ICE (LS) Gasoil Markets Forum

Oil futures forward curves: economics explained

www.pjk-international.com
www.enfx.net
Oil futures forward curves

• ir. Patrick Kulsen, MSc. B.
  Mail: patrick.kulsen@pjk-international.com
  Tel: +31-(0)76-7676 325

• Managing Director @ PJK International B.V.

• PJK International:

  ‘Market research company specialized in NWE oil markets’
  – ARA / Rhine barge freight rates
  – ARA oil product stocks
  – Market analysis reports
  – Consultancy & Quant research
  – Freight Control App
Contents

1. Forward curves in focus
2. Economics of forward curves
3. Relevance of ARA gasoil stocks for ICE gasoil forward curve
4. ICE gasoil & Brent forward curves: analysis of recent developments
Forward curves in focus (1)

Oil futures forward curves??

Futures prices on Nov. 11th 2012 at 14:14 CET:
What do we know about forward curves....

.... and why is this important?

- Relevance for various market players
- Stylized facts of oil forward curves
Relevance for various market players:

1. Physical traders:
   - Physical differentials (Gasoil 0.1% barges fob ARA)
   - Basis risk of hedge using derivatives (futures / swaps)
   - Inventory management: max. inventory or JIT
   - Availability of product / storage capacity

2. Tank storage companies:
   - Demand for tank capacity is linked to shape
     - Contango: much demand
     - Backwardation: little demand

3. Futures traders:
   - Speculative spread trading
Stylized facts of oil forward curves:

Most important:

1. Shape of curve:
   - Upwards sloping (contango) or
   - Downwards sloping (backwardation)

2. Shape is persistent and fairly independent of daily swings in futures prices

3. Crude and oil products forward curves are linked
Stylized facts of oil forward curves:
1. Slope of curve: contango / backwardation
Stylized facts of oil forward curves:

2. Shape is persistent and fairly independent of daily swings in oil prices
   → look at **time spreads** to see dynamics
   → Time spread = price differential between two consecutive futures contracts

Feb. – Mar. 2013
Forward curves in focus (7)

Dynamics of time spreads:

Shape is persistent:

Long period of:
- Contango (1)
- Backwardation (2)
Stylized facts of oil forward curves:
3. Crude and oil products forward curves are linked:
What fundamentals drive crude oil forward curves?

Distinguish between front-end and back-end of forward curve

1. **Back-end of curve**
2. **Front-end of curve**

*Both ends are connected by arbitrage mechanisms*
What fundamentals drive crude oil forward curves?

1. **Back-end of curve** → **long term fundamentals**

Supply side of crude market

→ **Price** to justify investments/divestments in exploration and development of oil wells

Demand side of crude market

→ **Price** to justify investment/divestment programs for
  - developing alternative fuels
  - increasing fuel efficiency
  - Etc..

**Price** = expected marginal ‘exploration, development and production’ costs to balance market in the “long run”
What fundamentals drive crude oil forward curves?

2. **Front-end of curve** → **short term fundamentals**
   - Current and expected supply and demand
   - Current and expected inventory levels

   If **supply > demand**: price drops to stimulate players to increase inventories to balance market

   If **demand > supply**: price rises to stimulate players to free up inventories and/or lower or postpone consumption to an extent that the market is balanced
Arbitrage mechanisms connect front and back end of curve

**Storage arbitrage play**
- Prevents time spreads from becoming too large
- Links futures prices along the curve
Storage arbitrage play?

If contango and
\[-(\text{time spread}) > \text{marginal storage cost}:\]

→ Long 1\textsuperscript{st} month, short 2\textsuperscript{nd} month
→ Hold both futures contracts till expiry
→ After expiry 1\textsuperscript{st} month: collect and store product
→ After expiry 2\textsuperscript{nd} month: deliver product

Profit = -(time spread) – storage costs

Storage costs:
• Transportation costs (transport product to tank terminal)
• Tank Terminal lease fee (opportunity costs: only if ‘spot’ market for storage capacity)
• Finance costs
Storage arbitrage play?

If backwardation and

time spread > shipping costs - interest

Subject to:
inventory level > min. level + replenishment lot:

→ Short 1\textsuperscript{st} month, long 2\textsuperscript{nd} month
→ Hold futures contracts till expiry
→ After expiry 1\textsuperscript{st} contract: deliver product from storage tank
→ After expiry 2\textsuperscript{nd} contract: collect product \rightarrow stock is replenished

Profit = time spread – shipping costs + interest

Shipping costs:
• Freight rate
• Insurance
Link crude oil & oil products forward curves?

- Crude oil is feedstock for refineries to produce oil products
- Most important input cost!

Difference between oil product price and crude price:

“Crack spread”

- Proportional to refiner’s gross profit margin
Economics of forward curves (8)

**ICE Gasoil – ICE Brent crack spreads**

Forward curves Gasoil, Brent crude

6th of Nov. 2012
Crack spread forward curve:

- **Back-end**: gross profit margin to justify investments/divestments in refining assets
- **Front-end**: short term fluctuations in supply/demand + inventory levels
- **Storage arbitrage** play limits spreads
- Refiner’s **production capacity** is limiting factor in arbitrage play

**Gasoil - Brent crack spread**

*Inventory levels are critical!*
ICE gasoil futures are traded all over the world….

…so why should ARA stocks be important?

Several reasons:
1. NWE main importer of middle distillates
2. ARA main trading hub in NWE
3. ARA physical delivery point of ICE gasoil contract
Relevance of ARA oil product stocks (2)

**NWE main importer of middle distillates**

S/D 'NWE' (broad definition)

*Source: Eurostat (NWE incl. Iberian peninsula + Scandinavia)*
ARA and hinterland

Source: Eurostat
Relevance of ARA oil product stocks (4)

**Import to ARA:**

![Import to ARA Chart]

*Source: Eurostat*
Balance global supply / demand, Crude

Level [Mb]

Date

-50
-45
-40
-35
-30
-25
-20
-15
-10
-5
0
5
10
15
20
25
30
35
40
45


Implied stock change (RH)
cumm. Stock change (LH)
Brent forward curve: time spread analysis (3)
Gasoil forward curve: time spreads vs. stocks

ICE gasoil Time spreads

ARA gasoil stocks

US EIA MD stocks PADD 1 & 3
ARA stocks vs. US stocks (PADD 3)
Gasoil forward curve: time spread analysis

- ICE Gas Oil calendar spreads
- Markets anticipate drop in stocks
- Period of backwardation
- Turning point, markets anticipate rise in stocks
- Period of large contango
- Switch from contango to backwardation
- Contango
- Backwardation

- PJM ARA Gas Oil Stock Levels
- Stable period
- Drop in stocks
- Short term dip in stocks
- Rise in stocks
- Drop in stocks

- EIA middle distillate stocks PADD 1 & PADD 3
- PADD 1
- PADD 3

- Price (USD T)
- Q1 2006 to Q4 2013
- Q2, Q3, Q4
Visit PJK website

For outlook on oil forward curves see:
www.pjk-international.com/scenarios

For more theory on forward curves see:
www.pjk-international.com/downloads
?? – Questions - ??
Outlook for forward curves

Crude oil market: main themes

Downside risks:
- Global economic slowdown
- Demand destruction due to high oil prices
- Political risks: Eurozone crisis & Fiscal Cliff
- Further surge in US tight oil production

Upside risks:
- Unrest Middle-East
- Militant clashes in Libya
- North-Sea production outages
Relevance of ARA oil product stocks (3)

Individual countries: Germany

Germany, gasoil/diesel

Source: Eurostat
Individual countries: France

France, gasoil/diesel

Source: Eurostat
Relevance of ARA oil product stocks (5)

**Individual countries: UK**

**UK, gasoil/diesel**

- **impl. import demand**
- **demand**
- **production**
- **import-export**

*Source: Eurostat*
ARA ideal location for trading in NWE
ARA: key benefits

• **Ideal topographical position in NWE:**
  – North Sea oil fields
  – Large consumer markets in Benelux, Germany, France, Switzerland and UK
  – Highly industrialized area and hinterland
  – Good logistics: sea ports, Rhine & canals

• **Large oil infrastructure:** refineries + tank terminals

• **Global trading hub**, links to: Med, USA, Caribbean, South-America, West Africa, the Mid East and the Far-East

• **Liquid physical** oil products market and oil derivatives market

• ICE Europe **futures** exchange and OTC **swap** markets for hedging physical positions

• **Brent crude**, a worldwide oil pricing benchmark
EIA stocks: PADD 1 and 3