

# Topic 4 – Introduction to forwards and futures

1. *Forward contracts & uses*
2. *Futures contracts, markets & uses*

# 1. Forward contracts and uses

## 1.1. Definition & example

- Agreement to buy or sell an underlying asset at a fixed price  $F_t$  and on a fixed date  $T$  in the future, for defined grade, quantity & place of delivery.
- Example of a forward contract on  $t = \text{March 1, 2013}$  :

<i>Asset</i>	<b>#1 Yellow grain field corn</b>	
<i>Nominal amount</i>	50,000 bushels (bu)	
<i>Forward price <math>F_t</math></i>	<b>4.00 USD/bu</b>	<i>Negotiated price between 2 counterparts</i>
<i>Buyer</i>	United Grain Brokers Corp.	<i>Commitment to pay USD 200 000</i>
<i>Seller</i>	Corn Grower ltd.	<i>Commitment to deliver 50 000 bu</i>
<i>Maturity date</i>	May 31, 2013	
<i>Place of delivery</i>	Saint-Louis City, MO	



# Example of cash bids :

$S_t$  price

$F_t$  price

## USDA in Saint Louis , MO -- Saint Louis City County

<u>Commodity</u>	<u>Bid</u>	<u>Date</u>
Soybeans/spot	15.23	Nov 07, 2012
Corn/yellow/spot	7.43	Nov 07, 2012
Wheat/srw/spot	8.82	Nov 07, 2012
Milo/spot	6.92	Nov 06, 2012

## CARGILL in East Saint Louis , IL -- Saint Clair County

<u>Commodity</u>	<u>Bid</u>	<u>Date</u>
Soybeans/spot	15.22	Nov 07, 2012
Soybeans/jan	15.40	Nov 07, 2012
Corn/yellow/spot	7.29	Nov 07, 2012
Corn/yellow/jan	7.62	Nov 07, 2012
Wheat/srw/spot	8.82	Nov 07, 2012
Wheat/srw/jan	9.08	Nov 07, 2012
Milo/spot	6.94	Nov 07, 2012
Milo/jan	7.16	Nov 07, 2012

## JERSEY COUNTY GRAIN in Hardin , IL -- Calhoun County

<u>Commodity</u>	<u>Bid</u>	<u>Date</u>
Soybeans/spot	14.99	Nov 07, 2012
Soybeans/jan	15.18	Nov 07, 2012
Corn/yellow/spot	7.14	Nov 07, 2012
Corn/yellow/jan	7.41	Nov 07, 2012

## ROSE ACRE FARMS-HAWK POINT in Hawk Point , MO -- Lincoln County

<u>Commodity</u>	<u>Bid</u>	<u>Date</u>
Corn/yellow/spot	6.85	Nov 07, 2012
Corn/yellow/jan	7.10	Nov 07, 2012

## CON AGRA in Alton , IL -- Madison County

<u>Commodity</u>	<u>Bid</u>	<u>Date</u>
Wheat/srw/spot	9.14	Nov 07, 2012
Wheat/srw/jan	9.17	Nov 07, 2012

## 1.2. Basis evolution

- **Basis on  $t = F_t - S_t$**
- Considering maturity  **$T = \text{Jan 31, 2013}$**  :

*Forward price*                      *Spot price*

Nov. 7 :  $basis_{t=0} = 7.62 - 7.29 = +0.33$  USD

Nov. 8 :  $basis_{t=1} = 7.51 - 7.40 = +0.11$  USD

Nov. 9 :  $basis_{t=2} = 7.55 - 7.58 = -0.03$  USD

...

Jan. 31 :  $basis_{t=86} = 0.00$  USD

*prime contango*

*discount backwardation*

Date	Forward Price	Spot Price	Basis
Nov. 7	7.62	7.29	+0.33 USD
Nov. 8	7.51	7.40	+0.11 USD
Nov. 9	7.55	7.58	-0.03 USD
...			
Jan. 31			0.00 USD

# 1.3. Using forwards for hedging

## 1.3.1. Commodity consumer case

- On  $t$ , the Kellogg's Co. needs 50,000 bushels of corn, deliverable on  $T = t + 3 \text{ months}$  :
  - spot price.....  $S_t = 3.60 \text{ USD/bu}$
  - 3 month-forward price.....  $F_t = 4.00 \text{ USD/bu}$
  
- *Solution 1* :
  - buying spot on  $t$
  - storage

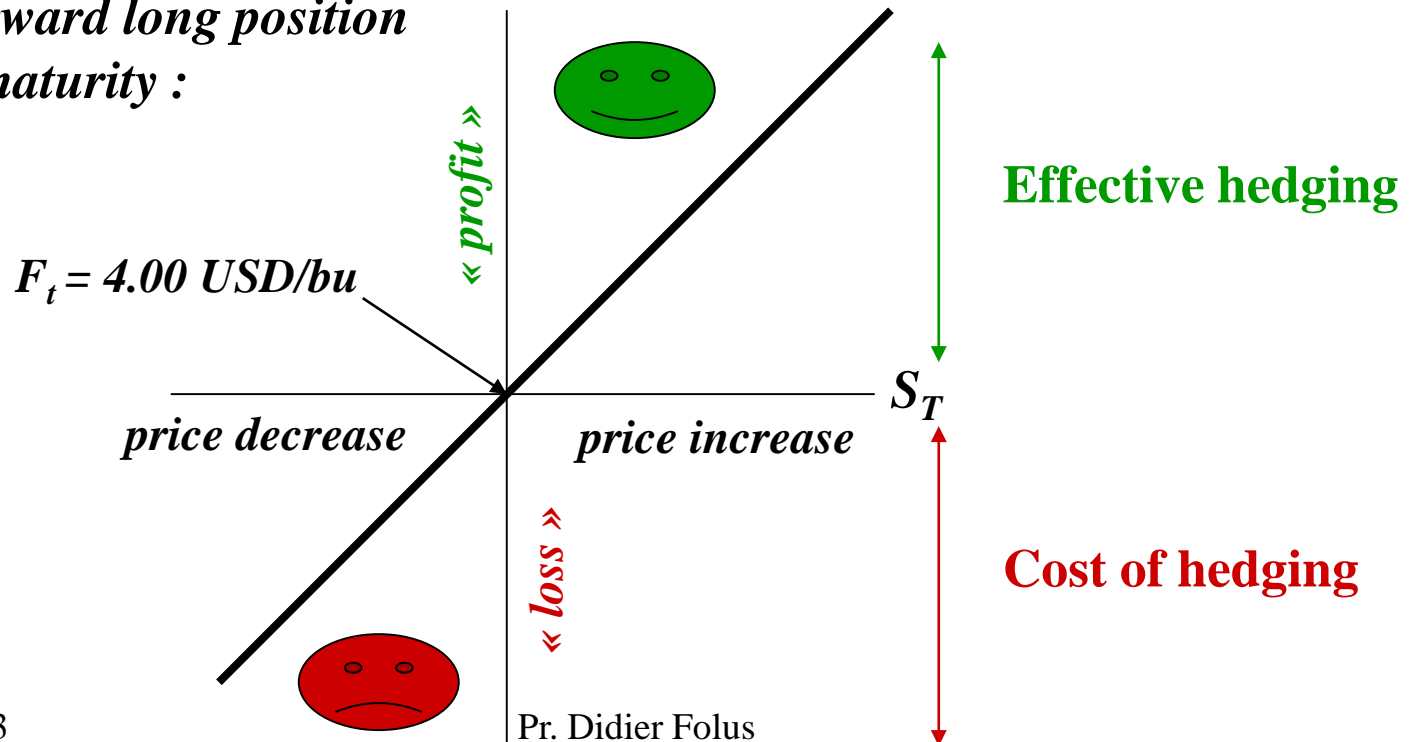
| Not risky / carrying cost
  
- *Solution 2* :
  - buying spot on  $T$

| Not costly / risky

*Solution 3 : buying forward on  $t$  for delivery on  $T$  :*

- deposit 3 % on  $t$ ..... USD 6 000
- settling on  $T$ ..... USD 200 000 – *deposit*
- receiving on  $T$ ..... 50,000 bu of corn

*Forward long position  
at maturity :*



## 1.3.2. Commodity producer case

- On  $t$ , a farmer expects a 50,000 bushels corn-crop, deliverable on  $T = t + 3 \text{ months}$  :
  - spot price.....  $S_t = 3.60 \text{ USD/bu}$
  - 3 month-forward price.....  $F_t = 4.00 \text{ USD/bu}$
- *Solution 1* : selling spot on  $T$
- *Solution 2* : **selling forward** on  $t$  for delivery on  $T$ 
  - **deposit 5 % on  $t$** ..... USD 10 000
  - **delivering on  $T$** ..... 50,000 bu of corn
  - **receiving on  $T$** ..... USD 200 000 + *deposit*

## 1.4. Using forwards for speculation

- Speculator, owning USD 200 000, expecting a future corn price increase
- Decision on  $t$  : **buying forward** 50,000 bu of corn at a price of  $F_t = 4.00$  USD/bu, settling on  $T$  :
  - **deposit on  $t$** ..... USD 10 000
  - **settling on  $T$** ..... USD 200 000 – *deposit*
  - **receiving + selling corn on  $T$** ..... USD  $S_T \times 50,000$
  - **result on  $T$  (in USD)**..... USD  $(S_T - F_t) \times 50,000$
  - **return on  $T$  (in %)**.....  $(S_T - F_t) \times 50,000$  /deposit





## 1.5. Using forwards for arbitrage

- **On  $t$** , an arbitrageur, having a **limit** of USD 304 000 :
  - *borrow cash.....* USD 300 000 at  $5\frac{1}{3}$  % for 90 days
  - *buys corn spot....* 75,000 bu of corn, paying 270 000 USD
  - *stores corn.....* 75,000 bu of corn, paying 20 000 USD
  - *sells corn forward* 75,000 bu of corn
- **On  $T$** , the arbitrageur :
  - *delivers corn.....* 75,000 bu
  - *receives cash.....* USD 300 000
  - *reimburses.....* USD 300 000 + 4 000 USD interests
- « **Riskfree** » **profit on  $T$  (locked on  $t$ )** : USD 6 000
- Numerous arbitrageurs make disappear the profit quickly

## 1.6. Forwards features

- **About forward contracts :**

- high nominal
- effective delivery
- non-tradable on a secondary market
- counterparty risk

*customized instruments*

- **About forward markets :**

- major underlying assets : *currencies, interest rates, commodities...*
- participants : *corporations & banks trading the physical asset*
- brokers
- quotes & market reports

# Market quotes : USD in London

Source : Financial Times, March, 2013.

*Bid, offer, mid spot rates & forward rates are derivate from Reuters*

Feb 28		Closing mid-point	Change on day	Bid/offer spread	Day's mid		One month		Three month		One year	
					High	Low	Rate	%PA	Rate	%PA	Rate	%PA
<b>Europe</b>												
Czech Rep.	(Koruna)	19.6562	0.0990	421-703	19.6710	19.4310	19.6529	0.2	19.6463	0.2	19.5912	0.3
Denmark	(Danish Krone)	5.7030	0.0143	022-038	5.7096	5.6642	5.7008	0.5	5.6962	0.5	5.6755	0.5
Hungary	(Forint)	226.252	0.4563	109-923	226.580	223.650	227.112	-4.5	228.629	-4.2	233.552	-3.1
Norway	(Nor. Krone)	5.7217	0.0183	195-239	5.7278	5.6776	5.7283	-1.4	5.7421	-1.4	5.8020	-1.4
Poland	(Zloty)	3.1746	-0.0037	734-757	3.1806	3.1541	3.1837	-3.5	3.2007	-3.3	3.2644	-2.8
Russia	(Rouble)	30.6027	0.0402	926-127	30.6313	30.4800	30.7539	-5.9	31.0639	-5.9	32.3539	-5.4
Sweden	(Krona)	6.4455	-0.0023	436-474	6.4549	6.4200	6.4500	-0.8	6.4584	-0.8	6.4953	-0.8
Switzerland	(Fr)	0.9332	0.0033	329-335	0.9352	0.9277	0.9329	0.4	0.9322	0.4	0.9280	0.6
Turkey	(New Lira)	1.7987	-0.0016	983-990	1.8010	1.7920	1.8056	-4.6	1.8192	-4.5	1.8822	-4.4
UK	(£)	1.5180	0.0046	177-182	1.5219	1.5147	1.5177	0.2	1.5172	0.2	1.5168	0.1
Euro	(Euro)	1.3074	-0.0036	072-075	1.3162	1.3055	1.3076	-0.3	1.3083	-0.3	1.3118	-0.3

$S_t$

$F_{t,1\text{ month}}$

$F_{t,3\text{ months}}$

$F_{t,1\text{ year}}$

## 2. Futures contracts and markets

### 2.1. Definition and example



- **Futures contract : exchange traded commitment to pay/deliver an asset for a specific time, place, grade and quantity.**
- Futures price appears through trades, for each maturity.
- Each buyer/seller faces a margin

#### Corn Futures

Contract Size	5,000 bushels (~ 127 Metric Tons)	
Deliverable Grade	#2 Yellow at contract Price, #1 Yellow at a 1.5 cent/bushel premium #3 Yellow at a 1.5 cent/bushel discount	
Pricing Unit	Cents per bushel	
Tick Size (minimum fluctuation)	1/4 of one cent per bushel (\$12.50 per contract)	
Contract Months/Symbols	March (H), May (K), July (N), September (U) & December (Z)	
Trading Hours	CME Globex (Electronic Platform)	5:00 pm - 2:00 pm, Sunday - Friday Central Time
	Open Outcry (Trading Floor)	9:30 am* - 2:00 pm Monday - Friday Central Time *opens at 7:20 a.m. CT for major USDA crop reports
Daily Price Limit	\$0.40 per bushel expandable to \$0.60 when the market closes at limit bid or limit offer. There shall be no price limits on the current month contract on or after the second business day preceding the first day of the delivery month.	
Settlement Procedure	<a href="#">Daily Grains Settlement Procedure (PDF)</a> <a href="#">Final Corn Settlement Procedure (PDF)</a>	
Last Trade Date	The business day prior to the 15th calendar day of the contract month.	
Last Delivery Date	Second business day following the last trading day of the delivery month.	

**USD 6.5825**

# Corn futures quotes

Daily Settlements for Corn Futures (FINAL)

Trade Date: 11/07/2012

Month	Open	High	Low	Last	Change	Settle	Estimated Volume	Prior Day Open Interest
DEC 12	740'4	751'6	734'0	743'0	+3'2	744'2	180,590	438,093
MAR 13	742'6	752'2	735'4	746'0	+3'0	746'0	89,975	413,453
MAY 13	739'6	748'0	732'6	-	+2'6	742'4	17,910	103,676
JLY 13	731'0	738'4	724'0	-	+2'6	733'6	13,045	149,334
SEP 13	658'2	662'4	653'0A	-	+2'0	660'0	2,462	29,131
DEC 13	636'2	642'4	632'4	640'0	+4'0	641'2	22,202	140,256
MAR 14	644'0	649'0B	640'4	-	+4'0	648'0	184	2,653
MAY 14	654'0	654'0	654'0	-	+4'0	653'4	34	830
JLY 14	651'0	658'0	651'0	-	+4'6	656'6	100	1,121
SEP 14	-	-	-	-	+3'6	610'0	6	90
DEC 14	600'2	603'6	598'0	-	+1'2	603'0	186	6,721
JLY 15	-	-	-	-	+1'2	620'4	-	76
DEC 15	588'0	588'0	588'0	-	+1'2	589'6	1	875
<b>Total</b>							326,695	1,286,309

Last Updated 11/07/2012 06:00 PM

**USD 6.4050**

# Dec 2012 corn futures chart



*Futures use ≠ forwards*

## 2.3. The operation of margins

- **CME corn futures (up to Sep 2013) :**
  - **initial margin = USD 2,700 per contract**
  - **maintenance margin = USD 2,000 per contract**

*Margin is a SPAN parameter  
Standard Portfolio  
Analysis of Risk performance*
- On  $t = \text{Nov 7, 2012}$ , an operator **buys 10 CME SEP13-corn futures contracts**, at USD 6.60 :
  - **commitment to pay**.....  $6.60 \times 5\,000 \times 10 = \text{USD } 330,000$
  - **maturity**..... # 11 months
  - **deposit**.....  $2,700 \times 10 = \text{USD } 27,000$
- The broker/bank opens a **margin account**
- The **CME Clearing** operates margins

## *Margin account running :*

Date	Settle Quote cents/bu	Daily result USD	Margin account balance USD	Margin call USD	Cumulative result USD
Nov. 7	660.00		27 000		
Nov. 8	662.00	+ 1 000	28 000		+ 1 000
Nov. 9	639.00	- 11 500	16 500	3 500	- 10 500
Nov. 11	636.00	- 1 500	18 500	1 500	- 12 000
Nov. 12	661.00	+ 12 500	32 500		+ 500

*Maintenance margin :  
USD 2,000 per contract*

*Futures contracts are  
daily marked to market*



## 2.4. The clearing house

### 2.4.1. Functions of the clearing house

- ➊ **Authorizing** members
- ➋ Being the **counterpart** of each transaction (registration)
- ➌ **Guaranteeing** full termination of operations
- ➍ Fixing the **deposit**
- ➎ Calculating and calling **margins**, every day
- ➏ Organizing **delivery and settlement**



**DTCC**

 CME Clearing Europe



**EuroCCP**

 **LCH.CLEARNET**

 **E** **urex clearing**

## 2.4.2. Rising demand for OTC clearing

- Increasing demand for clearing operations outside the Exchange traded universe : forwards, IRS, CDS...
- *Ex.* : **freight derivatives**
  - strong increase in the business of **shipping** goods to China
  - **shipping rate** volatility : hurricanes, oil prices...
  - **freight forwards** : OTC traded, cash-settled

- **OTC clearing facilities :**

- ✓ **clearing houses**

- ✓ **exchanges**

- ✓ **banks**

 LCH.CLEARNET

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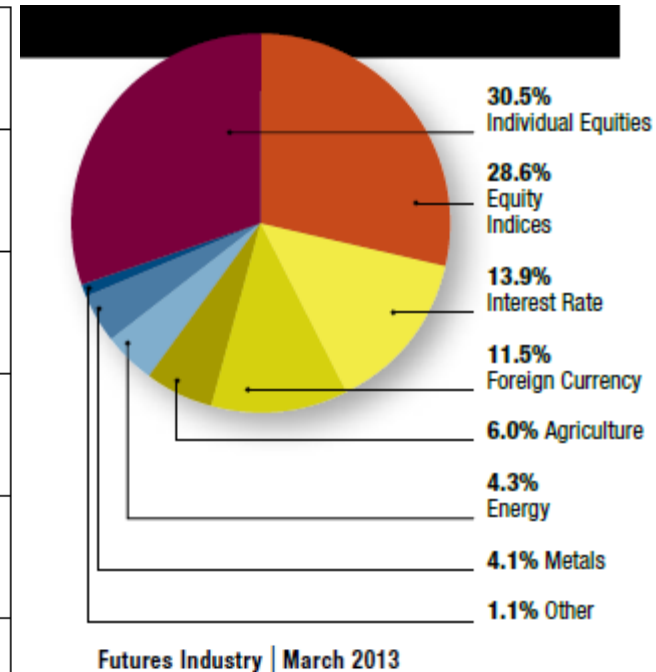
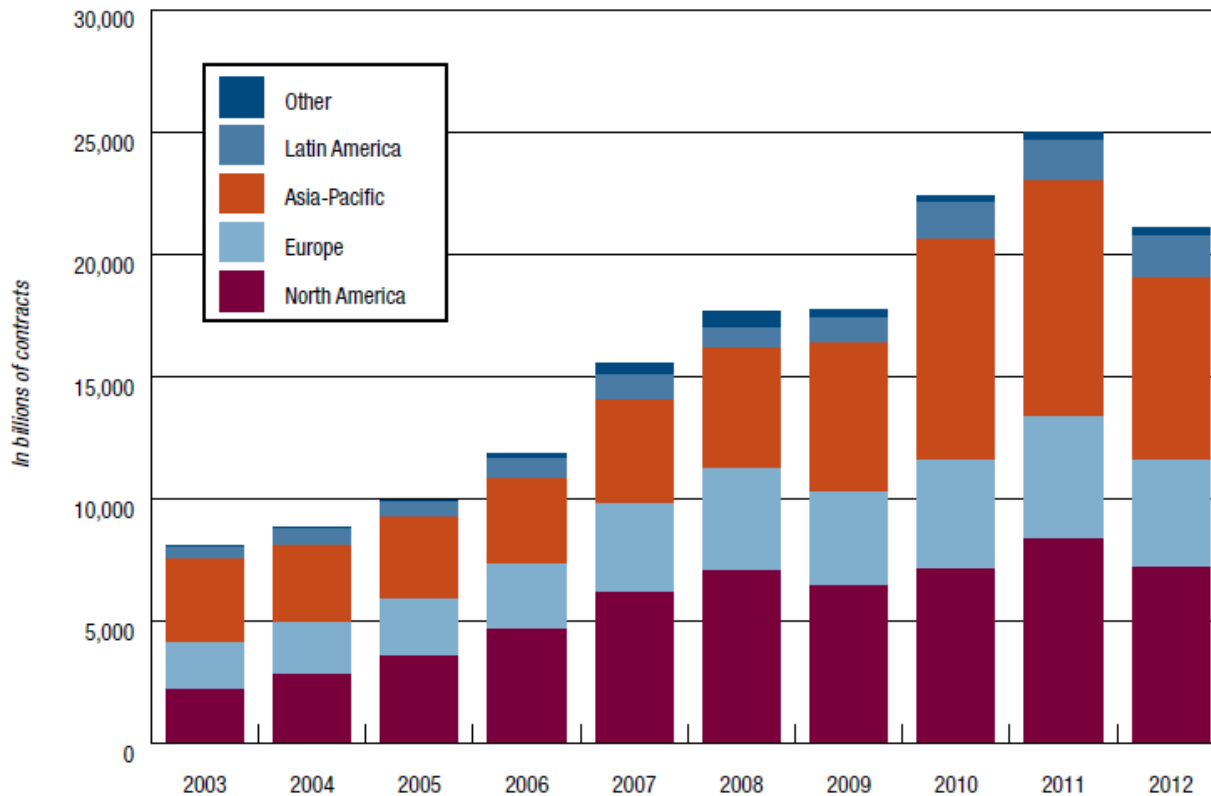
 NYSE  
EURONEXT

Bclear OTC Service



## 2.5. Market data from Futures Industry Assoc.

Based on the number of contracts traded and/or cleared at 84 exchanges worldwide



## Top 20 Agricultural Futures & Options Contracts

Rank	Contract	Contract Size	Jan-Dec 2011	Jan-Dec 2012	% Change
1	Soy Meal Futures, DCE	10 tonnes	50,170,334	325,876,653	549.5%
2	White Sugar Futures, ZCE	10 tonnes	128,193,356	148,290,190	15.7%
3	Rubber Futures, SHFE	5 tonnes	104,286,399	75,176,266	-27.9%
4	Corn Futures, CBOT	5,000 bushels	79,004,801	73,184,337	-7.4%
5	Soy Oil Futures, DCE	10 tonnes	58,012,550	68,858,554	18.7%
6	Soybean Futures, CBOT	5,000 bushels	45,143,755	52,041,615	15.3%
7	No. 1 Soybean Futures, DCE	10 tonnes	25,239,532	45,475,425	80.2%
8	Palm Oil Futures, DCE	10 tonnes	22,593,961	43,310,013	91.7%
9	Corn Futures, DCE	5,000 bushels	26,849,738	37,824,356	40.9%
10	Soybean Oil Futures, CBOT	60,000 pounds	24,156,509	27,627,590	14.4%
11	Wheat Futures, CBOT	5,000 bushels	24,283,331	27,379,403	12.7%
12	Sugar #11 Futures, ICE Futures U.S.	112,000 pounds	24,629,369	27,126,728	10.1%
13	Corn Options on Futures, CBOT	5,000 bushels	28,650,380	26,599,756	-7.2%
14	Strong Gluten Wheat Futures, ZCE	10 tonnes	7,909,755	25,796,425	226.1%
15	Cotton No. 1 Futures, ZCE	5 tonnes	139,044,152	21,033,646	-84.9%
16	Soybean Options on Futures, CBOT	5,000 bushels	13,236,367	18,402,208	39.0%
17	Soybean Meal Futures, CBOT	100 short tons	16,920,194	18,187,433	7.5%
18	Live Cattle Futures, CME	40,000 pounds	13,532,554	13,985,374	3.3%
19	Lean Hogs Futures, CME	40,000 pounds	9,969,961	11,461,892	15.0%
20	Refined Soya Oil Futures, NCDEX	10 tonnes	5,414,754	8,477,569	56.6%

Source : FIA Mag, March 2013.

## Top 20 Energy Futures & Options Contracts

Rank	Contract	Contract Size	Jan-Dec 2011	Jan-Dec 2012	% Change
1	Brent Crude Futures, ICE Futures Europe	1,000 barrels	132,045,563	147,385,858	11.6%
2	Light, Sweet Crude Oil Futures, Nymex	1,000 barrels	175,036,216	140,531,588	-19.7%
3	Henry Hub Natural Gas Futures, Nymex	10,000 MMBTU	76,864,334	94,799,542	23.3%
4	Gasoil Futures, ICE Futures Europe	100 tonnes	65,774,151	63,503,591	-3.5%
5	Crude Oil Futures, MCX	100 barrels	54,753,722	57,790,229	5.5%
6	NY Harbor RBOB Gasoline Futures, Nymex	42,000 gal	31,129,256	36,603,841	17.6%
7	No. 2 Heating Oil Futures, Nymex	42,000 gal	31,838,626	36,087,707	13.3%
8	WTI Crude Futures, ICE Futures Europe	1,000 barrels	51,097,818	33,142,089	-35.1%
9	Light Sweet Crude Oil Options, Nymex	1,000 barrels	36,716,805	32,525,624	-11.4%
10	Natural Gas Futures, MCX	1,250 MMBTU	9,882,133	27,886,670	182.2%
11	Natural Gas European-Style Options, Nymex	10,000 MMBTU	23,773,183	24,260,726	2.1%
12	U.S. Oil Fund ETF Options *	N/A	28,881,647	21,348,808	-26.1%
13	Henry Hub Natural Gas Swap Futures, Nymex	2,500 MMBTU	20,825,660	18,156,113	-12.8%
14	Brent Oil Futures, Micex-RTS	10 barrels	18,707,384	11,952,101	-36.1%
15	Brent Crude Oil Options, ICE Futures Europe	1,000 barrels	2,191,733	8,908,862	306.5%
16	Natural Gas Penultimate Swap Futures, Nymex	2,500 MMBTU	7,384,147	7,945,695	7.6%
17	EUA Futures, ICE Futures Europe	1,000 EUAs	5,444,050	6,465,262	18.8%
18	UK Nat. Gas (Monthly) Fut., ICE Futures Europe	1,000 therms/day	2,788,240	3,114,820	11.7%
19	UK Nat. Gas (Seasons) Fut., ICE Futures Europe	1,000 therms/day	2,604,150	3,096,300	18.9%
20	Crude Oil 1 Month Cal. Spread Options, Nymex	1,000 barrels	2,886,427	2,873,842	-0.4%

\* Traded on multiple U.S. options exchanges

Source : FIA Mag, March 2013.