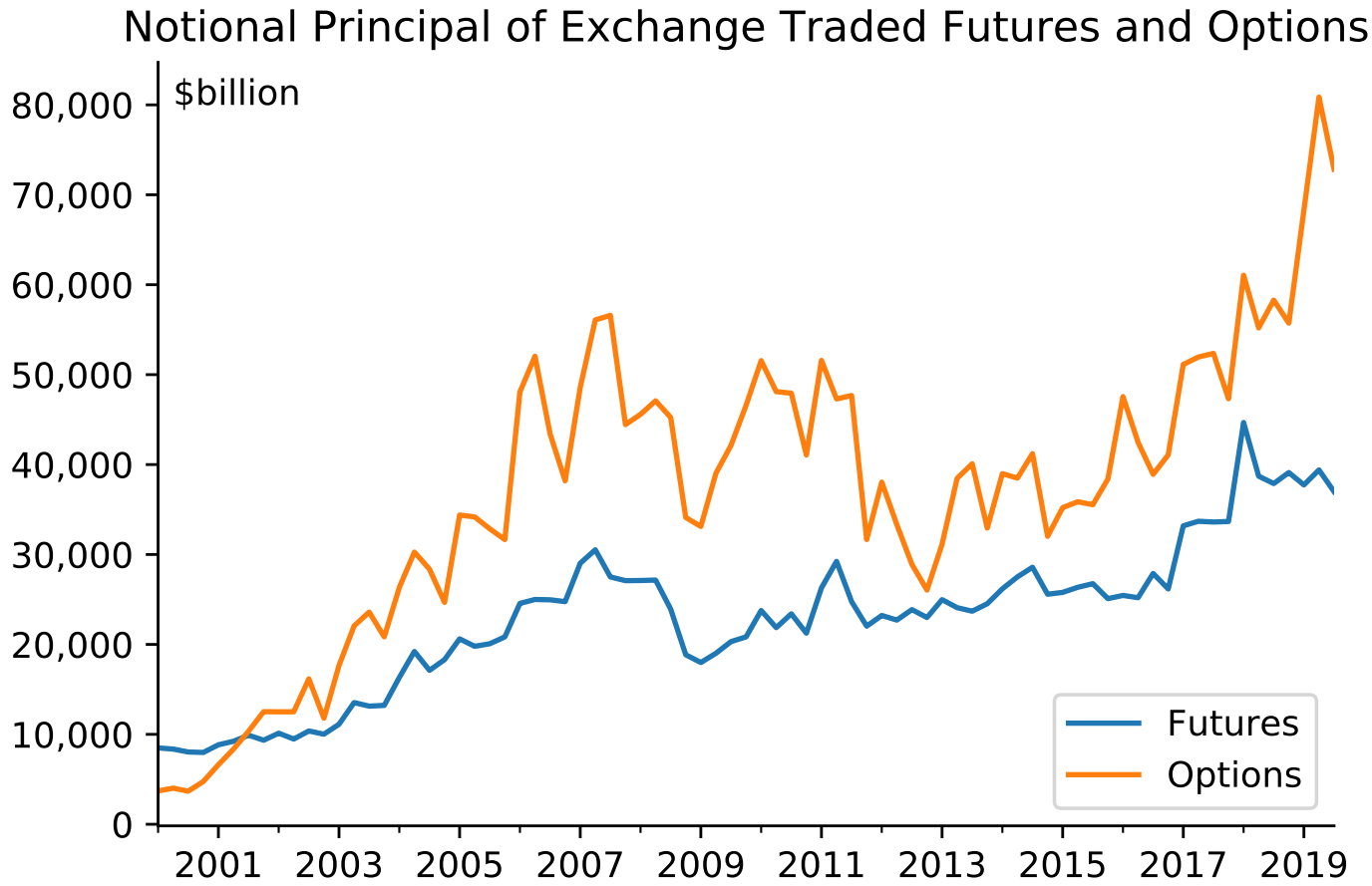
- What are payoffs from call options?

Why study derivatives markets?

- Big market size

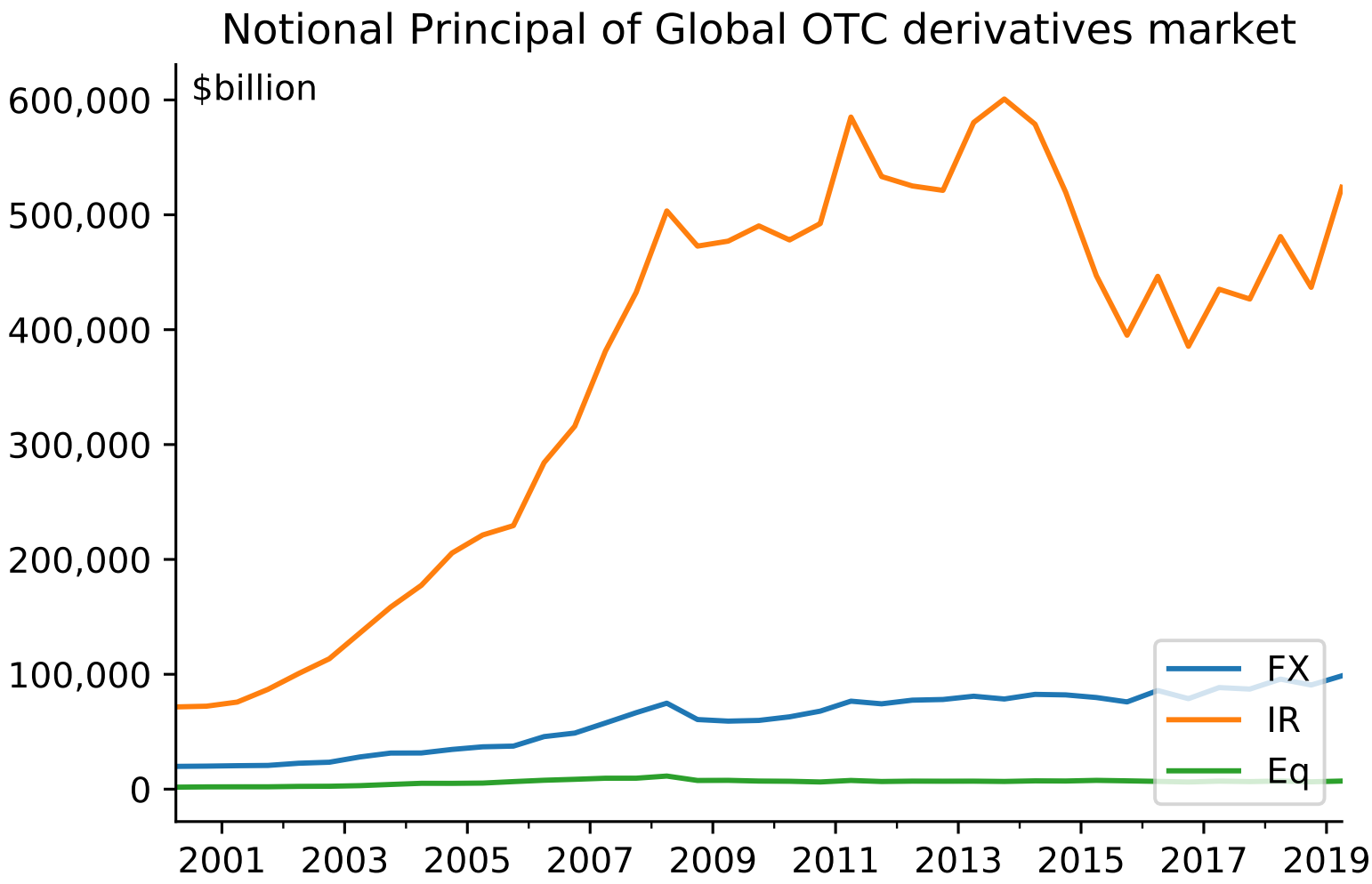


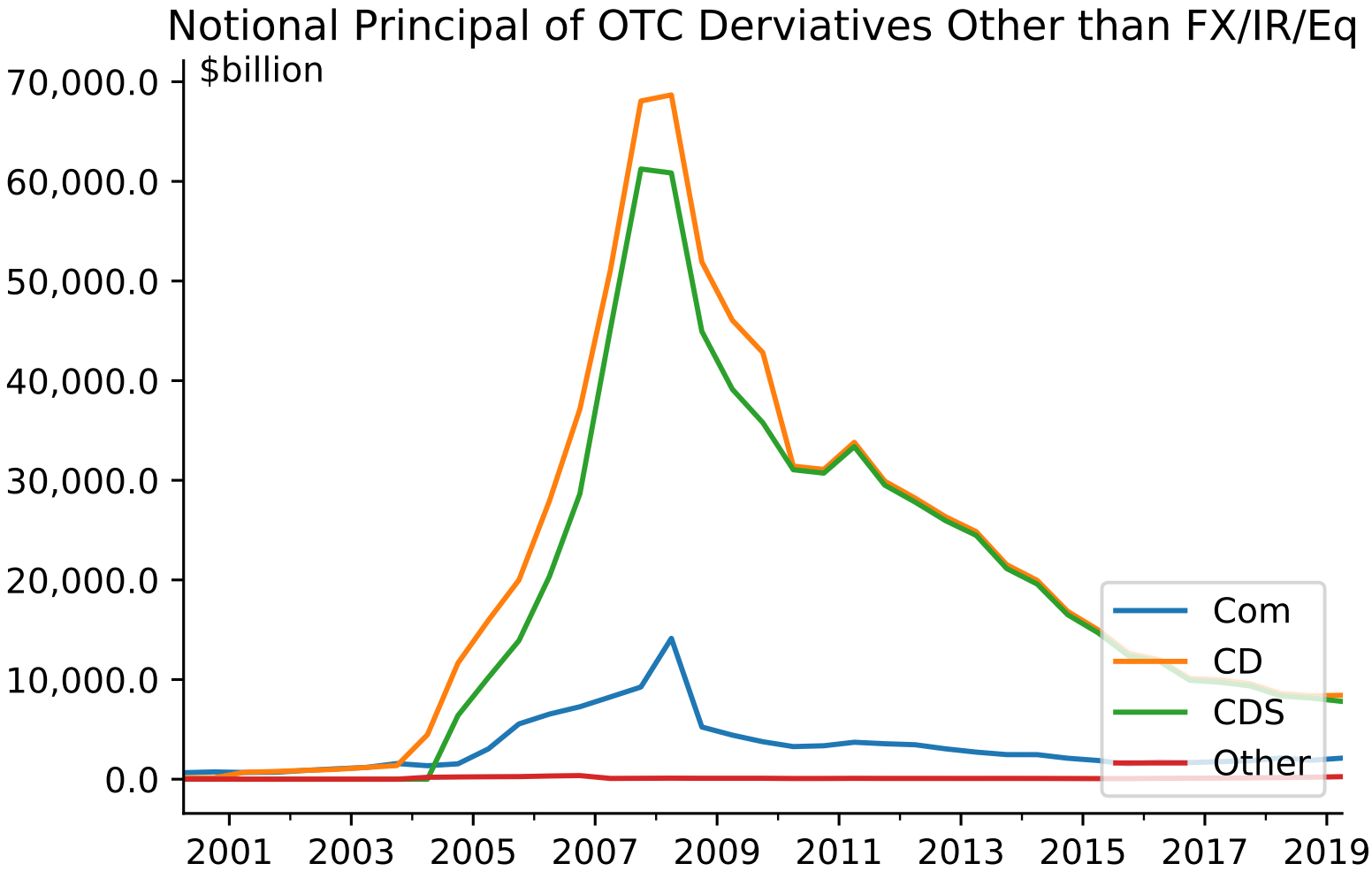
▷ Notional principal of exchange-traded futures & options



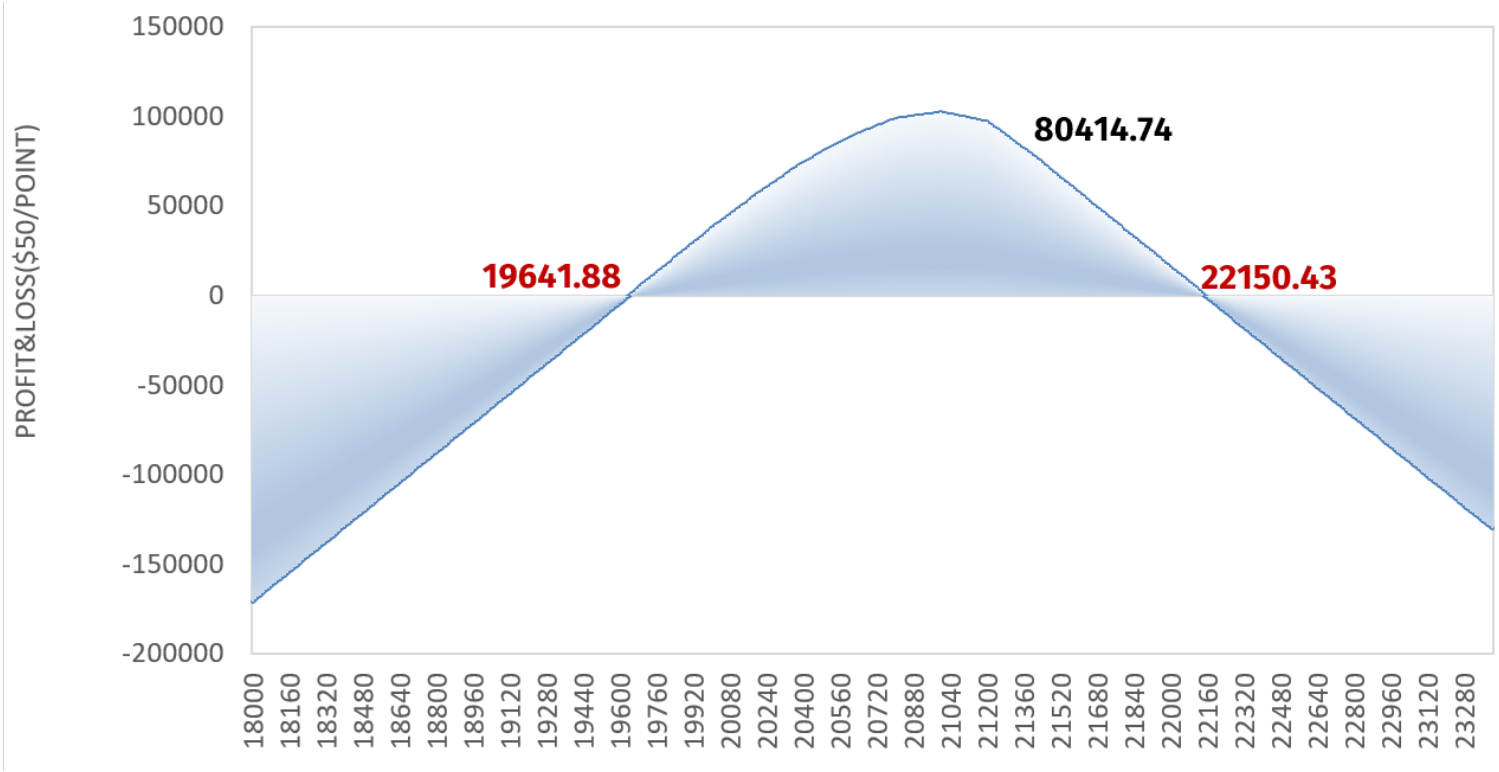
(data source: Bank for International Settlements – BIS, https://www.bis.org/statistics/about_derivatives_stats.htm)

▷ Notional amounts outstanding in Global OTC derivatives market




Notional Principal of OTC Derviatives Other than FX/IR/Eq
$billion
70,000.0
60,000.0
50,000.0
40,000.0
30,000.0
20,000.0
10,000.0
0.0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
Com
CD
CDS
Other

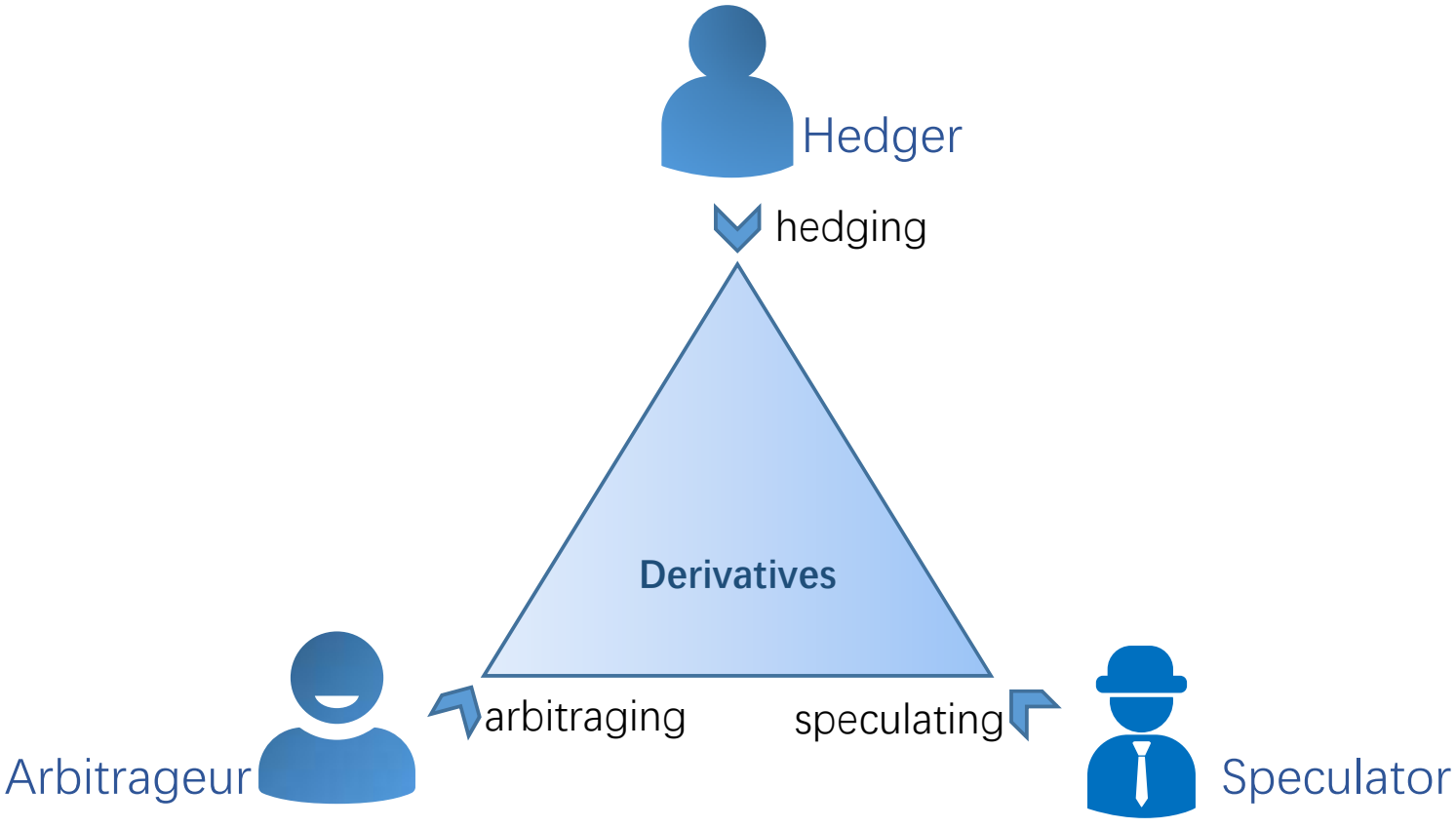
□ Many challenging and interesting topics



The profit and loss chart of an HSI options portfolio in Mar 2010

How to use derivatives?

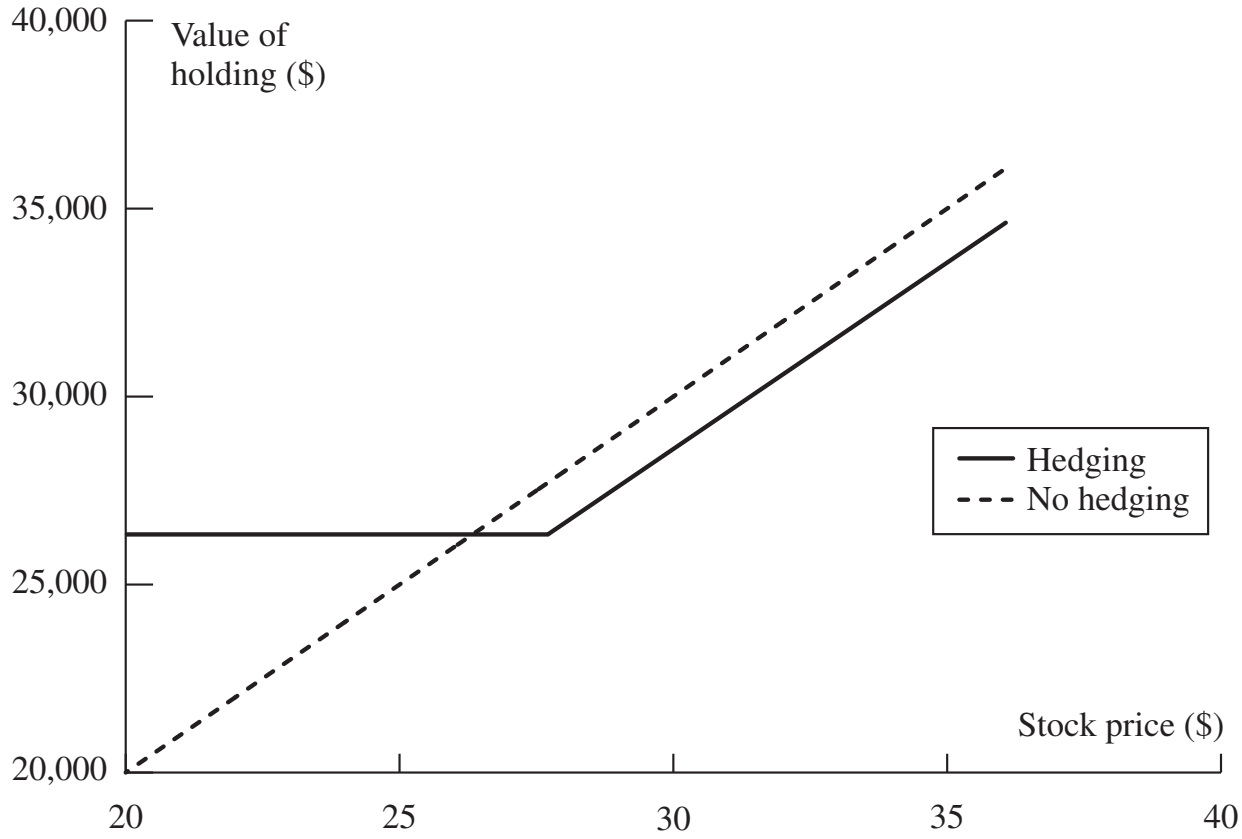
- Derivatives are financial instruments



Hedging Examples

- It is Feb 13, 2020. ImportCo must pay £10 million on June 13, 2020, for goods purchased from Britain. It buys £10 million with maturity of June 2020 from futures market to lock in an exchange rate of 1.2962 for the pounds it will pay.
- An investor owns 1,000 Microsoft shares currently worth $28 per share. A two-month put with a strike price of $27.50 costs $1. The investor decides to hedge by buying 10 contracts.

- Value of Microsoft Shares with and without Hedging



- If you are the farmer in previous example, what's your choice? Waiting, Using futures, or Using options? (Week1 homework)

Speculation Example

- An investor with $2,000 to invest feels that a stock price will increase over the next 2 months. The current stock price is $20 and the price of a 2-month call option with a strike of 22.50 is $1

What are the alternative strategies?

Arbitrage Examples

- Example 1:

A stock price is quoted as £100 in London and $152 in New York.

The current exchange rate is 1.5500.

What is the arbitrage opportunity?

- Example 2:

Suppose that:

The spot price of gold is $1,700 per ounce.

The quoted 1-year futures price of gold is $1,800.

The 1-year USD interest rate is 5% per annum.

No income or storage costs for gold.

Is there an arbitrage opportunity?

- Example 3:

Suppose that:

The spot price of gold is $1,700 per ounce.

The quoted 1-year futures price of gold is $1,680.

The 1-year USD interest rate is 5% per annum.

No income or storage costs for gold.

Is there an arbitrage opportunity?

Q&A

ClassWork

Week1 Classwork

(1) Assume you have a portfolio that contains stocks that track the market index. You now want to change this portfolio to be 20% in commodities and only 80% in the market index. How would you use derivatives to implement your strategy?

(2) A trader enters into a short cotton futures contract when the futures price is 50 cents per pound. The contract is for the delivery of 50,000 pounds. How much does the trader gain or lose if the cotton price at the end of the contract is (a) 48.20 cents per pound; (b) 51.30 cents per pound?

(3) In March, a U.S. investor instructs a broker to sell one July put option contract on a stock. The stock price is $42 and the strike price is $40. The option price is $3. Explain what the investor has agreed to. Under what circumstances will the trade prove to be profitable? What are the risks?