

Lecture 15: Futures and Swaps

ECON435: Financial Markets and the Macroeconomy

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Spring 2011

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Overview: Derivative Securities

Derivative Securities (or "derivatives"):

- price depends on (derives from) another security, e.g. stocks
→ also called "contingent" securities
- useful for both hedging and speculation

Main Categories:

- Options
- Futures
- Swaps

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Review: Options

- Call option = right to buy a security
 - at the strike price (exercise price)
 - by the maturity date (expiration date)
- Put option = right to sell a security
 - at the strike price (exercise price)
 - by the maturity date (expiration date)
- Seller (= "writer") of option: earns a premium
- Option strategies: protective put, covered call, straddle, ...

□ Put-Call Parity: $C + \frac{X}{(1+r_f)^T} = S_0 + P$

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Definition of Forwards & Futures

Futures & forwards are *deferred-delivery contracts*

They entail:

- an obligation to purchase (or sell) a commodity or security
- at a pre-specified price
- at a specified delivery (maturity) date

Long position: commitment to future purchase

Short position: commitment to future sale/delivery

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Difference btw. Forwards/Futures

Special Features of Futures:

- traded in an exchange
- formalized and standardized
- traded in secondary market
→ more liquid
- traded through a clearinghouse
- subject to margin requirements
→ marked to market

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Examples of Futures Contracts

Foreign Currencies	Agricultural	Metals and Energy	Interest Rate Futures	Equity Indexes
British pound	Corn	Copper	Eurodollars	S&P 500 Index
Canadian dollar	Oats	Aluminum	Euroyen	Dow Jones Industrials
Japanese yen	Soybeans	Gold	Euro-denominated bond	S&P Midcap 400
Euro	Soybean meal	Platinum	Euroswiss	NASDAQ 100
Swiss franc	Soybean oil	Palladium	Sterling	NYSE Index
Australian dollar	Wheat	Silver	British government bond	Russell 2000 Index
Mexican peso	Barley	Crude oil	German government bond	Nikkei 225 (Japanese)
Brazilian real	Flaxseed	Heating oil	Italian government bond	FTSE Index (British)
	Canola	Gas oil	Canadian government bond	CAC-40 (French)
	Rye	Natural gas	Treasury bonds	DAX-30 (German)
	Cattle	Gasoline	Treasury notes	All ordinary (Australian)
	Hogs	Propane	Treasury bills	Toronto 35 (Canadian)
	Pork bellies	Commodity index	LIBOR	Dow Jones Euro STOXX 50
	Cocoa	Electricity	EURIBOR	Industry indexes, e.g.,
	Coffee	Weather	Euroswiss	Banking
	Cotton		Municipal bond Index	Telecom
	Milk		Federal funds rate	Utilities
	Orange juice		Bankers' acceptance	Health care
	Sugar		Interest rate swaps	Technology
	Lumber			
	Rice			

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Payoffs of Futures Contracts

S_T = Stock price at delivery date

F_0 = Agreed future price

Payoff to long position (future buyer):

$$S_T - F_0$$

Payoff to short position (future seller):

$$F_0 - S_T$$

→ zero-sum game

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Payoffs of Future Contracts



Payoffs of future contracts (plus, for comparison, a call option)

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Example: Crude Oil Futures

□ Buy 1000 barrels on 3/17/11 for June delivery at a price of \$80.05

→ cost =

□ Reverse the position on 4/28/11 at a price of \$83.20

→ payoff =

→ total profit = payoff – cost =

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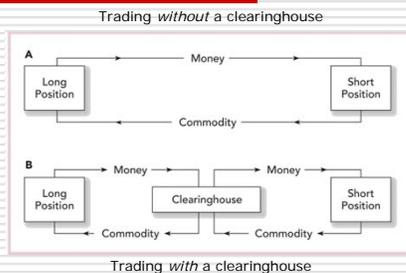
Trading Mechanics

Clearinghouse:

- acts as counterparty to each trader
- to mitigate the high risk of futures:
 - require an initial margin and
 - a maintenance margin (mark-to-market)
- makes it easy to “reverse” a position

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Role of Clearinghouse



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Open Interest

Open interest = # of contracts outstanding

- starts at zero when contract first traded
- increases over time
- most positions are reversed shortly before expiration of the contract
- otherwise (1 – 3% of all cases): physical delivery, e.g. through warehouse receipts, or cash settlement takes place

→ **Convergence property:** at maturity, futures and spot prices converge

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Example: Quotes of Interest Rate Futures

<http://www.cmegroup.com/trading/interest-rates/stir/eurodollar.html>

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Example of Margin Requirements

Continuation of earlier example:

- 1 contract = 1000 barrels of oil
- bought long on 3/17/11 for at a price of \$80.05
- Assume initial margin of 10%, maintenance margin of 8%
- position closed on 4/28/11 at a price of \$83.20

- What is the initial margin requirement?
- What are the required maintenance margins?
- Will these always be met?
- What happens if not?
- What is your total return on capital?

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Example of Margin Requirements

Date	Price	Profit/Loss	Current Margin	Required Margin
3/17/2011	\$80.05	0		
3/24/2011	\$79.44			
3/31/2011	\$77.76			
4/07/2011	\$78.70			
4/14/2011	\$80.18			
...	...			
4/28/2011	\$83.20			

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Basis Risk

Basis = Futures price – spot price

At maturity: basis = 0

Before maturity: there can be a substantial divergence

→ arbitrageurs can bet on the difference narrowing

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Spot-Futures Parity Theorem

- In well-functioning markets:
 - holding a security
 - holding a future and saving the value of the security in T-bills
 should yield the same return:

$$F_0 = S_0(1+r)$$

Otherwise: arbitrage can be performed

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Spot-Futures Parity Theorem

Deviations if carrying the security has its own costs/payoffs:
→ “cost of carry relationship”

E.g. with dividends D/dividend yield d:

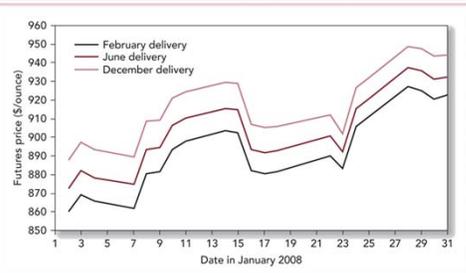
$$F_0 = S_0(1+r) - D$$

$$\text{or } F_0 = S_0(1+r-d)$$

(Note: with $d = 0$, futures price should always be higher than the spot price → e.g. gold)

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Gold Futures of Different Maturity



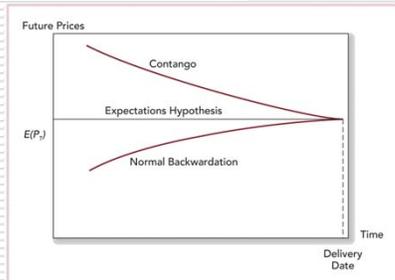
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Futures and Expected Spot Prices

- *Expectations Hypothesis*: $F_0 = E[S_T]$
- *Normal Backwardation*:
producers who want to hedge may bid down the futures price: $F_0 < E[S_T]$
- *Contango*:
buyers of commodities who want to hedge may bid up $F_0 > E[S_T]$

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Contango/Normal Backwardation



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