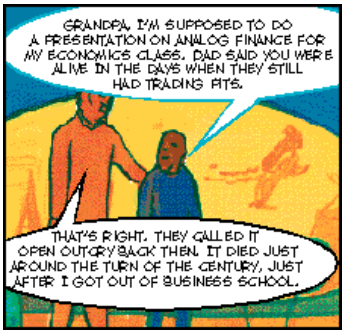
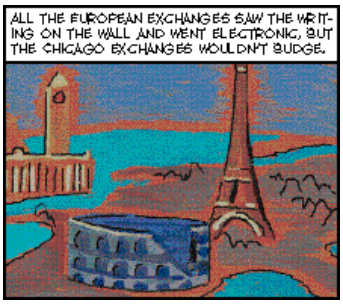
2

Mechanics of futures markets





The recovery in profitability has been amazing following the reorganisation, leaving Barings to conclude that it was not actually terribly difficult to make money in the securities business.

—Peter Baring

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Overview

- Background
- Specification – what, how much, when, where
- Convergence – futures price to spot
- Daily settlement and margins – payments to broker reduce credit risk
- Newspaper quotes
- Delivery
- Types of traders and types of orders
- Regulation
- Accounting and tax
- Forward vs. futures contracts

Background

Exchanges

US

- Chicago Board of Trade
- Chicago Mercantile Exchange

European

- London International Financial Futures and Options Exchange
- Eurex
- Euronext

Other

- Bolsa de Mercadorias y Futuros (Brazil)
- Tokyo International Financial Futures Exchange (Japan)
- Singapore International Monetary Exchange (Singapore)
- Sydney futures exchange (Australia)

E.g. corn future

- Chicago Board of Trade (CBOT)
- March 5th, NYC investor calls a broker: "buy 5,0000 bushels for delivery in July"
- Broker passes the instructions to a trader (on the floor)
- Kansas investor instructs broker to sell 5,000 bushels
- Price agreed on the floor is the July corn *futures price*

Jargon

- NYC has a *long futures position*
- KC has a *short futures position*

Supply and demand

More traders wish to $\left\{\begin{matrix}\text{buy}\\\text{sell}\end{matrix}\right\}$ than $\left\{\begin{matrix}\text{sell}\\\text{buy}\end{matrix}\right\}$, then the price goes $\left\{\begin{matrix}\text{up}\\\text{down}\end{matrix}\right\}$;
which discourages $\left\{\begin{matrix}\text{buyers}\\\text{sellers}\end{matrix}\right\}$ and encourages $\left\{\begin{matrix}\text{sellers}\\\text{buyers}\end{matrix}\right\}$
⇒ balance between buyers and sellers is maintained

Closing Positions

- Majority of contracts do not lead to delivery
- Most positions are *closed out* by entering into an opposite position
- e.g. $\left\{\begin{matrix}\text{NYC}\\\text{Kansas}\end{matrix}\right\}$ would go $\left\{\begin{matrix}\text{short}\\\text{long}\end{matrix}\right\}$ July corn on April 20
- For both, gain or loss given by change in futures price between 5/3 and 20/4
- Delivery rare – however possible ⇒ convergence of future to spot

Futures Contracts

- Available on a wide range of underlyings
- Exchange traded
- Specifications for delivery need to be defined:
  - *What* (+ how much)
  - *Where* &
  - *When*
- Settled daily

Specification

Asset

- Variable grades for OJ, lumber, corn, so
  - specify grade
  - price adjustment
- Financial assets mostly unambiguous
- However Treasury instruments
  - Treasury bond – “any US T bond $T > 15$ yrs, not callable within 15 yrs”
  - Treasury bill – “any US T bill $6.5 < T < 10$ yrs”
- Formula for price adjustments $f\left(\overset{\text{coupon}}{c}, \overset{\text{maturity}}{T}\right)$ (Chapter 6)

Contract size

- Exchange chooses: if too
  - big – can't hedge small exposure
  - small – per contract transaction costs
- Size taylored to user
  - T bonds on CBOT \$100,000
  - Agricultural product \$20,000
  - Mini Nasdaq 100 on CME 20×index (cf. 100×index)

Delivery arrangements

- Spec'd by exchange
- Price adjustment reflects location

Delivery months

- Contract referred to by month e.g. July corn
- Delivery can be subinterval or whole month
- Months contract specific
- E.g. corn on CBOT: March, May, July, Sept., Dec.
- Trades on closest and additional months
- Trading stops < last delivery day

Price quotes

- Smallest unit for quotes and min price movement
  - oil NYME \$0.01
  - Treasury bond/bill CBT \$ $\frac{1}{32}$

Price and position limits

- Prevent / reduce market manipulation by speculators by imposing limits on
  - price moves
  - positions
- Price moves $\left\{ \begin{matrix} \text{up} \\ \text{down} \end{matrix} \right\}$ by daily price movement, contract is *limit* $\left\{ \begin{matrix} up \\ down \end{matrix} \right\}$
- *Limit move*, move (u or d) equal to daily price movement
- → trading stops
- Controversial

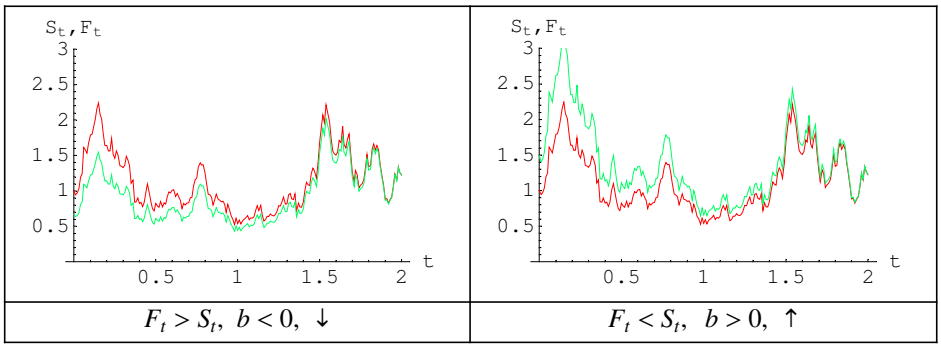
Convergence of futures to spot

- Hull Figure 2.1, page 26

Figure

Code

Output



$F_t > S_t,\ b < 0,\ \downarrow$ | $F_t < S_t,\ b > 0,\ \uparrow$

Figure 2.1: Relationship between future price and spot price as delivery period is approached. E.g. gold (lhs) and oil (rhs).

- Situations in which patterns observed in Chapter 5
- If at delivery futures price is $\left\{\begin{matrix}\text{above}\\\text{below}\end{matrix}\right\}$ spot, i.e. $\left\{\begin{matrix}F_T > S_T\\F_T < S_T\end{matrix}\right\}$ then arb opp is
  - $\left\{\begin{matrix}\text{short}\\\text{go long}\end{matrix}\right\}$ future (zero cost)
  - $\left\{\begin{matrix}\text{buy}\\\text{sell}\end{matrix}\right\}$ asset (for S_T)
  - $\left\{\begin{matrix}\text{deliver}\\\text{receive}\end{matrix}\right\}$ underlying ($\left\{\begin{matrix}\text{earning}\\\text{at a cost of}\end{matrix}\right\}$ F_T)
- Eventually, futures price will $\left\{\begin{matrix}\text{fall}\\\text{rise}\end{matrix}\right\}$ to match spot
- Prior to expiry,
  - spot can be $\left\{\begin{matrix}\text{below}\\\text{above}\end{matrix}\right\}$ future,
  - i.e. $\left\{\begin{matrix}-\\+\end{matrix}\right\}$ basis,
  - e.g. $\left\{\begin{matrix}\text{gold}\\\text{oil}\end{matrix}\right\}$, which are $\left\{\begin{matrix}\text{investment}\\\text{consumption}\end{matrix}\right\}$ assets
  - prices related by $\left\{\begin{matrix}F = S\,e^{rT}\\F = S\,e^{(r+u-y)\,T}\end{matrix}\right\}$

Margins and daily settlement

Description

Purpose

- Default – one party does not honour contract
- Exchange seeks to reduce risk
- Margins minimize the possibility of a loss through a default on a contract

Definition

Definition 2.1. A *margin* is cash or marketable securities deposited by an investor with his or her broker.

Operation

- The balance in the margin account is adjusted to reflect daily settlement – *marking to market*
- Types
  - *Initial margin* – amount deposited when contract entered
  - *Maintenance margin* – trigger level for margin call to restore balance to initial margin
- $0 < \overbrace{[\text{maintenance margin}] < [\text{initial margin}]}^{\text{Difference is } \textit{variation margin}}$
- Investor can withdraw balance in excess of initial margin

Details

- Brokers permit investor to earn interest, so not a cost *per se*
- When futures price changes, margin payments pass back and forth along the chain:
  long client $\longleftrightarrow$ broker $\longleftrightarrow$ exchange $\longleftrightarrow$ broker $\longleftrightarrow$ short client
- In lieu of cash
  - T-bills @ 90% of face value
  - shares @ 50% of market value
- Margin payments bring value of contract back to zero, in effect close-out and rewrite each day
- Investor specific margin levels:
  - hedger < speculator
  - day / spread transactions < hedge
- Symmetry: same for short as for long (cf. spot)

Example of a futures trade

Description

- An investor takes a long position in 2 December gold futures contracts on June 5 on COMEX

- contract size is 100 oz.
- futures price is US$400
- initial margin is US$2,000/contract (US$4,000 in total)
- maintenance margin is US$1,500/contract (US$3,000 in total)

- Hull page 27-28

A possible outcome

- Hull Table 2.1, Page 28

Code

Code2

Output

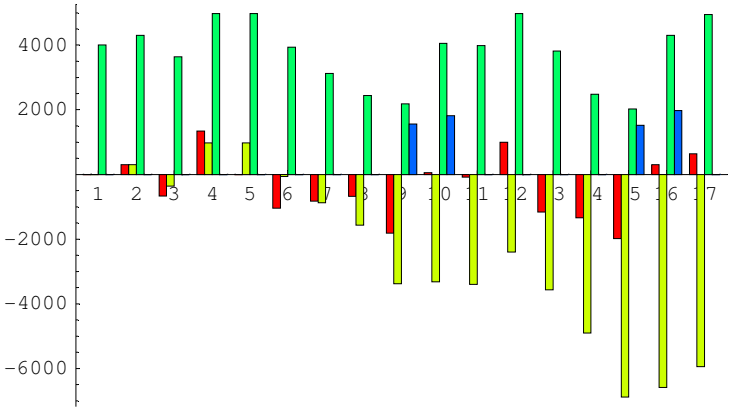


Figure 2.2: Operations of margins for a long position in two gold futures contracts. Variables on barchart are PnL, cumulative PnL, margin account and margin calls.

Table 2.1. Operations of margins for a long position in two gold futures contracts.

Fut price	*Daily gain*	*Cum gain*	*Mgn ac bal*	*Mgn call*
400.	0	0	4000	0
401.5	300.	300.	4300.	0
398.2	−660.	−360.	3640.	0
404.9	1340.	980.	4980.	0
404.9	0.	980.	4980.	0
399.7	−1040.	−60.	3940.	0
395.6	−820.	−880.	3120.	0
392.2	−680.	−1560.	2440.	0
383.1	−1820.	−3380.	2180.	1560.
383.4	60.	−3320.	4060.	1820.
383.	−80.	−3400.	3980.	0
388.	1000.	−2400.	4980.	0
382.2	−1160.	−3560.	3820.	0
375.5	−1340.	−4900.	2480.	0
365.6	−1980.	−6880.	2020.	1520.
367.1	300.	−6580.	4300.	1980.
370.3	640.	−5940.	4940.	0

Example

Example 2.1. An investor takes a long position in two December gold futures contracts on June 5, the contract size is 100 oz., the futures price is US$400 initial margin is US$2,000/contract and the maintenance margin is US$1,500/contract.

- (i) After one day the futures price has increased to $401.5. What is the gain or loss for this day, to the nearest $10, and what is the effect on the cumulative gain and the margin account balance?
- (ii) After six trading days the margin account balance stands at $3120 and the futures price is $395.6. If a day later the futures price falls further to $392.2, will a margin call be triggered? Calculate the margin account balances for day seven and day eight, given that the futures price falls further to $383.1. This information is summarised in table form:

Day	Future price	Margin account
6	395.6	3120.
7	392.2	?
8	383.1	?

(i) Gain or loss for first day

[# contracts]×[contract size]×([new futures price]-[old futures price])=2×100×(401.5-400)=$300 (gain)

(ii) Margin account balances for days 7 & 8

Margin calls occur when the balance falls below 2×\$1500=\$3000, and restore the balance to the initial margin of 2×\$2000=\$4000.

Day	*P & L* (\$)	MAB (\$)	Margin call (\$)
6	–	3120	0
7	$2\times100\times(392.2-395.6)=-680$	$3120-680=2440$	$4000-2440=1560$
8	$2\times100\times(383.1-392.2)=-1820$	$2440-1820+1560=2180$	$4000-2180=1820$

Clearinghouse

- *Exchange clearing house* is an intermediary which monitors and guarantees transactions
- Members deposit a margin with the ECH
- Brokers are or use members
- Clearing margin is adjusted on a gross or net basis

Collateralization in OTC markets

- Collateralization is margining system for OTC transactions
- Collateralization agreement obliges parties to exchange payments as contract changes value
- Similar to futures contracts in that they are settled regularly (e.g. every day or every week)

Quotes

- Commodities futures; (for index, FX, IR futures, see Chapters 3, 5, 6)
- Details at top
  - asset
  - exchange
  - contract size

Terminology

- *Open interest:* the total number of contracts outstanding, equal to number of long positions or number of short positions
- *Settlement price:* the price just before the final bell each day used for the daily settlement process
- *Volume of trading*: the number of trades in 1 day

Prices

- Yesterday's
- Opening – > bell
- Highest / lowest during day

Settlement price

- Used for P&L and margin calculations

- Change is 5th

Lifetime highs and lows

- Highest and lowest futures price during lifetime

Open interest and volume

- *Open interest* = total # of contracts outstanding
- = # long = # short
- Day before yesterday
- Total at end for all maturities:
  - volume
    - estimate for yesterday,
    - actual for previous day
  - open interest
    - total
    - change
- Volume > OI ⇒ day trades

Patterns of futures prices

Futures Prices for Gold and Oil on Feb 4, 2004

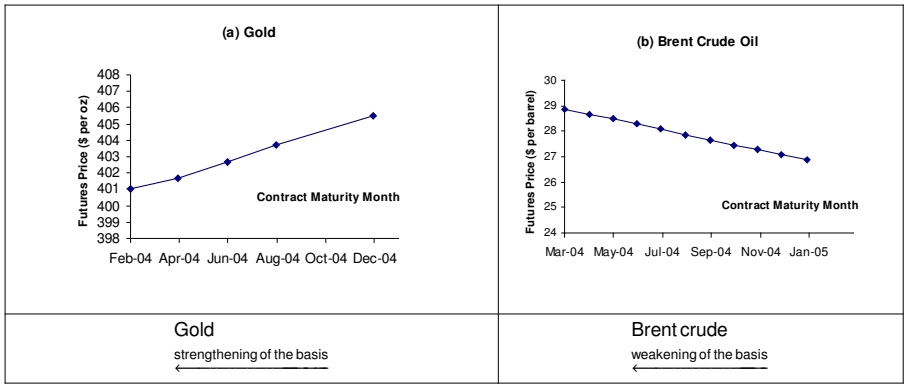


Figure 2.3: Futures Prices for Gold and Oil on Feb 4, 2004: Prices Increase and decrease with maturity, respectively (Figure 2.2, page 35)

- Upwards is *normal*; downwards is *inverted*; some markets concave or convex
- Chapter 3: *basis*; Gold $b < 0$, ↓, Oil $b > 0$, ↑

Delivery

- Most contracts are closed out before maturity
- Close out with offsetting trade
- If not closed out before maturity, settled by delivering assets underlying contract

- Some contracts settled in cash (e.g. stock indices, Eurodollars)

Contracts with alternatives

> When ∃ alternatives, party with *short* position chooses

- When ready, gives *notice of intention to deliver,* specifies
  - grade
  - location

Process

- Investor A decides when
- A's broker issues a NOITD to the ECH (how many, $\overbrace{\text{where, what}}^{\text{Commodities}}$)
- Exchange finds long party
- Original counterparty was B. However, B can close out with C, C with D...
- NOITD passed to oldest outstanding long
- Longs have to accept
- Take delivery: accept warehouse receipt, pay
- Price is settlement on day < NOITD
- Takes 2-3 days

Critical days

- *First notice* – 1st day for NOITD
- *Last notice* – last `` `` ``
- *Last trading*
- [close out long] < FND < LTD < LND

Cash settlement

- Impossible to deliver stock index
- Outstanding declared closed on day
- E.g. S&P500 CME, 3rd Fri of delivery month
- Final settlement price is opening of index that day

Types of traders and types of orders

- Hull 2.7

Classification of traders

- Types of traders
  - *Commission brokers* — for clients and charge commission
  - *Locals* — trade on own account
- Position takers (see Hull 2006 Chapter 1)
  - Hedgers

- Speculators
  - *scalpers*, (minutes)
  - *day traders* (hours) or
  - *position traders* (days)
- Arbitrageurs

Orders

- *Market order* — simplest, immediately at best price
- *Limit order* — trade executed at specific price (or more favourable)
- *Stop order* or *stop-loss order* — best price once bid or offer made at price or less favourable; closes out position to limit losses
- *Stop-limit order* — combination of stop and limit orders e.g.
  Current \$30 < Stop \$40 < Limit \$41
- *Market if touched* (MIT) *order* or *board order* — best price after trade at specified price; ensures profits taken if favourable price movements (cf. stop order)
- *Discretionary order* or *market-not-held order* — like market, but broker delays to get better price
- *Time of day* — particular period
- *Open order* or *good-till-cancelled* — until executed or end of trading in contract
- *Fill or kill* — immediately or not at all

Regulation

Purpose

- Hull 2.8
- Protect the public interest
- Prevent questionable trading practices by either individuals on the floor of the exchange or outside groups
- E.g. Commodity Futures Trading Commission
  - contracts approved,
  - prices & positions communicated,
  - individuals licensed,
  - complaints,
  - make exchange discipline
- National Futures Association

Trading irregularities

- *Corner market* –
  - take long future and restrict supply,

  - shorts cannot deliver enough
  - spot and future ↑
- *Front running* – traders trade 1st for themselves

Accounting & tax

Accounting

- Recognition of P&L
  - hedging – same time as P&L on item being hedged (*hedge accounting*)
  - speculation – on a mark-to-market basis
- Goal of accounting and tax treatment of futures in the U.S. etc.
- Hull 2.9

Example

Example 2.2. A company with a Dec yr end, in Sept 2004 takes a long position in a Mar 2005 corn future and closes out the position at the end of Feb 2005. The futures price is
• 270 cents per bushel when the contract is entered,
• 280 cpb at the end of 2004 and
• 280 cpb when the position is closed out.
Find the gains for accounting purposes in the cases that the trade does not and does qualify as a hedge

Gains
2004 $5000×(2.7 – 2.5) = $1000
2005 $5000×(2.8 – 2.7) = $500
Qualify as a hedge:
No
2004 $1000, 2005 $500
Yes
Entire $1500 in 2005

FAS 133 & IAS 39

- Standards set by
  - Financial Accounting Standards Board #133, June 1998
  - International Accounting Standards Board #39
- Derivatives (fut, fwd, swp, opt) on balance sheet at fair market value
- Previously off

Tax

- Issues re taxable P&L
  - nature – capital gains / ordinary income
  - timing – losses to be carried forward and back
- Taxpayers, how CGs are taxed
  - corporate – as OI
  - non-corporate – short-term as OI, long-term as CG (max 15%); treated 60:40
- Usually, posns in futures treated as if closed out on last day of tax yr.
- Hedges exempt

Forward contracts vs futures contracts

- Hull 2.10

Summary table – simple

Table 2.2. Forward Contracts vs Futures Contracts. See (Hull 2006) Section 2.10

Property	*Forwards*	*Futures*
How traded	Private contract between 2 parties	Exchange traded
Standard contract	No	Yes
Delivery date	Usually 1 specified	Range
Settled	End of contract	Daily
Delivery occurs	Usually	Rarely—closed out before
Credit risk	Some	Virtually none

Summary table – detailed

Table 2.3. Forward Contracts vs Futures Contracts. See (Musiela & Rutkowski 2004) Section 1.3.

Property	*Forwards*	*Futures*
Specification and delivery	• Unlimited range. Delivery on any date and location • 90 %	• Contract precisely specifies underlying instrument and price • 2%
Prices	• Varies with size of transaction and credit risk of participant • ∄ price limits	• Same for all • ∃ price limits
Marketplace and trading hours	• Direct negotiations between individual buyers and sellers, OTC • 24 hr/day	• Centralised on exchange floor with worldwide communication • During working hours
Margin	• Negotiable collateral • Market participant takes credit risk	• Initial + daily settlement • Clearing house takes credit risk
Volume and liquidity	• Low • Offset with original counterparty only	• High • Offset easy

Example

Example 2.3. The sterling exchange rate for 90-day forward contract is 1.6, and this is the same as the futures price for a contract that will be delivered in exactly 90 days. Describe the difference between the gains and losses earned by investors A and B, who are respectively long £1 million in 90-day forward and futures contracts, if the spot rate after 90 days is 1.8 dollars per pound. How many contracts does B purchase?

B buys $\$1\times10^6 / \$62500 = 16$ contracts

A makes $\$0.2\times10^6$ on day 90

B makes same, but spread out over 90 days – some days loss, some days gain

Foreign Exchange Quotes

- Futures FX rates # USD per unit of foreign
- Forward FX rates same as spot exchange rates. I.e:
  - # USD per unit of foreign – GBP, EUR, AUD, and NZD
  - # foreign per USD – CAD and JPY

Example

Example 2.4. The futures price quote for CAD is 0.7050. Estimate what the forward price quote is likely to be.

$\left\{ \begin{matrix} \text{Forward} \\ \text{Futures} \end{matrix} \right\}$ price for C$ is quoted as $\left\{ \begin{matrix} \text{C\$ per USD} \\ \text{USD per C\$} \end{matrix} \right\}$

Futures price quoted as $\frac{1}{0.7050} = 1.4184$ C$ per USD.

Summary

Delivery

- High proportion of futures closed < delivery
- Possibility of delivery ⇒ convergence of spot and futures
- Range of delivery days & well-defined procedure
- Some cash settled e.g. indices

Specification

- Specification by exchange
  - what
  - where
  - when
  - trading hours
  - quote conventions
  - max price movements

Margins

- Margins by investor with broker
  - adjusted daily
  - periodically topped up (when?)
- Clearinghouse
  - broker has account with, or is, clearinghouse member
  - CHM has account with exchange clearinghouse
  - balance adjusted daily to reflect P&L in CHM's business

Quotes

- Exchange gathers trading information
- Disseminated around world e.g. as newspaper data for previous day

Forwards vs futures

- Private vs exchange
- Single vs multiple delivery date
- Non-standard

- Final vs daily settlement

Next

- Hedging strategies involving futures