

# The Futures Market

## Introductions and Mechanics



(c) 2002-2011 Gary R. Evans. May only be used for non-profit educational purposes only without permission of the author.

## What are futures contracts?

A futures contract allows a trader to undertake a contract to **accept or make** delivery of a commodity or some kind of financial asset (a) in the future on a known date, (b) under specified conditions, (c) for a price contracted today.

The party to the contract who is agreeing to take delivery of the commodity is **long** in the position, whereas the party who is agreeing to deliver the commodity is **short** in the position. A speculator will benefit when she is long if the prices rise, short if the price falls.

Through submission of bids and asks, the exchange will match long orders with short orders, either with outside traders or with their own trades.

## An example of a futures contract

On November 5, 2010, you could have agreed to pay \$87.18 per barrel (42 gallons) for 1,000 barrels of light sweet crude oil (with 0.42% sulfur or less) for delivery at an agreed time during the month of December to a facility at Cushing, Oklahoma, F.O.B.

This contract was traded at the New York Mercantile Exchange (now CMEGroup), one of many futures exchanges in the United States.

Like options, you can speculate or hedge in this contract without taking delivery - you simply reverse your position before the last trading day.

## Key terms

- **Spot price:** Today's cash price.
- **Futures price:** Today's price of a specified futures contract, like December 2010 NYMEX light sweet crude contract.
- **Expected future spot price:** Exactly what the name implies. (There is a theory that says that this price will not be the same as the futures price).
- **Volume:** The number of contracts traded today (or in any period of time)
- **Open interest:** The number of contracts that are "open," that exist right now, that have a matched long and short position.
- **e-Mini contract:** A much smaller contract in some commodity, typically electronically traded.

## Types of Futures Contracts

- **Energies:** Oil, gasoline, diesel, heating oil, natural gas, ethanol
- **Currencies:** Euro, Pound, Yen, Peso, etc. (more than FOREX), mostly but not entirely priced in Dollars (called Crosses if not).
- **Financials:** Interest rate futures in mostly Dollar and Euro.
- **Indices:** Multiple stock indices of different countries.
- **Metals:** Aluminum, gold, palladium, platinum, copper, silver, uranium
- **Ag commodities:** Corn, wheat, soybeans, rice, coffee, oats, cattle, hogs, pork bellies, cotton, lumber, cocoa, milk, sugar, orange juice
- **Exotics:** Weather (heat), hurricane, snowfall, frost, economic event (statistical releases), commercial/residential real estate (see CMEGroup website for the exotics).

## The exchanges

The primary futures exchanges in the U.S. *were* the New York Mercantile Exchange (**NYMEX**), the Chicago Board of Trade (**CBOT**), and the Chicago Mercantile Exchange (**CME**) and the New York Board of Trade (**NYBOT**). In 2007 the first three exchanges listed here were merged into the **CMEGroup** [NYSE: CME]. **Globex**, an electronic trading arm, is a division of the CMEGroup.

The huge, global **IntercontinentalExchange** [NYSE: ICE], which bought NYBOT in 2007, competes with the CMEGroup and emphasizes electronic trades. ICE trades energy futures through the U.K.-regulated London market, and its commodity, foreign exchange, and index futures through a U.S.-regulated market.

Formerly exchanges sold "seats" allowing members to trade on the exchange floor, called the "pit" and to bid and ask using a complicated system of hand signals and verbal orders in an "open outcry" system. This system is similar to that used on the NYSE.

Electronic trading is rapidly replacing open outcry. ICE is purely electronic.

Trades are cleared through a **clearinghouse** that matches buy and sell orders. The "clearing member" is a market maker who assures that all trades are matched, or matches it himself.

## Web sites

Intercontinental Exchange (owns NYME): <http://www.theice.com>

**CMEGroup** (CME and CBOT): <http://www.cmegroup.com>

Ino (good free site for checking prices): <http://www.ino.com>

Kitco (metals): <http://www.kitco.com>

OpenECry (online futures broker): <http://www.openecry.com>

Class assignment: Peruse the CMEGroup site before the next lecture and see what information they provide. **Look at the list of commodities they trade and look at their contract specifications and prices.**

### Example: NYMEX (CMEGroup) Light Sweet Crude Futures

Figure 1 – The NYMEX light sweet crude oil December 2010 contract



A single contract, the December 2010 CMEGroup CLZO.

Futures price was \$87.18 on 11/15/2010

Spot price was \$86.49.

Source: CMEGroup.com

## Example: NYMEX light sweet crude contracts

Daily Settlements for Light Sweet Crude Oil Futures (FINAL)

Trade Date: 11/12/2010

Month	Open	High	Low	Last	Change	Settle	Estimated Volume	Prior Day Open Interest
DEC 10	87.73	87.85	84.52	84.83A	-2.93	84.88	482,083	216,785
JAN 11	88.25	88.32	85.00	85.19	-2.94	85.34	183,420	306,554
FEB 11	88.62	88.65	85.47	85.68A	-2.89	85.80	57,396	92,948
MAR 11	88.80	88.86	85.90	86.12A	-2.85	86.22	30,969	101,747
APR 11	88.36	88.39	86.28A	86.54	-2.83	86.56	12,697	42,285
MAY 11	88.85	88.85	86.76	86.82A	-2.82	86.87	7,274	39,054
JUN 11	89.27	89.27	86.78	87.05A	-2.80	87.12	20,605	90,950
JLY 11	88.96	88.96	87.00	87.00	-2.78	87.34	3,944	35,813
AUG 11	89.04	89.09	88.92	89.08	-2.77	87.54	3,350	14,497
SEP 11	89.60	89.62	87.60	87.60	-2.76	87.74	2,407	24,672
OCT 11	89.28	89.58	87.93	87.95	-2.74	87.94	1,431	16,501
NOV 11	90.18	90.18	88.03	88.10	-2.72	88.15	1,461	19,968
DEC 11	90.79	90.83	88.05	88.30A	-2.70	88.38	29,051	151,483

Source: <http://www.CMEGroup.com>

## What do we need to know about the Crude contract?

- Contract size
  - 1,000 bbls (42,000 gallons)
- Pricing of quote
  - \$ per bbl
- The exchange
  - CMEGroup (formerly NYMEX)
- **Initial margin requirement**
  - **\$5,063** non-member, **\$3,750** member

On April 8, 2009.

## need to know ... (cont).

- **Maintenance Margin**
  - **\$3,750**
- Last trading date
  - 3rd business day prior to the 25th day of the month in the preceding month of the contract (Nov 22 for Dec).
- Delivery date or period
  - By arrangement, anytime in the month of the contract.
- Delivery location
  - Various named locations in Cushing, Oklahoma or pipeline access to TEPPCO or Equilon Pipeline Co.

## Margins and Leverage

- ✓ Initial Margin - The amount of cash per contract that you must have in your account prior to trading. (**\$5,063**)
- ✓ Maintenance Margin - If the amount of cash per contract falls below this value, you will get a margin call and must replenish cash balance. (**\$3,750**)
- ✓ Leverage (maximum) - The value of the contract divided by the initial margin.
  - $[\$87.18 \times 1000] / 5,063 = 17.22 \text{ to } 1$
- ✓ Each penny move in the price of oil affects the margin account by \$10.00 per contract.

## Settlement

Unlike options, futures are not paid for (which is to say, the commodity to be delivered is not paid for) until the delivery of the commodity.

The buyer of the future, however, is required to deposit funds in a special *margin account* which is, at the end of each day, **adjusted to reflect the capital gain or loss**. The starting required balance for this account is called the *initial margin*.

The seller is also required to maintain a margin account that is adjusted daily and if the seller does not own the commodity, may have to meet special requirements.

The account balance must always be kept above the *maintenance margin*, sometimes called the *day margin*.

## An example of margin account adjustment

December crude oil futures contract, long 1,000 bbls

Date	Price	Position	Gain	Margin
0	87.18	87,180	0	5,063
1	87.34	87,340	160	5,223
2	86.84	86,840	-500	4,723
3	86.12	86,120	-720	4,003
4	85.02	85,020	-1,100	2,903
5	86.44	86,440	1,420	4,323
6	87.66	87,660	1,220	5,543
				MC

For a short contract, the signs in the **Gain** would simply reverse.

Each one cent move affects margin by \$10. Leverage is 17.22 to 1.

## How you pay for delivery Mudd Finance (iff you *take* delivery)

- If you go long (buy) on a futures contract for \$87 (such as \$87 per barrel of oil), and if you take delivery, you *will* end up paying \$87 for the commodity.
- This net cost, however, will consist of two components:
  - the price you pay at delivery, which is *spot* for that day, and
  - the results of the daily adjustment to your margin account, whether a capital gain or capital loss.
- Therefore, you are ***effectively paying \$87 because of the adjustment in your margin account.***

## Example Mudd Finance

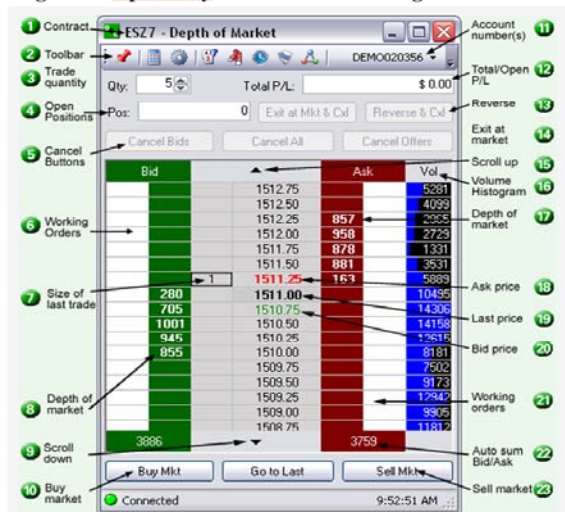
- In November, you buy an December Crude Oil future for \$87.18 per barrel (nominal value \$87,180). You are long. You want to take delivery.
- Spot price in on the day you enter this contract is \$86.49 (not relevant to settlement nor to this contract).
- When Nov 22 arrives, spot price has risen to \$91.50.
- Question: What are the settlement terms?
  - You take delivery of the oil in Dec at the Nov 22 spot (\$91.50), *not* \$87.18, so you pay \$91,500.
  - You have gained \$4,320 in your margin account.
  - The **total cost** of this contract to you is (\$91,500 – 4,320) which equals \$87,180, exactly as you intended.
- Therefore, **the only asset you have is the cash balance of your margin account!** (Relevant to delta ETFs).

## Notes on these contracts

1. Short also
  - The previous example was for a long position (taking delivery or the equivalent). With futures, you are just as likely, and it is just as easy, to go short. With that position the trader *makes* delivery or the equivalent. In a spec position you benefit if the price goes down while you are in the contract.
2. Bid/Ask and limit orders
  - When you buy (long) or sell (short) a futures contract, you will pay close attention to the Bid/Ask queue, called the Depth of Market (DOM) queue, which is similar in structure to the NASDAQ Level II queue for stocks, and will likely use a limit order like you would do for stocks and options (see the OpenECry DOM for an example).
3. Implicit Leverage
  - Clearly with futures you have implicit leverage, which equals the *value of the position divided by the initial margin*. [Note the example in the second slide after this]. This leverage will clearly compound your gain or loss by the scale of the leverage.

### Example: Online DOM Interface (OpenECry)

Figure 4 – OpenECry DOM Futures Trading Interface



This works the same way as Level II, except the Ask queue goes up (to higher prices, as it does in Level II).

Market orders can be traded directly and quickly from this screen.

## Exiting the contract (offset)

Less than 1% of all futures contracts end with delivery of the commodity! Nearly all traders reverse their trades (called "offset") before the contract expiration date.

Remember that the futures price must converge to the spot price as the expiration date approaches. Open interest declines until it is zero.

Generally long positions exit at about the same pace as short positions, so open interest is gradually cleared off by the exchange.

Remember, you did not "buy" or pay for anything when you opened the contract. You agreed to daily settlement terms, which have been satisfied daily. When you offset you do not sell anything or get paid. *You just inform your broker that you are closing out your trade and the exchange says goodbye.*

Most ICE contracts allow either futures swaps (EFP) or cash settlement instead of delivery even if you do not offset. Many contracts are cash settlement only.

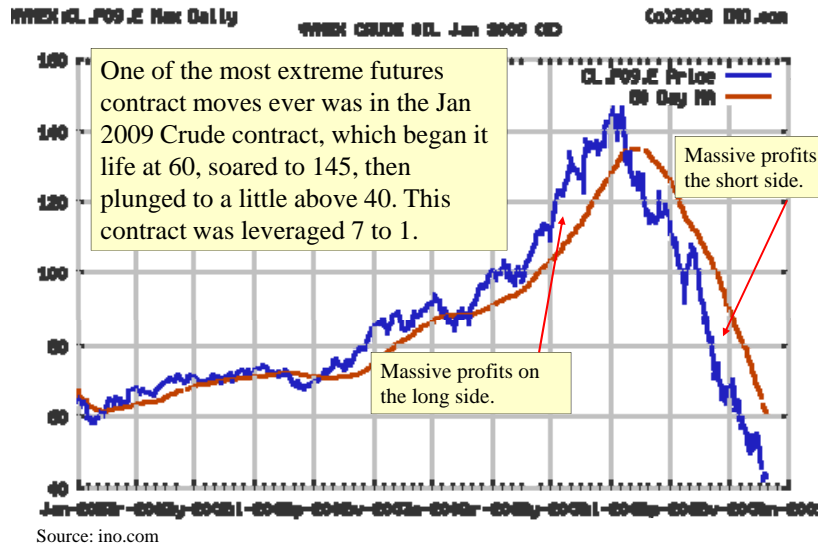
Many non-commodity contracts do not have deliverables so offset is automatic.

## Pricing fundamentals of tangible, storable commodities (like oil)

The prices of tangible, storable commodities like crude oil, natural gas, wheat, copper, and so forth are fundamentally determined by global trends in **supply** (production), **demand** (consumption), and stored **inventory**, which acts as a buffer between supply and demand. Often futures prices, which have a short-run orientation (although they are influenced by long-run expectations) are strongly affected by unexpected inventory fluctuations.



## Jan 2009 Crude Contract (2008)



### Sample CMEGroup Futures Contracts

	Size	Recent Value
Light Sweet Crude	1,000 bbls.	87.18
Natural Gas	10,000 mmBtu	3.809
Wheat	5,000 bushels	6.692
Oats	5,000 bushels	3.51
No 11 Sugar	112,000 pounds	0.2619
E-mini S&P 500	50 X S&P 500	1198.75
S&P 500	250 X S&P 500	1198.75
EUR/USD	\$10,000	1.372
30-Year UST Bond	Nominal \$100,000	127.30
13 week Tbill	Nominal \$1M	99.27
Gold GC	100 Troy ounces	1372.0
Copper HG	25,000 pounds	3.91
Nonfarm Payroll	\$25 X chg NFP	151

Quotes are in \$, some contract quotations in cents.  
 Prices are for November 12, 2010 or within a few days.  
 Source: CMEGroup November 2010

## An interesting 2010 contract - sugar



112,000 pounds, notional value **\$37,000** @ .33, **\$29,355** @ .2621  
 Maint Margin \$2,000 Initial Margin \$2,200 (Nov 2010)

## Copper goes stratospheric in 2010



## Hedging

Hedging, especially when using derivatives, involves the purchase or sell of a derivative for the purpose of reducing risk - sometimes substantial risk.

Here is a typical hedging problem:

You are a jewelry manufacturer. You use silver in the manufacture of your film, and anticipate using about 10,000 troy ounces in July. You have nice margins and you don't want an unexpected increase in the price of silver to reduce or eliminate those margins. How should you use the futures market to hedge your position?

## What you need to know and decide ...

---

- ✓ Which future on which market?
- ✓ What is the contract size
  - ... and how many contracts do you need?
- ✓ Long or short?
- ✓ What is your initial and maintenance margin
  - ... and hence your cash requirement for the hedge?
- ✓ Are you going to take delivery?

## But ... (a rather important point)

Futures contracts can be used to hedge against rising (or falling) prices and inflation in general, *but* if inflationary expectations are robust and inflationary expectations are *already priced* in futures prices, no good hedge or no hedge at all will be available!

That's why when hedging is part of your business or investment strategy, you must either hedge all of the time (including when it may look like you least need to hedge), which involves some cost, or you have to be confident that you have an edge and can move into the market before inflationary expectations push up the price of futures contracts.

When futures prices rise as the contracts get more distant, the media and analysts sometimes call this a **contango** (see the example next slide). The opposite is called "backwardation."

[Technical note: In derivatives math modeling, a *contango* exists only when the futures price is above the expected future spot price, but the media ignores such refinements. Econ 136 sorts this out].

## The oil contango of late 2008

[New York Mercantile Exchange \(NYMEX\)](#)  
[Energy](#)  
 CRUDE OIL (CL)

This is a 31% spread, far beyond any carry cost!

[Download data](#) | [Analyze Chart](#)

Market	Open	High	Low	Last	Change	Pct	Time
<a href="#">CL.F09</a> <a href="#">Jan 2009</a>	43.40	44.20	43.15	43.15	-0.56	-1.28%	14:33
<a href="#">CL.G09</a> <a href="#">Feb 2009</a>	46.10	46.40	44.60	44.60	-1.76	-3.78%	14:28
<a href="#">CL.H09</a> <a href="#">Mar 2009</a>	46.80	46.80	46.80	46.80	-1.82	-4.07%	14:29
<a href="#">CL.J09</a> <a href="#">Apr 2009</a>	50.25	50.25	50.25	50.25	-0.04	-0.08%	10:32
<a href="#">CL.K09</a> <a href="#">May 2009</a>	77.15	77.15	77.15	51.64	+4.03	+7.80%	set 15:25
<a href="#">CL.M09</a> <a href="#">Jun 2009</a>	54.20	54.20	54.15	52.78	+3.94	+7.46%	set 15:25
<a href="#">CL.N09</a> <a href="#">Jul 2009</a>	59.58	59.58	59.58	53.76	+3.84	+7.14%	set 15:25
<a href="#">CL.Q09</a> <a href="#">Aug 2009</a>	54.63	54.63	54.63	54.63	0.00	0.00%	09:42
<a href="#">CL.U09</a> <a href="#">Sep 2009</a>	64.15	64.15	64.15	55.48	+3.59	+6.47%	set 15:25
<a href="#">CL.V09</a> <a href="#">Oct 2009</a>	117.80	118.00	117.80	56.32	+3.50	+6.21%	set 15:25
<a href="#">CL.X09</a> <a href="#">Nov 2009</a>	100.70	100.70	100.70	57.15	+3.41	+5.97%	set 15:25
<a href="#">CL.Z09</a> <a href="#">Dec 2009</a>	60.25	60.25	60.00	57.98	+3.33	+5.74%	set 15:25
<a href="#">CL.F10</a> <a href="#">Jan 2010</a>	61.35	61.35	60.80	58.78	+3.27	+5.56%	set 15:25

Source: ino.com

... can you effectively hedge when this contract is in contango??

## Considering Delta ETFs – The USO example

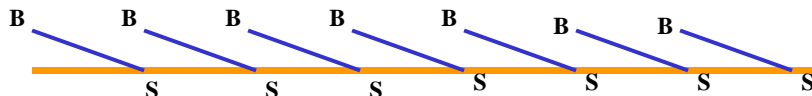
Daily Holdings				Fund Facts	
as of 11/12/2010, subject to change				USO	as of 11/12/2010
Security	Quantity	Price	Market Value		
<b>Oil Futures and Other Oil Interests</b>					
NYM Crd.Oil Fincl.Futr. WS JAN11	2,000	\$85.34	\$170,680,000.00	NAV	\$36.62
ICE WTI Crude Future JAN11	10,000	\$85.34	\$853,400,000.00	4PM Bid/Ask Midpoint	\$36.49
NYM Crude Oil Future CL JAN11	8,767	\$85.34	\$748,175,780.00	Last Trade Price	\$36.47
<b>Cash</b>					
US DOLLARS	1,868,445,911	\$1.00	\$1,868,445,911.32	Units Outstanding	48,400,000
				Total Net Assets	\$1,772,219,260.91
				Estimated Yield on Cash Holdings <sup>1</sup>	0.03%
				Estimated Management Expenses <sup>2</sup>	0.45%
				Total Expense Ratio	0.78%

Note that the holdings of cash are roughly equal to the nominal value of their three futures contracts (all Jan 2011s): CL is light sweet crude, the term “financial” in the WS contract means that settlement is cash only.

Given that “cash” (actually, the margin balance) roughly equal the notional value of the futures, USO hopes to match the daily delta in the spot price.

Note that their net assets are a little bit less than their cash – futures contracts are not an “asset” because they are not something that you own.

## The problem with Contango futures for delta ETFs: tracking bias



From a previous slide: Oil in Contango in 2008:

New York Mercantile Exchange (NYMEX)  
Energy  
CRUDE OIL (CL)

[Download data](#) | [Analyze Chart](#)

Market	Open	High	Low	Last Change	Pct	Time
CL.F09 Jan 2009	43.40	44.20	41.15	43.15	-0.26	-1.28% 14:33
CL.G09 Feb 2009	46.10	46.40	44.60	44.60	-1.76	-3.78% 14:28
CL.H09 Mar 2009	46.80	46.80	46.00	46.00	-1.82	-4.07% 14:29
CL.J09 Apr 2009	50.25	50.25	50.25	50.25	-0.04	-0.08% 10:32
CL.K09 May 2009	77.15	77.15	77.15	51.64	+4.03	+7.80% set 15:25
CL.M09 Jun 2009	54.20	54.20	54.15	52.78	+3.94	+7.46% set 15:25
CL.N09 Jul 2009	59.58	59.58	59.58	53.76	+3.84	+7.14% set 15:25
CL.O09 Aug 2009	54.63	54.63	54.63	54.63	0.00	0.00% 09:42
CL.U09 Sep 2009	64.15	64.15	64.15	55.48	+3.59	+6.47% set 15:25
CL.V09 Oct 2009	117.80	118.00	117.80	56.32	+3.50	+6.21% set 15:25
CL.X09 Nov 2009	100.70	100.70	100.70	57.15	+3.41	+5.97% set 15:25
CL.Z09 Dec 2009	60.25	60.25	60.00	57.05	+3.33	+5.74% set 15:25
CL.F10 Jan 2010	61.35	61.35	61.00	58.78	+2.77	+5.56% set 15:25

During times when the futures contracts are in Contango (example shown for oil in 2008) then all futures are well above spot and all go subsequently higher with duration.

These contracts must be rolled over.

Therefore you are tending to buy higher than settlement if spot doesn't rise enough to cover the spread.

Figure 14: Example of a Contango Introducing Tracking Bias into a Delta Tracking ETF Secured with Futures

