Finance 6470 - Derivatives Markets

Chapter 1 - Introduction to Derivatives

Tyler J. Brough

Department of Finance and Economics

What is a Derivative?

- **Definition:** a financial instrument that has a value determined by the price of something else
- An agreement where you pay $1 if the price of corn is greater than $3 and receive $1 if the price of corn is less than $1 is a derivative
  - This contract can be used to speculate on the price of corn or it can be used to reduce risk. It is not the contract itself, but how it used, and who uses it, that determines whether or not it is risk-reducing.

An Overview of Financial Markets

The trading of a financial asset involves at least four discrete steps:

- A buyer and a sellter must locate one another and agree on a price
- The trade must be *cleared* (the obligations of each party are specified)
- The trade must be *settled* (the buyer and the seller must deliver the cash or securities necessary to satisfy their obligations in the required period of time)
- Ownership records are updated

NB: notice that well-defined property rights are an assumption of properly functioning capital markets.

An Overview of Financial Markets (Continued)

- Much trading of financial claims takes place on organized exchanges. In the past, the exchange was solely a physical location where traders would buy and sell. Such in-person venues have largely been replaced by electronic networks that provide a virtual trading venue.
- After a trade has taken place, a **clearinghouse** matches the buyers and sellers, keeping track of their obligations and payments. To facilitate these payments and to help manage credit risk, a derivatives clearinghouse typically imposes itself in the transaction, becoming the buyer to all sellers and the seller to all buyers.

An Overview of Financial Markets (Continued)

- It is possible for large traders to trade many financial claims directly with a dealer bypassing organized exchanges. Such trading is said to occur in the **over-the-counter** (OTC) market
- Exchange activity is public and highly regulated
- OTC trading is not easy to observe or measure and is generally less regulated
- For many categories of financial claims, the value of OTC trading is greater than the value traded on exchanges.

An Overview of Financial Markets (Continued)

There are at least four different measures of a market and its activity

- **Trading volume**. This measure counts the number of financial claims that change hands
- **Market value**. The market value is the sum of the market value of the claims that *could* be traded, without regard to whether they have traded
- **Notional value**. Notional value measure the *scale* of a position, usually with reference to some underlying asset
- **Open Interest**. Open interest measures the total number of contracts for which counterparties have a future obligation to perform

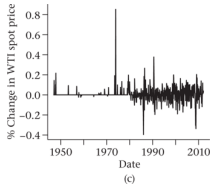
Derivatives Markets

The introduction of derivatives markets in a market often coincides with an increase in price risk in that market

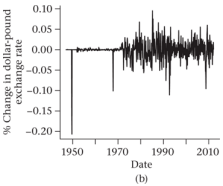
- Currencies were permitted to float in 1971 when the gold standard was officially abandoned. The modern market in financial derivatives began in 1972, when the Chicago Mercantile Exchange started trading futures contracts on seven currencies.
- OPEC's 1973 reduction in the supply of oil was followed by high and variable oil prices
- U.S. interest rates became more volatile following inflation and recessions in the 1970s
- The market for natural gas has been deregulated gradually since 1978, resulting in a volatile market in recent years
- The deregulation of electricity began during the 1990s

Increased Volatility . . .

- Oil prices 1947-2011

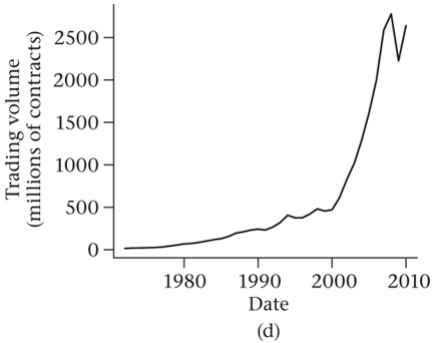


- Dollar/Euro rate 1947-2011



. . . Led to New and Big Markets

- Exchange-traded derivatives



- Over-the-counter markets have also grown rapidly over this period

Exchange Traded Contracts

Contracts proliferated in the last four decades

TABLE 1.2 Examples of underlying assets on which futures contracts are traded.

Category	Description
Stock index	S&P 500 index, Euro Stoxx 50 index, Nikkei 225, Dow-Jones Industrials, Dax, NASDAQ, Russell 2000, S&P Sectors (healthcare, utilities, technology, etc.)
Interest rate	30-year U.S. Treasury bond, 10-year U.S. Treasury notes, Fed funds rate, Euro-Bund, Euro-Bobl, LIBOR, Euribor
Foreign exchange	Euro, Japanese yen, British pound, Swiss franc, Australian dollar, Canadian dollar, Korean won
Commodity	Oil, natural gas, gold, copper, aluminum, corn, wheat, lumber, hogs, cattle, milk
Other	Heating and cooling degree-days, credit, real estate

The Role of Financial Markets

- Insurance companies and individual communities/families have traditionally helped each other to share risks
- Markets make risk-sharing more efficient
  - Diversifiable risks vanish
  - Non-diversifiable risks are reallocated to those most willing to hold it

The Uses of Derivatives

(Some) Uses for derivative contracts

- **Risk management**. Derivatives are a tool for companies and other users to reduce risks
- **Speculation**. Derivatives can serve as investment vehicles
- **Reduce transaction costs**. Sometimes derivatives provide a lower cost way to undertake a particular financial transaction
- **Regulatory arbitrage**. It is sometimes possible to circumvent regulatory restrictions, taxes, and accounting rules by trading derivatives

Perspectives on Derivatives

- End users
  - Corporations
  - Investment managers
  - Investors
- Intermediaries
  - Market-makers
  - Traders
- Economic observers
  - Regulators
  - Researchers

Financial Engineering and Security Design

- The construction of a financial product from other products
- New securities can be designed by using existing securities
- Financial engineering principles
  - Facilitate hedging of existing positions
  - Allow for creation of customized products
  - Enable understanding of complex positions
  - Render regulation less effective

Transaction Costs and the Bid-Ask Spread

- Buying and selling a financial asset
  - Brokers: commissions
  - Market-makers: bid-ask (offer) spread
- Example 1.1: Buy and sell 100 shares of XYZ
  - XYZ: bid $= \$49.75$, offer $= \$50$, commission $= \$15$
  - Buy: $(100 \times \$50) + \$15 = \$5,015$
  - Sell: $(100 \times \$49.75) - \$15 = \$4,960$
  - Transaction cost: $\$5,015 - \$4,960 = \$55$

Short-Selling

- When the price of an asset is expected to fall
  - First: borrow and sell an asset (get \$\$)
  - Then: buy back and return the asset (pay \$)
  - If price fell in the mean time: Profit \$ = \$\$ − \$
  - The lender must be compensated for dividends received (lease-rate)
- Example: short-sell IBM stock for 90 days

TABLE 1.4 Cash flows associated with short-selling a share of IBM for 90 days. S_0 and S_{90} are the share prices on days 0 and 90. Note that the short-seller must pay the dividend, D, to the share-lender.

	Day 0	Dividend Ex-Day	Day 90
Action	Borrow shares	—	Return shares
Security	Sell shares	—	Purchase shares
Cash	$+S_0$	$-D$	$-S_{90}$

Short-Selling (Continued)

- Why short-sell?
  - Speculation
  - Financing
  - Hedging
- Credit risk in short-selling
  - Collateral and "haircut"
- Interest received from lender on collateral
  - Scarcity decreases the interest rate
  - Repo rate in bond markets
  - Short rebate in the stock market

TABLE 1.1 The six largest stock exchanges in the world, by market capitalization (in billions of US dollars) in 2011.

Rank	Exchange	Market Cap (Billions of U.S. $)
1	NYSE Euronext (U.S.)	11,796
3	Nasdaq OMX	3,845
2	Tokyo Stock Exchange	3,325
4	London Stock Exchange	3,266
5	NYSE Euronext (Europe)	2,447
6	Shanghai Stock Exchange	2,357

Source: http://www.world-exchanges.org/.

TABLE 1.3 Estimated year-end notional value of outstanding derivative contracts, by category, in billions of dollars.

	Foreign Exchange	Interest Rate	Equity	Commodity	Credit Default	Total
1998	18011	50014	1488	408	—	80309
1999	14344	60090	1809	548	—	88201
2000	15665	64667	1890	662	—	95199
2001	16747	77567	1880	598	—	111177
2002	18447	101657	2308	923	—	141665
2003	24475	141990	3787	1405	—	197166
2004	29288	190501	4384	1443	6395	258627
2005	31360	211970	5793	5434	13908	299260
2006	40270	291581	7487	7115	28650	418131
2007	56238	393138	8469	8455	58243	585932
2008	50042	432657	6471	4427	41882	598147
2009	49181	449874	5937	2944	32692	603899
2010	57795	465259	5634	2921	29897	601046

Source: Bank of International Settlements.