Commodity Derivatives Markets

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1. The development of derivatives markets
2. The normal backwardation theory
3. The theory of storage
4. The term structure of commodity prices : Dynamic behavior and models
5. Applications of term structure models : Investment and dynamic hedging

The development of derivatives markets

1. Key dates on the history of derivatives markets

2. The relative importance of commodity derivatives markets today

3. The frontier between OTC and organized markets

Key dates

- 1850 – 1930
  Forward markets on agricultural products
- 1930 – 1970
  Futures markets on commodities
- 1970-1985
  Futures markets on financial assets
- 1985-2000
  The era of OTC markets
- 2000-2007
  Towards a new organization of derivative markets

1850-1930. Forward markets on commodity products

- Forward transactions on:
  - potatoes (Maine, US)
  - non ferrous metals (London Metal Exchange)
- Options (1rst generation)
- Non standardized contracts
- Consequences :
  - Delivery
  - Quality
  - Transfer contracts
  - Credit risk
  - …

From forward to futures

- Standardization of the contracts
  - Facilitates the transfer
  - Avoids the problems of liquidity and delivery

Standardization: Light, sweet crude oil

- **Trading Unit** : 1,000 U.S. barrels (42,000 gallons).
- **Price Quotation :** U.S. dollars and cents per barrel.
- **Trading Hours :**

  - Open outcry trading is conducted from 10:00 AM until 2:30 PM.

  - Electronic trading is conducted from 6:00 PM until 5:15 PM via the CME Globex® trading platform, Sunday through Friday. There is a 45-minute break each day between 5:15PM (current trade date) and 6:00 PM (next trade date).

- **Trading Months** :

  The current year and the next five years. A new calendar year will be added following the termination of trading in the December contract of the current year

- **Minimum Price Fluctuation**

  $0.01 (1¢) per barrel ($10.00 per contract).

- **Maximum Daily Price Fluctuation**

  $10.00 per barrel ($10,000 per contract) for all months. If any contract is traded, bid, or offered at the limit for five minutes, trading is halted for five minutes.

- **Delivery**

  F.O.B. seller's facility, Cushing, Oklahoma, at any pipeline or storage facility with pipeline access to TEPPCO, Cushing storage, or Equilon Pipeline Co., by in-tank transfer, in-line transfer, book-out, or inter-facility transfer (pumpover).

- **Deliverable Grades**

  Specific domestic crudes with 0.42% sulfur by weight or less, not less than 37° API gravity nor more than 42° API gravity.

  The following domestic crude streams are deliverable: West Texas Intermediate, Low Sweet Mix, New Mexican Sweet, North Texas Sweet, Oklahoma Sweet, South Texas Sweet.
  Specific foreign crudes of not less than 34° API nor more than 42° API.

  The following foreign streams are deliverable: U.K. Brent and Forties, for which the seller shall receive a 30 cent per barrel discount below the final settlement price; Norwegian Oseberg Blend is delivered at a 55¢–per–barrel discount; Nigerian Bonny Light, Qua Iboe, and Colombian Cusiana are delivered at 15¢ premiums.

- Inspection

  Inspection shall be conducted in accordance with pipeline practices. A buyer or seller may appoint an inspector to inspect the quality of oil delivered. However, the buyer or seller who requests the inspection will bear its costs and will notify the other party of the transaction that the inspection will occur.

From forward to futures

- Standardization of the contracts
  - Facilitates the transfer
  - Avoids the problems of liquidity and delivery
- Clearing house :
  - Management of credit risk (through deposit and margin calls)
  - Insures the liquidity of the market
- The market becomes a financial market :
  - Physical deliveries become exceptional

Heating Oil, Nymex

Physical delivery / number of futures contracts exchanged

Year	%
1979	6,86
1980	4,17
1981	1,92
1982	…
1983	…
1984	0,66
1985	0,53

1930-1970. Futures markets on commodity products

- Agricultural products
- Metals
- Animals

1960 : - Futures contracts on live cattle

- Creation of the premium system

Later….futures markets on

- Petroleum (1978 – 1985)
- Gaz
- Electricity

Options on futures contracts

1970-1985. Futures markets on financial assets

- 1973 : End of the convertibility of the US dollar
- Risk management techniques developed for commodities are employed for financial assets
- Innovations :

  Futures on indexes :

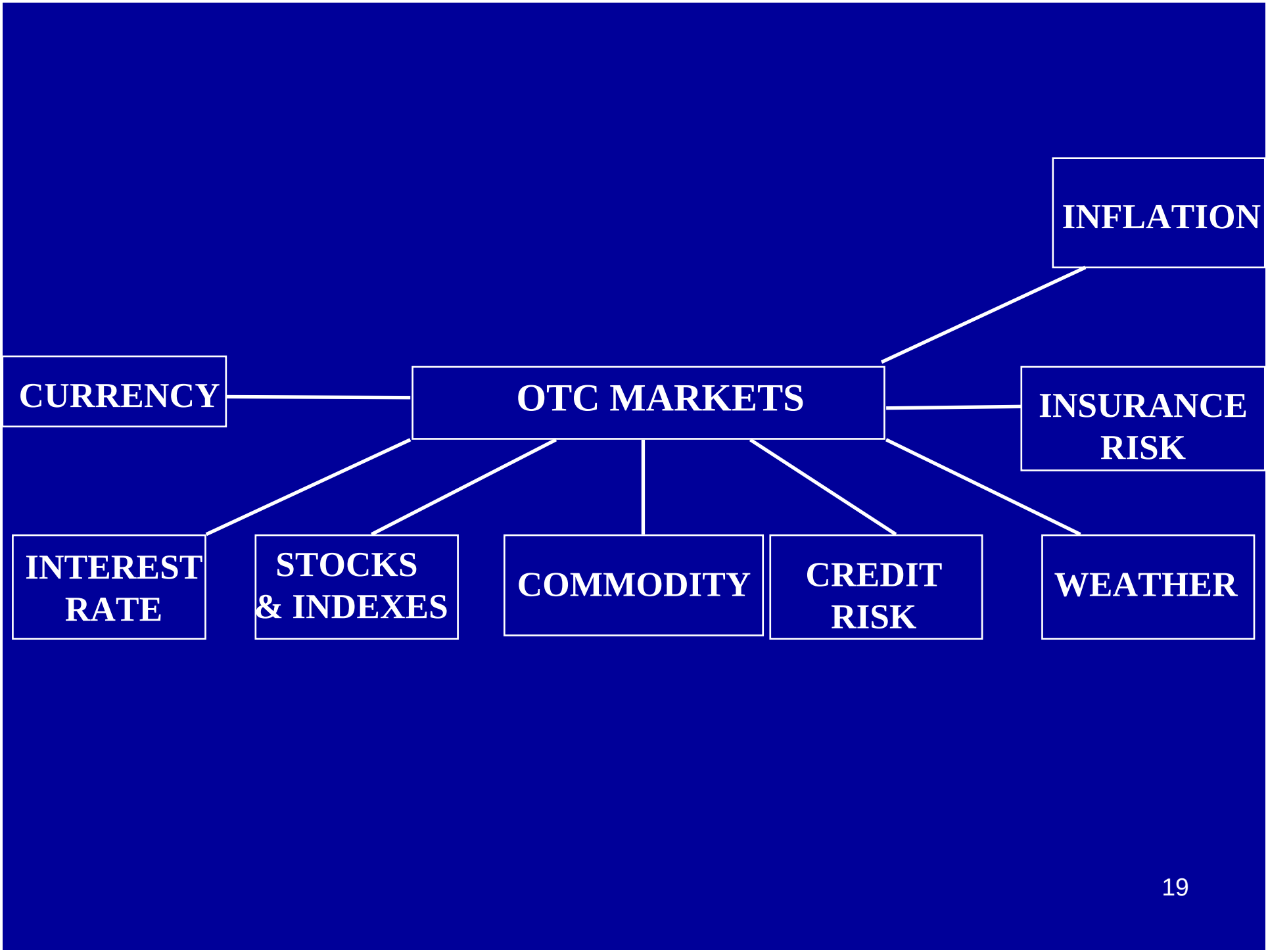
  - Non traded assets
  - Cash settlement

- Currencies (1972, CME)
- Interest rates (1975, CBOT and 1981, CME)
- Stocks indexes (1982, CME)
- …..
- Stocks (2001, Liffe)

1985-2000. The era of OTC markets

- Forward
- Forward forward
- Forward rate agreement
- Swap

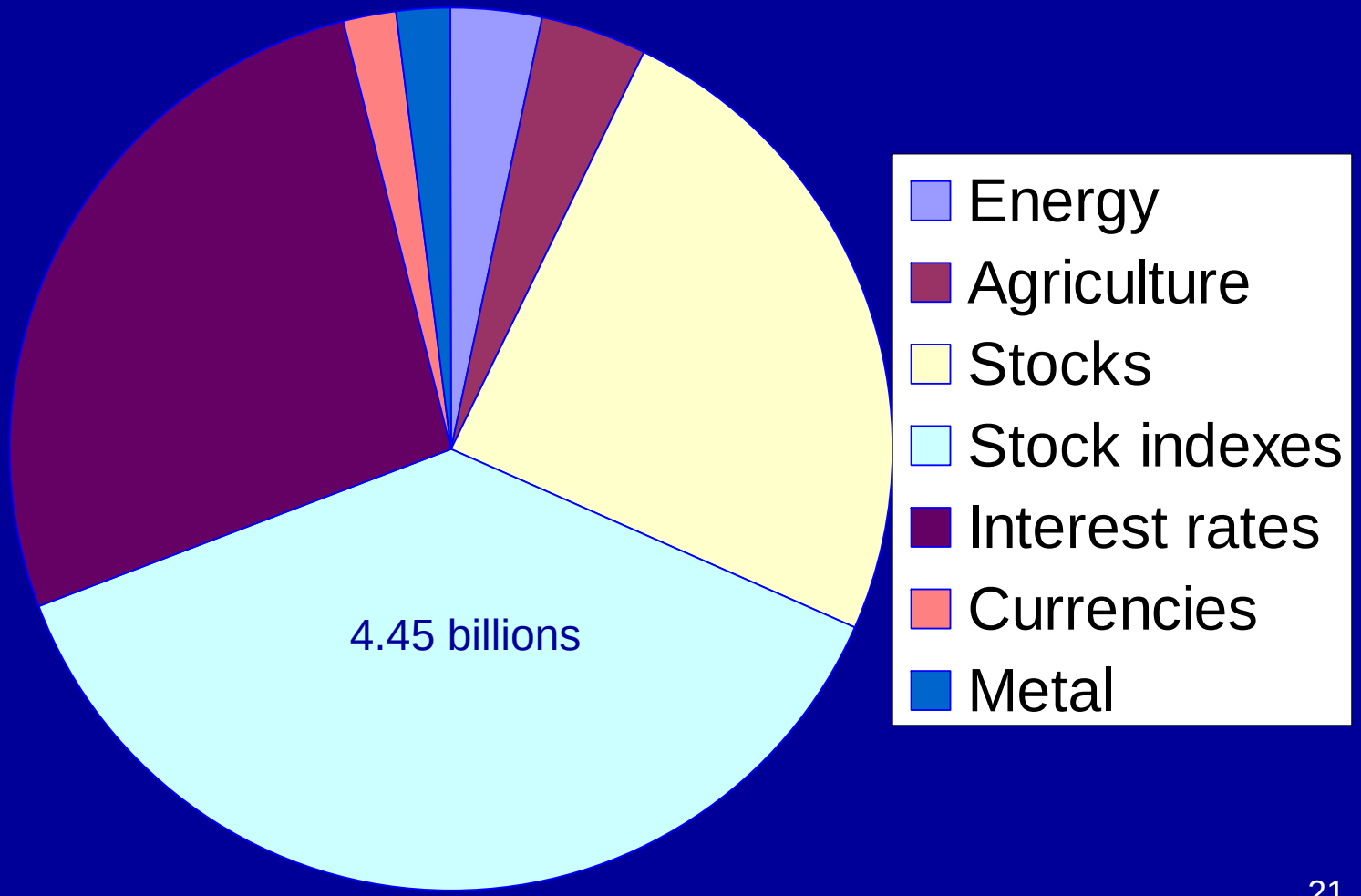
- Options
- Warrants
- Cap
- Floor
- Collar
- Swaption
- Options (2nd generation)


INFLATION
CURRENCY
OTC MARKETS
INSURANCE RISK
INTEREST RATE
STOCKS & INDEXES
COMMODITY
CREDIT RISK
WEATHER

The relative importance of commodity derivatives today

- Futures markets
- OTC markets

Number of contracts traded on futures markets in 2006



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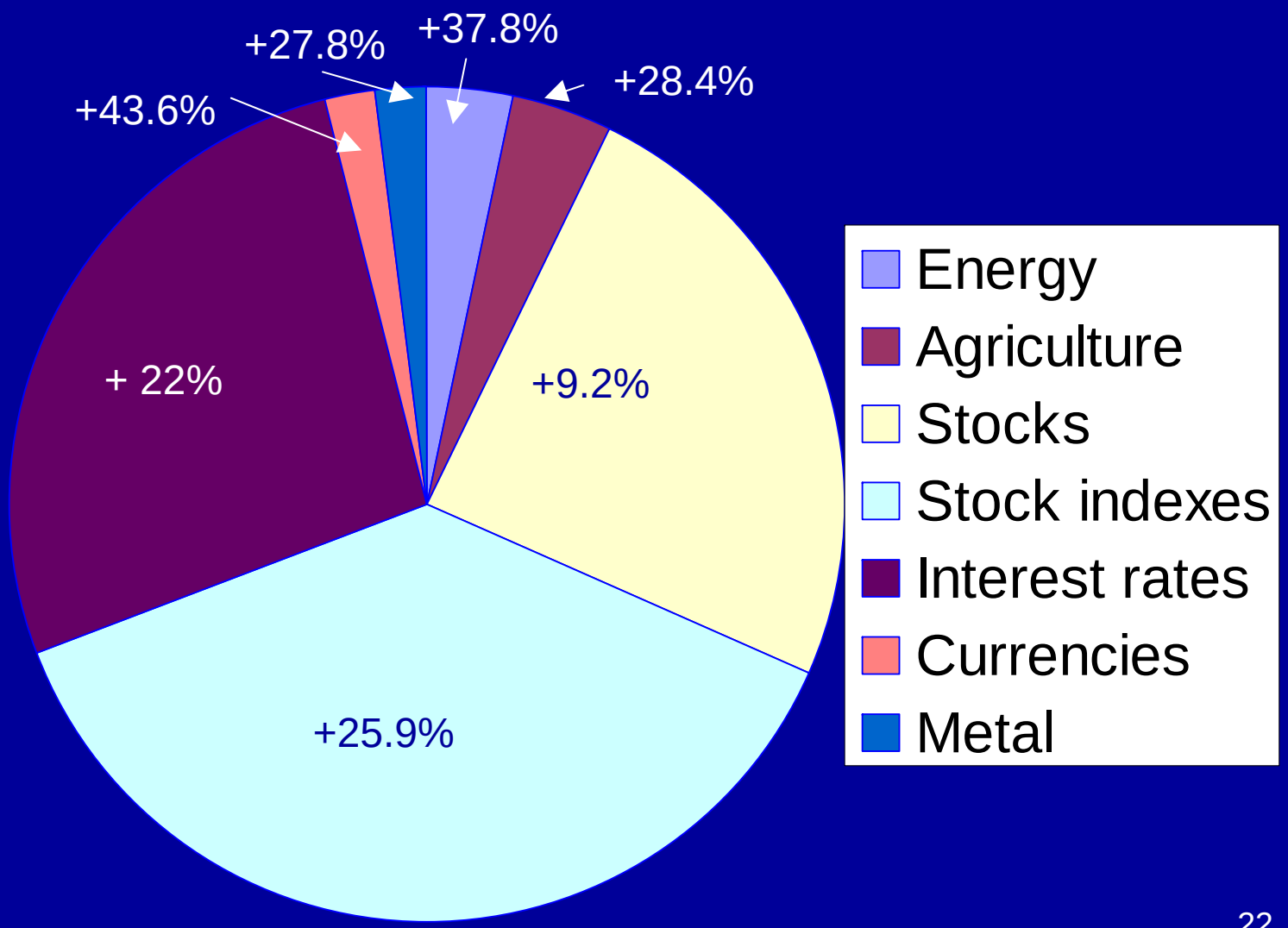
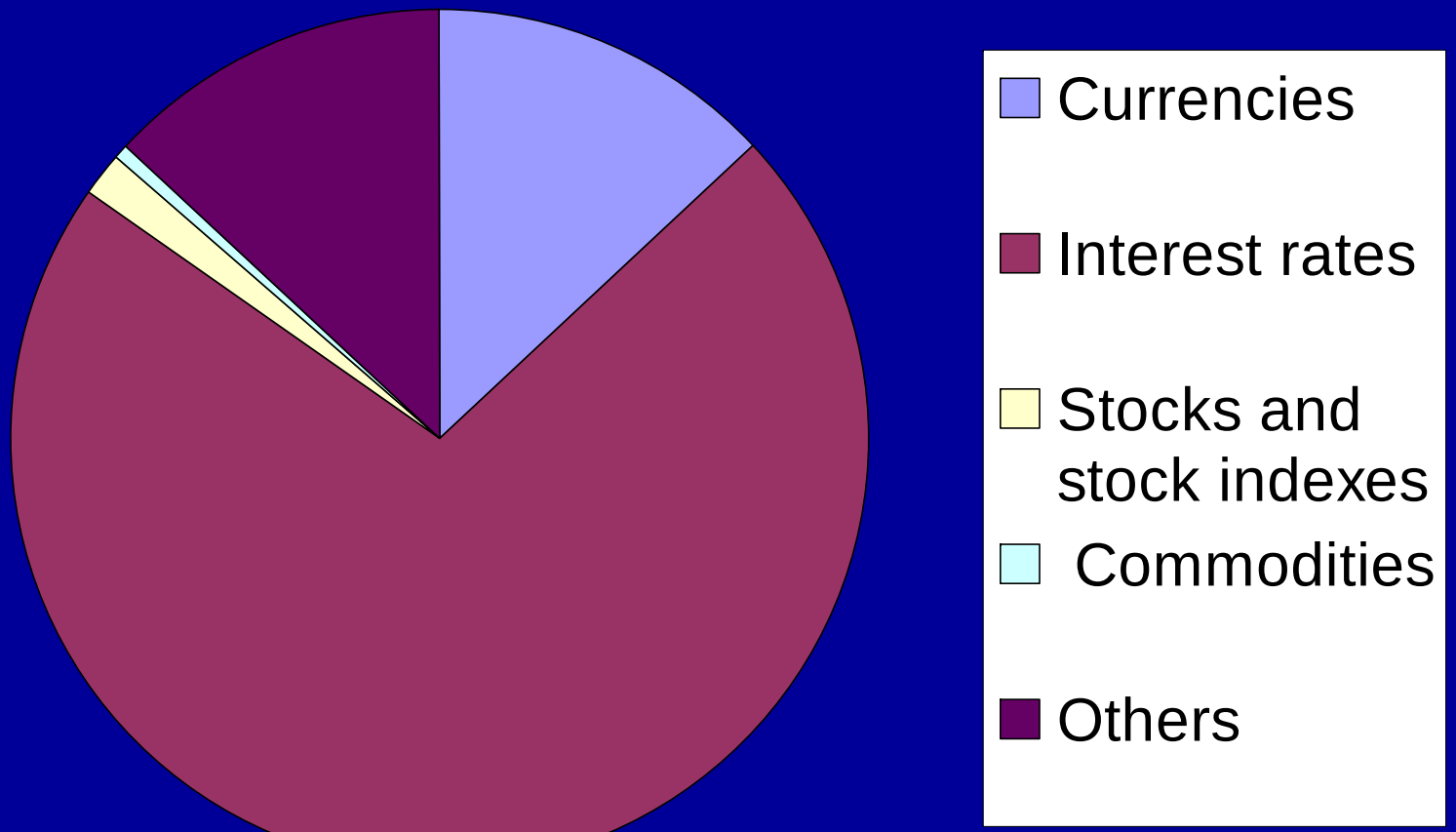


OTC markets, 2002



Top 20 Commodity Contracts

(In millions)

Rank	Contract	2006	2005	% Change
1	WTI Crude Oil Futures, Nymex	71.05	59.65	19.12%
2	Corn Futures, DCE	64.98	21.86	197.24%
3	Corn Futures, CBOT	47.24	27.97	68.92%
4	Brent Crude Oil Futures, ICE Futures	44.35	30.41	45.82%
5	High Grade Primary Aluminum, LME	36.42	30.43	19.69%
6	Soy Meal Futures, DCE	31.55	36.74	-14.12%
7	White Sugar Futures, ZCE	29.34	**	N/A
8	WTI Crude Oil Futures, ICE Futures	28.67	**	N/A
9	Rubber Futures, SHFE	26.05	9.50	174.09%
10	Henry Hub Swap Futures, Nymex *	24.16	10.41	132.14%
11	Natural Gas Futures, Nymex	23.03	19.14	20.31%
12	Soybean Futures, CBOT	22.65	20.22	12.03%
13	Gold Futures, Tocom	22.23	17.96	23.78%
14	WTI Crude Oil Options, Nymex	21.02	14.73	42.71%
15	Natural Gas Options, Nymex *	19.52	6.97	180.06%
16	Copper Futures, LME	18.87	19.23	-1.91%
17	Gas Oil Futures, ICE Futures	18.29	10.97	66.70%
18	Wheat Futures, CBOT	16.22	10.11	60.42%
19	Gold Futures, Nymex Comex Division	15.92	15.89	0.17%
20	Sugar #11 Futures, Nybot	15.10	13.01	16.10%

** cleared-only transactions* *** introduced in 2006*

Source: FIA

Volatility Comparison

Market	Annualized volatility 2005	Annualized volatility 2006	Annualized volatility (bp) 2005	Annualized volatility (bp) 2006
Interest Rates (money market)				
Eurodollar	14.4%	10.3%	57.3	54.5
Euribor	13.6%	10.7%	31.7	35.8
Euroyen	53.0%	56.6%	6.5	28.8
Interest Rates (government bonds)				
10-year Treasury notes	4.5%	3.8%		
Bunds	3.8%	3.8%		
JGBs	2.9%	3.6%		
Equity				
S&P 500	10.0%	9.7%		
Euro Stoxx 50	11.0%	14.4%		
Topix	13.7%	18.9%		
Foreign Currencies				
British pound	8.2%	7.6%		
Euro	8.8%	7.2%		
Japanese yen	8.5%	8.0%		
Commodities				
Crude oil	31.6%	26.4%		
Natural gas	48.6%	62.2%		
Wheat	24.6%	29.5%		
Corn	24.2%	28.3%		
Copper	24.0%	38.5%		
Aluminum	19.7%	32.2%		

Source: Calyon Financial

Forward and futures markets are not competing markets

- Futures markets :
  - For professionals
    (cover residual risks)
- OTC markets :
  - For industrials

	FUTURES TRANSACTIONS	***FORWARD TRANSACTIONS***
STANDARDIZATION	EXTREME	NON-EXISTANT
DELIVERY	PHYSICAL DELIVERY IS EXCEPTIONAL	PHYSICAL DELIVERY IS NORMAL
LIQUIDITY	HIGH	ALMOST NULL
INVESTMENT	DEPOSIT MARGIN CALLS	NO INVESTMENT
HEDGING	IMPERFECT COSTLESS REVERSIBLE	PERFECT COSTLY NON-REVERSIBLE

2000-2007. Towards a new organization of derivative markets

- ICE : Inter Continental Exchange
- 2001 :
  - ICE buys the International Petroleum Exchange
  - ICE develops electronic brokerage on the OTC market
- Electronic confirmation of transactions
- Through LCH-Clearnet, ICE offers the compensation of OTC products
- Introduction of American futures contracts on Ice (WTI, options on WTI, gold, etc)

- CBOT and Liffe

  Interest rate swaps

  Swaps on interest rate differentials

  ….

- Today, four categories of derivatives instruments :
  - Pure OTC
  - OTC with electronic quotation (and confirmation)
  - Cleared OTC products
  - Standardized futures contracts

The development of commodity markets : Consequences for futures researches (1)

- There is a long tradition of derivatives markets on commodities :

  Literature is rich, interesting, and starts in 1930 with Keynes, Kaldor, Brennan, …
- Today, commodity markets occupy a modest place in the world of derivatives instruments
- There are a lot of new data on commodity markets, on OTC products

  (be careful of historic period and of the quality of data)

Consequences for futures researches (2)

- Quite often, innovations on commodity derivatives markets come from financial markets… without taking into account some specificities of commodity markets
- Financial point of view
- There is room for people :

  - taking into account economical and / or technical constraints

  - having skills for the exploitation of low quality data