



INSIGHTS GLOBAL

# Oil futures versus physical markets

*How are they related?*

*Part 2: The effect of forward curves*





Oil futures versus physical markets: how are they related?

Part 2: The effect of forward curves

Copyrights © 2012 PJK International B.V.

Pieter J. Kulsen  
Patrick D. Kulsen

## Oil futures versus physical markets: how are they related?

### *Part 2: The effect of forward curves*



### Contents of e-paper:

#### Table of contents

1	Introduction .....	3
2	The influence of forward curves .....	3
2.1	Calendar spreads .....	3
2.2	Forward curve .....	4
2.3	Linkage to physical markets.....	5
3	The Big picture .....	6
4	More information .....	6

Oil futures versus physical markets: how are they related?

Part 2: The effect of forward curves

Copyrights © 2012 PJK International B.V.

Pieter J. Kulsen  
Patrick D. Kulsen

## 1 Introduction

*Everybody who is active in the oil industry knows that financial futures markets are linked to physical oil markets and that they determine to some extent the behavior of players in that market. But what is the logic behind these links, how do they exactly influence markets and most importantly, how can one anticipate on changes in market fundamentals? This is the mystery that we will try to unravel in this e-paper.*

The explanation of this vast subject has been cut into three e-papers. One will cover the linkage between spot and futures prices, one will cover the effect of the forward curve on physical markets and the last e-paper will cover the effect of crack spreads on market players.

This e-paper focuses on the effect of forward curves. We will start our investigation by determining what links are present and how this drives fundamentals. We will look at some examples which highlight the interplay between futures and physical markets. Based on this analysis we will discuss what a trader should monitor in order to get a broad view of the market structure and what is needed to be successful.

## 2 The influence of forward curves

An important feature of futures markets is that it is possible to trade contracts for oil with delivery dates ranging from one month till five years into the future. For instance ICE gas oil futures contracts can be traded for delivery in subsequent months till four years into the future. Each futures contract has a separate price process. The difference in price between two futures contracts with different delivery months is called a **calendar spread** or **time spread**. When prices of subsequent futures contracts are charted a so-called **forward curve** is created.

Features of calendar spreads and forward curves are discussed first. Afterwards the link between forward curves and calendar spreads on the one hand and physical markets on the other hand are highlighted.

### 2.1 Calendar spreads

The difference in price between two subsequent futures contracts is called a calendar spread. Charting this spread in time reveals the dynamics associated with forward curves. Also the size of the calendar spread is important as we will see later on.

Figure 1 shows a day-chart of various calendar spreads between ICE gas oil futures contracts (bottom chart). In the same chart also the ICE gas oil first month futures price and open interest are displayed (top chart). Especially the open interest chart is relevant because it signals when the front month futures contract expires. This event gives a strange spike in the calendar spread chart because on that day the calendar spreads are actually calculated using the expiry settlement price. Due to the special circumstance surrounding the expiry it is best to disregard the calendar spread on this day.



Oil futures versus physical markets: how are they related?

Part 2: The effect of forward curves

Copyrights © 2012 PJK International B.V.

Pieter J. Kulsen  
Patrick D. Kulsen

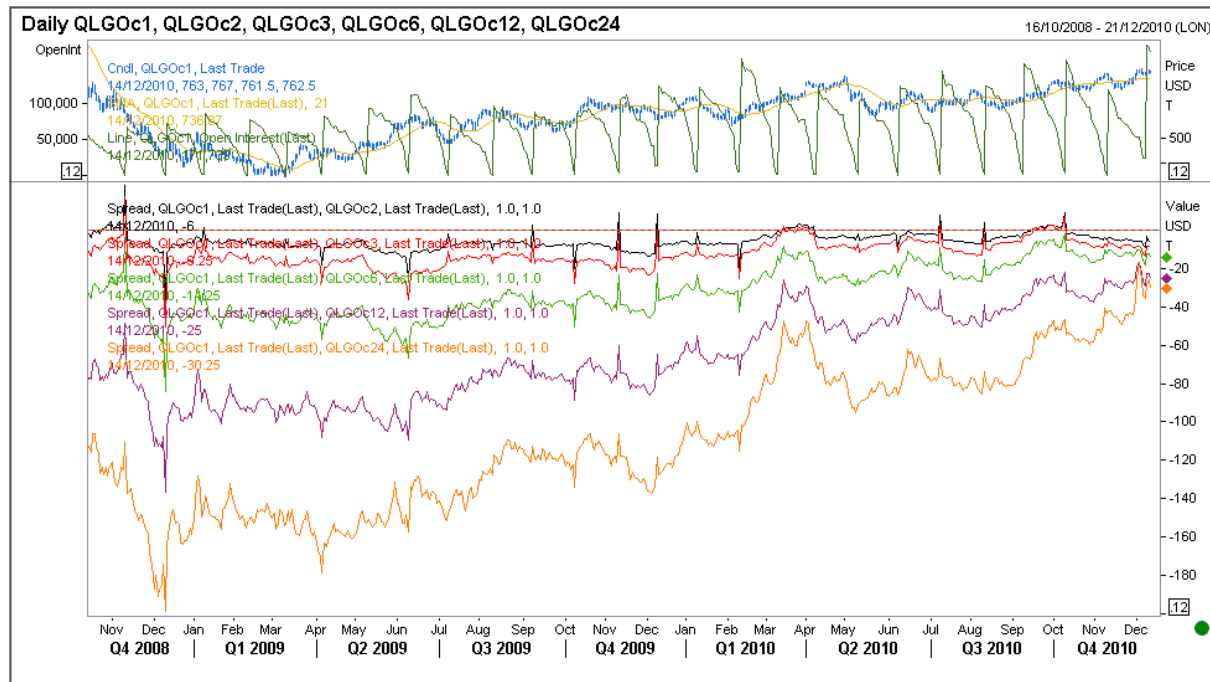


Figure 1: Top chart → ICE first month futures gas oil prices (blue bars) and open interest (dark green line)  
Bottom chart → ICE gas oil calendar spreads, differences in price between first month and various subsequent months:  
black line: 1<sup>st</sup> and 2<sup>nd</sup> / red line: 1<sup>st</sup> and 3<sup>rd</sup> / green line: 1<sup>st</sup> and 6<sup>th</sup> / purple line: 1<sup>st</sup> and 12<sup>th</sup> / light brown line: 1<sup>st</sup> and 24<sup>th</sup>

During the displayed period of figure 1 (from November 2008 till December 2010) almost all the time the market was in contango. Calendar spreads were negative in this case. As can be seen the size of the spreads varies greatly during this period. During the height of the credit crisis in December 2008 calendar spreads peaked and afterwards spreads narrowed further and further.

## 2.2 Forward curve

A chart of prices of subsequent futures contracts at a certain moment is called a forward curve. A forward curve displays a situation at a specific moment in time and from this picture the dynamics are not clearly visible such as with calendar spreads. Nevertheless the information derived from a forward curve is very useful. The shape of the forward curve is important for physical markets.

Generally speaking forward curves can have an upward or downward slope. An upward sloping forward curve means that oil prices are expected to rise in the future and this constellation is called a **contango**. The opposite, a downward sloping forward curve, is called a **backwardation**. Figure 2 displays a forward curve of ICE gas oil futures dated at the 7<sup>th</sup> of December 2010.



Oil futures versus physical markets: how are they related?

Part 2: The effect of forward curves

Copyrights © 2012 PJK International B.V.

Pieter J. Kulsen

Patrick D. Kulsen

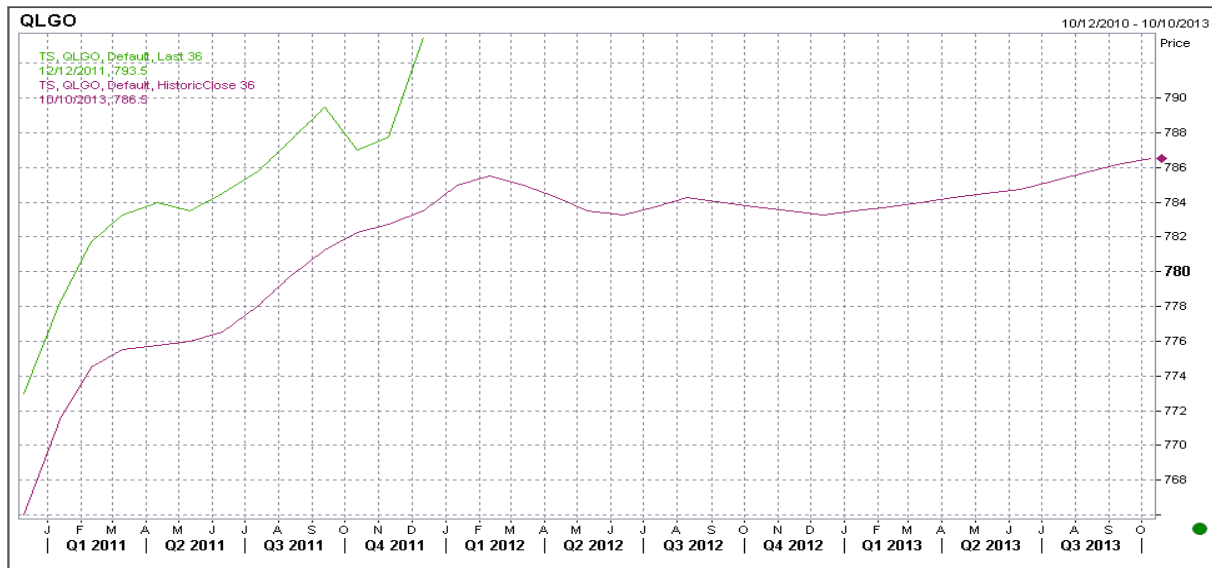


Figure 2: ICE gas oil forward curve @ 7<sup>th</sup> of December 7, 2010 / 13:45hrs.

In general according to figure 1 the market is in contango because prices are higher for contracts with expiration dates further in the future. However the forward curve is not entirely smooth. There is a wavy pattern visible due to seasonal influences. For instance in the period between February 2012 and June 2012 a backwardation is applicable. In this period less demand is expected for gas oil due to milder temperatures and this translated into lower prices.

### 2.3 Linkage to physical markets

The main link between forward curves and physical markets is through inventory management. Both the shape of the forward curve and size of calendar spreads influence inventory management in oil markets to a great extent. As we will explain either market players are stimulated to hold high or low oil stocks.

#### High oil stocks: contango

If the market is in contango and if calendar spreads are large enough then arbitrage is possible by going long and at the same time going short in two futures contracts. The long position expires sooner than the short position. After the long position expires the received oil is stored till the short position expires and is then delivered to the counterparty of the short position. The calendar spread between the long and short contract minus storage, financing and operational costs is the profit margin of this arbitrage opportunity. The shape of the forward curve and calendar spreads are quite persistent and this means that these arbitrage opportunities tend to stay open for a long period. When it occurs many traders take advantage of this opportunity and store oil products. This will result in increasing oil inventories and eventually in very limited access to storage capacity. For example after the financial crisis in 2008 oil prices dropped and a contango formed in ICE gas oil forward curve. Soon almost all tanks were filled with middle distillates. Traders began to use empty tankers as floating storage tanks. Tanker freight rates were low because of the economic crisis and calendar spreads enabled arbitrage even when storing product in tankers which is quite exceptional.

Oil futures versus physical markets: how are they related?

Part 2: The effect of forward curves

Copyrights © 2012 PJK International B.V.

Pieter J. Kulsen  
Patrick D. Kulsen

### Low oil stocks: backwardation

A backwardation also influences inventory management. Because prices are expected to drop in the future it is uneconomic to store oil products. The depreciation of the value of the stored oil products results in financial losses. The financial loss equals the calendar spread plus inventory, financing and operational costs. Traders tend to apply "Just in Time" (JIT) inventory management in case of a backwardation and minimize financial losses by keeping inventory levels as low as possible. Logistic performance declines as a general consequence of such low inventory levels. In a situation of backwardation small disruptions in the supply chain can cause large delivery delays and can cost much money.

### **3 The Big picture**

Now that we know what links exist between futures and physical markets it is a good idea to summarize the insights so far. We have learned that the shape of the forward curve and the size of calendar spreads influence inventory management. Either players are stimulated to have high (contango) or low (backwardation) inventory levels.

Oil traders therefore need to monitor forward curves because it gives a picture of market fundamentals. For Northwest Europe the ICE gas oil forward curve and related calendar spreads are the most important.

The key to success in oil markets is not only to monitor these indicators but to anticipate on changes and make plans for possible scenarios that can emerge. You can profit from resulting dynamics and beat the market before it beats you. The window of opportunity is short so: **Be prepared to take action!**

### **4 More information**

Specifically for oil traders PJK has developed **market analysis reports** for the Northwest European oil products markets. We monitor and report on the highlighted indicators and the reports support scenario planning. Furthermore our advanced knowledge of market mechanisms complemented with our econometric experience can be utilized to your advantage by providing a platform to see how different scenarios influence oil markets. With this information **scenario planning** is improved drastically. Finally companies can profit from market dynamics instead of being a victim of it.

If you want to learn more about these subjects or wish to be supported with your daily oil market analysis or with market research then you can always contact PJK International. PJK has more than thirty years of experience in this field and has helped many companies with its knowledge. Contact details can be found in the header of this document.

PJK International B.V.



Oil futures versus physical markets: how are they related?

Part 2: The effect of forward curves

[Copyrights © 2012 PJK International B.V.](#)

Pieter J. Kulsen  
Patrick D. Kulsen

---

Disclaimer:

*This document is the property of PJK International B.V.. Copyrights belong to PJK International B.V.. You are not permitted to make the document public or either parts of it, to save or to copy without permission of PJK International B.V.. This document has been made with care by PJK International B.V., however PJK International B.V. is not responsible for any errors in it.*

*All information in this document has been collected with care by PJK International B.V.. The information in this document can be updated or edited. PJK International B.V. has the right to change the contents without any prior notice.*

*PJK International B.V. is not liable for direct or indirect damage linked to the publication or use of this document.*