EE432 Monetary Theory and Policy

Lecture 4 Stocks and Derivatives

Dr. Chamadanai Marknual
Faculty of Economics, Thammasat University

Semester 1/2019

Outline

- Stock Valuation
- Theory of Efficient Market
- Derivatives; Forward and Futures
- Calls and Puts Options
- Swaps

Chapter 8

Stocks, Stock Markets, and Market Efficiency

Stock Valuation

The Essential Characteristics of Common Stock

- **Stocks**, also known as ***common stock* or *equity***, are **shares in a firm's ownership**.
  - The idea was **to spread the risk through *joint-stock companies*, *organizations*** that issued stock and ***used the proceeds to finance*** several expeditions at once.
  - In **exchange for investing**, stockholders ***received a share of the company's profits***.
- Shares were issued in *small denominations*, allowing investors to ***buy as little or as much*** *as they wanted*.
- Shares were ***transferable*** - an owner could sell them to someone else.

The Essential Characteristics of Common Stock

- Although a **stockholder** is entitled to *participate in the profits of the firm*, they are merely a **residual claimant**.
  - Stockholders are ***paid last***, only *after all other creditors* have been paid.
- However, stockholders have **limited liability** in the firm.
  - *Even if a company fails* completely, the maximum amount a shareholder can ***lose*** is ***their initial investment***.

Valuing Stocks

- People *differ* on **how stocks should be valued**.
- Some believe they ***can predict changes by looking at patterns*** or ***past movements*** - **chartists**.
- Some estimate the *value of stocks based on* their ***perceptions of investor psychology and behavior*** - **behavioralists**.
- Others *estimate stock* based on both its ***current assets*** and on ***estimates of future profitability*** - the **fundamentals**.

Fundamental Value and the Dividend-Discount Model

- A **stock** represents a *promise to* ***make monetary payments*** on *future dates*, under *certain circumstances*.
- The ***payments*** are usually in the form of **dividends**: ***distributions*** *made to the* ***owners*** of a company ***when the company makes a profit***.
- *If a company is sold*, the *stockholders* ***receive a final distribution*** that represents their *share of the purchase price*.

Valuing Stocks: Dividend-Discount Model

- The **current price** is the ***present value*** *of next years price* plus the *dividend*:

$$P_{today} = \frac{D_{next\ \ year}}{(1+i)} + \frac{P_{next\ \ year}}{(1+i)}$$

- *Expanding over an investment horizon of n years*:

$$P_{today} = \frac{D_{next\ \ year}}{(1+i)} + \frac{D_{in\ \ two\ \ years}}{(1+i)^2} + \ldots\ldots + \frac{D_{n\ \ years\ \ from\ \ now}}{(1+i)^n} + \frac{P_{n\ \ years\ \ from\ \ now}}{(1+i)^n}$$

Valuing Stocks: Dividend-Discount Model

- The **price today** is the ***present value*** of the *sum of* the ***dividends*** plus the ***present value*** of the ***price at the time the stock is sold*** *n years from now*.
- What if a company does not pay dividends?
  - We estimate when the ***company will start paying dividends*** and *use the present-value* framework.
  - We *must know something more* about annual *dividend payments*.

Valuing Stocks: Dividend-Discount Model

- **Assume** that ***dividends grow at a constant rate of g per year*** so:

$$D_{next\ year} = D_{today}(1+g)$$

- As long as *growth remains constant*, we can do this for *n* year from now:

$$D_{n\ \ years\ \ from\ now} = D_{today}(1+g)^n$$

Valuing Stocks: Dividend-Discount Model

- We can *rewrite the price equation* as:

$$P_{today} = \frac{D_{today}(1+g)}{(1+i)} + \frac{D_{today}(1+g)^2}{(1+i)^2} + \ldots + \frac{D_{today}(1+g)^n}{(1+i)^n} + \frac{P_{n\ \ years\ \ from\ \ now}}{(1+i)^n}$$

- But we *don't know the price in n years*, so we **assume firm pays dividends forever** turning the stock into something like a consol.
- We can then covert the above into:

$$P_{today} = \frac{D_{today}(1+g)}{i-g}$$

Valuing Stocks: Dividend-Discount Model

- This relationship is the **dividend-discount model**.
  - The ***fundamental price of a stock*** is the ***current dividend*** *divided by the interest rate, minus the dividend growth rate*
- The model tells us that **stock prices** should be **high** when
  - **dividends are high** (D_{today}),
  - **dividend growth** is **rapid** (g is large), or
  - the **interest rate** (i) is **low**.
- Although this model is simple, we have ***ignored risk*** in deriving it.

Why Stocks are Risky

- When you **buy stocks**, it is as if you *put up your wealth to buy the firm* and *borrow the rest*.
  - **Stockholders *get part of the profits***, but **only after everyone else is paid**, including ***bondholders***.
- The **borrowing** creates ***leverage*** *(using debt as a source of funding)*, and *leverage creates risk*.
- The **more debt**, the *more leverage* and the *greater the owners' risk*.

Why Stocks are Risky

- **Stocks are risky** because *shareholders are* ***residual claimants***.
  - They *never know for sure* how much their ***return will be***.
- In contrast, **bond holders *receive fixed nominal payments*** and are ***paid before stockholders*** in the event of *bankruptcy*.

Risk and the Value of Stocks

- **Stockholders** require *compensation for risk.*
  - The *higher the risk*, the *higher the compensation*.
- An investor will *buy a stock* with the idea of **obtaining a certain return**, which *includes* ***compensation for the stock's risk.***
- We know the return to holding stock for one year

$$= \frac{D_{next\ \ year}}{P_{today}} + \frac{P_{next\ \ year} - P_{today}}{P_{today}}$$

Risk and the Value of Stocks

- We can think of the **required return** as the *sum of* the *risk-free return* and the *risk premium* (*equity risk premium*).
- We can write this as:

Required Stock Return (*i*)
= Risk-free Return (*rf*) + Risk Premium (*rp*)

- Rewrite dividend-discount model:

$$P_{today} = \frac{D_{today}(1+g)}{rf + rp - g}$$

The Theory of Efficient Markets

The Theory of Efficient Markets

- The basis for the **theory of efficient markets** is the notion that the ***prices of all financial instruments*** *reflect all available information*.
  - Markets **adjust** immediately and continuously **to changes in fundamental values**.
- This implies that **stock price movements** are ***unpredictable***.
  - *Any prediction* that *causes people to buy or sell* the stock, *thereby changes the price* through *simple supply and demand*.

The Theory of Efficient Markets

- This means active portfolio management will *not yield a higher return* than of the *broad stock-market index*, year after year.
- Evidence suggests both that:
  - **Prices are unpredictable**, and
  - Professional money managers cannot beat *an index like the S&P 500 regularly*.

The Theory of Efficient Markets

- *But* we do *see some managers who claim to exceed the market*. How?
  - They have *inside information*, which is illegal.
  - They are *taking on risk and are compensated* as such.
  - They are *lucky*.
  - **Markets aren't efficient**.

Investing in Stocks For the Long Run

- *Stocks appear to be risky*, but **people hold a substantial proportion of their portfolio in stock**.
- *Thus, some investors either thought either* ***stocks are not that risky*** *or themselves* ***are not risk averse***.

The Stock Market's Role in the Economy

- The **prices** determined in the stock market tell us the *market value of companies*.
  - This *guides the **allocation** of resources*.
- If **stock prices** accurately ***reflect fundamental values***, the *resource allocation mechanism works well*.
- **However**, stock prices ***sometimes deviate significantly from the fundamentals***.

The Stock Market's Role in the Economy

- Both **euphoria** and **depression** are **contagious**
  - When investors become unjustifiably exuberant, **prices rise regardless** of the **fundamentals** this creates ***bubbles***, *persistent and expanding gaps between actual stock prices* and those warranted by the *fundamentals*.
  - *Bubbles lead to* ***crashes***.
  - This explains the *very jagged pattern* in annual stock returns.

The Stock Market's Role in the Economy

- **Bubbles** affect everyone because they *distort economic decisions* that companies and consumers make.
  - Companies ***sell shares*** for *prices that are* ***too high***.
  - Companies then ***invest too much***.
  - Those *not in the euphoria* ***invest too little***.
  - People think they are ***wealthier*** *than they are* and *spend too much*.

The Stock Market's Role in the Economy

- **Crashes** *do the* *opposite*.
  - The *shift from over-optimism* to **excessive pessimism** causes a **collapse** in investment and economic growth.
  - Large stock market swings alter economic prospects even if grounded in fundamentals.
  - The recent financial crisis, the inducement to *pull back on investment* intensified helping to *amplify the recessions* of 2007-2009.

Chapter 9

Derivatives: Futures, Options, and Swaps

Forward and Futures

The Basics: Defining Derivatives

- A **derivative** is a ***financial instrument*** whose ***value*** *depends on,* is ***derived from***, the *value of some* ***other financial instrument***, call the ***underlying asset***.
- For example:
  - A **contractual agreement** *between two investors* that ***obligates*** *one to* ***make a payment*** *to the other,* **depending on the movement** ***of interest rates*** over the *next year*.
    - An **interest-rate** ***futures contract***

The Basics: Defining Derivatives

Derivatives are different from *straight purchases* because:

1. Derivatives *provide* an easy way for *investors* **to profit from price declines**.
2. In a *derivatives transaction*, ***one person's loss*** is *always* ***another person's gain***.

The Basics: Defining Derivatives

- While derivatives can be used to ***speculate***, or *gamble* on future price movements, they **allow investors to manage and reduce risk**.
  - *Farmers* use derivatives regularly to *insure themselves against fluctuations* in the price of their crops.
- *The purpose of derivatives is to* ***transfer risk*** *from one person or firm to another.*

The Basics: Defining Derivatives

- By shifting risk to those willing and able to bear it, *derivatives* **increase the risk-carrying capacity of the economy** as a whole.

- This *improves the allocation of resources* and *increase the level of output*.

Forward and Futures

- *A* **forward**, *or* **forward contract**, *is an* ***agreement*** *between a buyer and a seller* ***to exchange*** *a commodity or financial instrument* ***for a specified amount*** *of cash* ***on a prearranged future date****.*
- Because they are *customized*, **forward contracts** are very *difficult to resell*.

Forward and Futures

- *A* **future**, *or* **futures contract**, *is a forward contract that has been* ***standardized*** *and* ***sold through an organized exchange***
- The contract specifies that the **seller** (*short position*) ***will deliver*** *some quantity of a commodity* or *financial instrument* to the *buyer (long position)* **on a specific date**, called the ***settlement* or *delivery* date**, for a **predetermined price**.

Forward and Futures

- **No payments are made** when *the contract is agreed to*.
- The **seller/short position** *benefits from* ***declines in the price*** of the underlying asset.
- The **buyer/long position** *benefits from* ***increases in the price*** of the underlying asset.

Forward and Futures

- The **two parties to a futures contract** each ***make an agreement*** *with* a **clearing corporation**.
- The *clearing corporation* operates like a *large insurance company* and is the *counter party to both sides of the transaction*.
  - They **guarantee** that the *parties will meet their obligations*.
- This **lowers** the ***risk*** buyers and sellers face.
- The *clearing corporation* has the ability to *monitor traders* and the *incentive to limit their risk taking*.

Hedging and Speculating with Futures

- **Futures contracts** allow the *transfer of risk between buyer and seller* through **hedging** or **speculation**.
- For example of the ***sale of a U.S. Treasury bond future contract***, the **seller/short position** benefits from the **price declines**.
    - The ***seller of the futures contract*** can ***guarantee the price*** at which the ***bonds are sold***.

Hedging and Speculating with Futures

- **Buying a futures contract** *fixes the price that the fund will need to pay*.
  - In this example, ***both sides use the futures contract as a hedge*** - they are both *hedgers*.
- **Producers and users of commodities** employ *futures markets* to hedge their risks
- They **own the commodity outright**, so they want to ***stabilize revenue streams***.

Hedging and Speculating with Futures

- **Speculators** are *trying to make a profit*.
  - They bet on price movements.
    - ***Sellers of futures*** are betting that **prices will fall**.
    - ***Buyers of futures*** are betting that **prices will risk**.
- **Futures contracts** are popular tools for speculation because *they are cheap*.
- An investor needs only a ***small amount to invest - the margin*** - to *purchase the future contract.*
  - Margin requirements of 10% or less are common.

Arbitrage and the Determinants of Futures Prices

- On the **settlement or delivery date**, the ***price of the futures*** *contract must equal the* ***price of the underlying asset*** *the* ***seller is obligated to deliver***.
- The practice of ***simultaneously buying and selling financial instruments*** in order *to benefit from temporary price differences* is *called* **arbitrage** while the people who engage in it are called ***arbitrageurs***.

Arbitrage and the Determinants of Futures Prices

- If the ***price of a specific bond*** is **higher** *in one market than in another*:
  - The **arbitrageur** can *buy at the low price and sell at the high price*.
  - This **increases demand** *in one market* and *supply in another.*
  - The *increase in demand* **raises price in that market**.
  - The *increase in supply* **lowers price in the other market.**
  - This ***continues*** *until* ***the prices are equal*** *in both markets.*

Calls and Puts Options

Calls, Puts, and All That: Definitions

- **Options** are *agreements* between two parties.
  - The *seller* is an ***option writer***.
  - A *buyer* is an ***option holder***.
- A **call option** is the *right to buy*, "call away", *a given* ***quantity of an underlying asset*** at a *predetermined price*, called the **strike price** (or ***exercise price***), on or before a specific date.
  - A July 2016 **call option** on *100 shares of Apple stock* at a strike price of 100 gives the **option holder** the *right to buy 100 shares of Apple for $100* each *prior to the 3rd Friday of July 2016*.

Calls, Puts, and All That: Definitions

- The ***writer*** of the **call option** *must* **sell the share** *if and when the holder choose to use the call option*.
- The ***holder*** of the call is ***not required*** to **buy the shares** - they have *the option if it is beneficial*.
  - When the **Apple stock price** *exceeds the option strike price of 100*, the **option holder** can either *call away the 100 shares* by ***exercising*** the *option or sell the option at a profit*.

Calls, Puts, and All That: Definitions

- When the ***price of the stock*** *is above the* ***strike price*** *of the* ***call option***, ***exercising the option*** *is* ***profitable*** and the option is said to be "***in the money***"; while the price of the stock exactly equals the strike price, the option is said to be "***at the money***"
- Otherwise, the ***strike price*** exceeds the ***market price of the stock***, it is termed ***"out of the money"***

Calls, Puts, and All That: Definitions

- A **put option** gives the *holder* the ***right*** but *not the obligation* to ***sell the underlying asset*** at *a* ***predetermined price*** on or before a ***fixed date***
- The *writer* of the option is *obliged to buy* the shares should the *holder choose to exercise the option*.
- The same terminology that is *used to describe calls*, is also used to *describe* ***puts***:
  - **In the money** - ***profitable***
  - **At the money** - ***same price***
  - **Out of the money** - ***not profitable***

Calls, Puts, and All That: Definitions

- Although **options** can be ***customized***, most are *standardized and traded on exchanges*.
- A *clearing corporation* guarantees the *obligations embodied in the option* -- those of the option writer.
  - The **options writer** is required to *post margin*.
  - The **option holder** incurs *no obligation*, ***so no margin is needed***.

Using Options

- ***Options*** *transfer risk* from the *buyer to the seller*, so can be **used for** both **hedging** and **speculation**.
- For someone who *wants to* ***purchase*** *an asset in the future*, a **call option** ensure that the *cost of buying the asset will not rise*.
- For someone who *plans to* ***sell*** *the asset in the future*, a **put option** ensures that the *price at which the asset can be sold will not go down*.

Using Options

Suppose that **interest rates are going to fall**.

- You can:
  - *Buy a bond* but *that's expensive* as you need money.
  - *Buy a futures contract* taking the long position - *low investment but high risk*.
  - *Buy a call option* that *pays off only if the interest rate falls* - if you are wrong, *only cost is the price of the option*.

Using Options

The **option writer** can take a large loss, so who does this?

1. **Speculators** willing to *take the risk* and *bet that prices will not move against them*.
2. Dealers called *market makers* who engage in the regular purchase and sale of the underlying asset.

Using Options

- **Market makers** both
  - **Own the underlying asset** so they *can deliver it*, and
  - Are **willing to buy the underlying asset** so they *have it read to sell to someone else*.
- If you *own the underlying asset*, **writing a call option** that ***obligates you to sell it*** at ***a fixed price*** is not that risky.
- Market makers *write options* to **get the fees** *from the buyer.*

Using Options

- **Options** are ***very versatile*** and *can be bought and sold* in many combinations.
- *Allow investors* to **get rid of risks** they do not want and keep the ones they do.
- **Options** *allow investors to bet that prices will be volatile*.

Pricing Options: Intrinsic Value and the Time Value of the Option

An **option** *has two parts*:

1. ***Intrinsic value*** - the value of the option *if it is exercised immediately*, and
2. **Time value of the option** - the *fee paid for the option's potential benefits*.

Option price = Intrinsic value + time value of the option

Pricing Options: Intrinsic Value and the Time Value of the Option

- We can **calculate the time value of the option** by calculating the *expected present value of the payoff*.
  - For a **call option**, we take the ***probability*** *of a favorable outcome (a higher price),* ***times the payoff***
  - ***Increasing the standard deviation*** *of the stock price*, an *increase in* ***volatility***, *increases the* ***option's time value***.

Swaps

Swaps

- **Swaps** are ***contracts*** that ***allow traders to transfer risk*** just like other derivatives.
  - ***Interest-rate swaps*** which *allow one swap party, for a fee*, to **alter the stream of payments** it makes or receives.
  - ***Credit-default swaps (CDS)*** which are a form of ***insurance*** that allow a buyer to **own a bond or mortgage** ***without bearing its full default risk***.

Understanding Interest-Rate Swaps

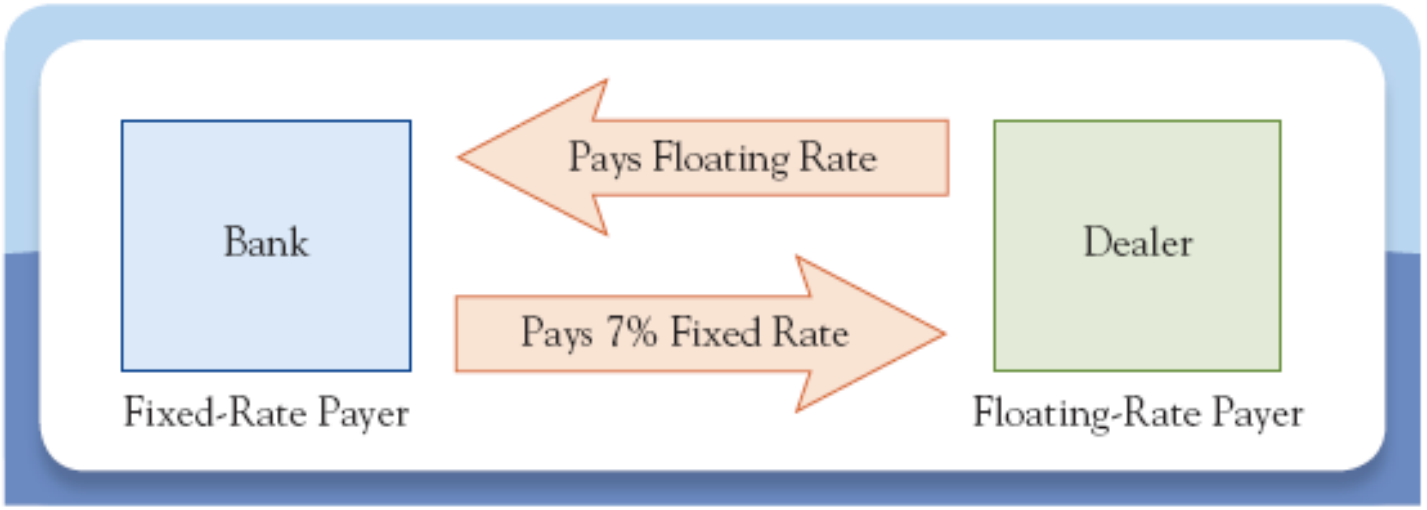
- **Interest-rate swaps** are *agreements* between two counterparties ***to exchange periodic interest-rate payments*** *over some future period*, based on an *agreed-upon amount of principal*, called the **notional principal**.
- The term *notional* is used because the *principal of a* ***swap*** *is* *not borrowed*, lent, or exchanged.

Understanding Interest-Rate Swaps

- In the simplest type of **interest-rate swap**, ***one party*** *agrees to* ***make payments*** *based on a fixed interest rate*, and *in exchange* the ***counterparty*** *agrees to* ***make payments based on a floating interest rate***.
  - This ***turns*** **fixed rates** in to **floating rates** and vice versa.

Understanding Interest-Rate Swaps

Figure 9.1 An Interest-Rate Swap Agreement



The bank agrees to pay a fixed rate to the swap dealer in exchange for payments based on a floating rate. The fixed-rate payments match the bank's loan income, while the floating-rate payments match the payments promised to the bank's deposit holders.

Pricing and Using Interest Rate Swaps

- *Pricing* **interest-rate swaps** means figuring out the *fixed interest rate to be paid*.
- Financial firms begin by *noting the market interest rate* on a U.S. Treasury bond of the same maturity as the **swap**, called a *benchmark*.
- The *rate* to *be paid by the fixed-rate payer*, the ***swap rate***, is the *benchmark rate plus a premium*.

Pricing and Using Interest Rate Swaps

- The **difference** between the *benchmark rate* and the *swap rate* is called the **swap spread** and is a ***measure of risk***.
  - The **swap spread** has become a *measure of overall risk in the economy*.
  - When the **swap spread *widens***, it signals that *general economic conditions are* ***deteriorating***.

Pricing and Using Interest Rate Swaps

- **Who uses interest-rate swaps?**
  - ***Banks***
    - **Deposits** are *short-term liabilities*
    - **Loans** are *long-term assets*
    - *Swaps help control risk*
  - ***Government debt managers***
    - Issue *long-term debt* relatively cheaply
    - *Tax revenue* matches up *better with short-term interest rate*

Pricing and Using Interest Rate Swaps

- The ***primary risk*** in a swap is the *risk that one of the parties* will **default**.
  - The risk is *not very high* because the *other side can enter into another agreement* to *replace the one that failed*.
- **Unlike futures and options**, ***swaps*** are not ***traded on organized exchanges***.
  - Swaps are **very difficult to resell**.

Credit-Default Swaps

- A **credit-default swap (CDS)** is a *credit derivative* that ***allows lenders to insure themselves against the risk*** that a *borrower will default.*
- The *buyer of a CDS* makes *payments*, like **insurance premiums**, *to the seller*, and the **seller agrees to pay the buyer** *if* an underlying loan or security defaults.
- The **CDS buyer** pays a fee to ***transfer the risk of default***, the credit risk, to the CDS seller.
- A **CDS agreement** often ***lasts several years*** and *requires that collateral be posted to protect* against the *inability to pay* of either the seller or the buyer of the insurance.

Credit-Default Swaps

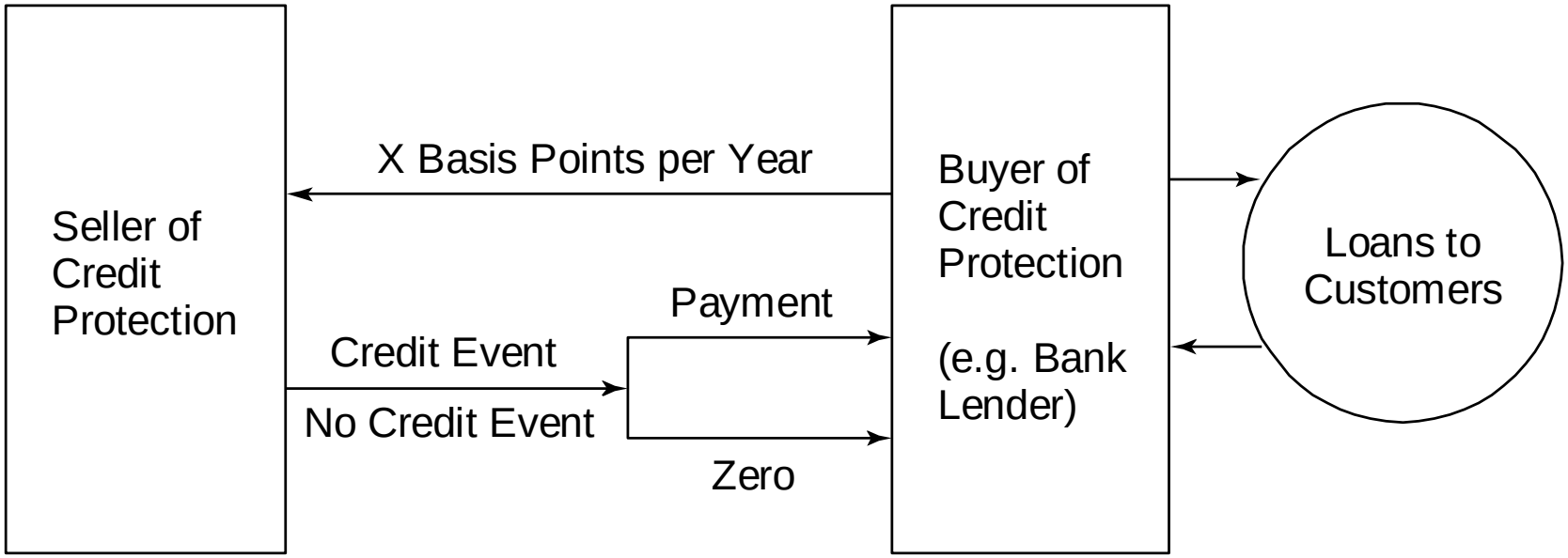
CDS *contributed to the financial crisis* in three important ways:

1. ***Fostering uncertainty*** about *who bears the credit risk* on a *given loan or security*,
2. Making the ***leading CDS sellers*** *mutually vulnerable*, and
3. Making it ***easier for sellers*** of insurance *to assume and conceal risk*.

Credit-Default Swaps

- Because **CDS contracts** are *traded over the counter (OTC)*, even traders cannot identify others who take on concentrated positions on one side of a trade.
- So long as **CDS trading** *lacks transparency*, the lingering worry is that *a failure of one institution* could *bring down the financial system* as a whole.

Figure 15.6 A credit default swap (CDS).



End of lecture