

## **Asia Oil Price Analysis 4: Marker Crude Values Based on Oil Product Market and Assessment of Price Differentials of Marker Crude**

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### **Highlighting Points**

- The refining margins when processing marker crude oils for European/U.S. markets had remained competitive, moving in narrow plus or minus ranges, till the end of the 1990s. Although they have fallen into disorder in recent years, it can be said that the linkage between the crude oil market and the oil product market in Europe and the U.S. have been fairly good.
- The refining margin when processing the marker crude for the Asian market had remained plus on a large scale until the first half of 1997, but turned minus thereafter, greatly departing from changes in crude oil and product markets in Europe and the U.S.
- In the case of Europe and U.S. markets, marker crude price indicators are linked with spot prices and netback values. In the case of the Asian market, however, the linkage of Dubai crude is weak and the process in which it is priced is unreliable.
- It is necessary to have a new marker crude for the Asian market in place of Dubai crude, which has lost the market's confidence due to a decline in its production. It is also necessary to establish a linkage between the oil product market and the marker crude price so that the latter is supported by the former through the streamlining and expansion of the former.
- Considering that the sharp increase in oil prices in 2000 primarily in the U.S. was triggered by a weakened supply cushions (spare capacities) and so on, it is essential to establish a global link binding the three major oil-consuming markets of the U.S., Europe and Asia.

## **Introduction**

In and after the second half of 1987, major oil-producing countries adopted the formula method, under which a marker crude was selected for each market of the U.S., Europe and Asia to determine the selling prices of their respective crude oil, in reference to the market price of the marker crude. This crude oil pricing method which is linked with the market price has overcome the Gulf crisis and remained effective to date for more than 15 years. This means that the establishment of crude oil prices on a global basis as the basic indices for energy supply and demand activities has depended largely on the price formation of marker crude oils. How have these marker crude prices been affected by oil product prices in each oil-consuming area? This report presents a study of marker crude values based on oil product prices in the U.S. Gulf, Rotterdam and Singapore markets.

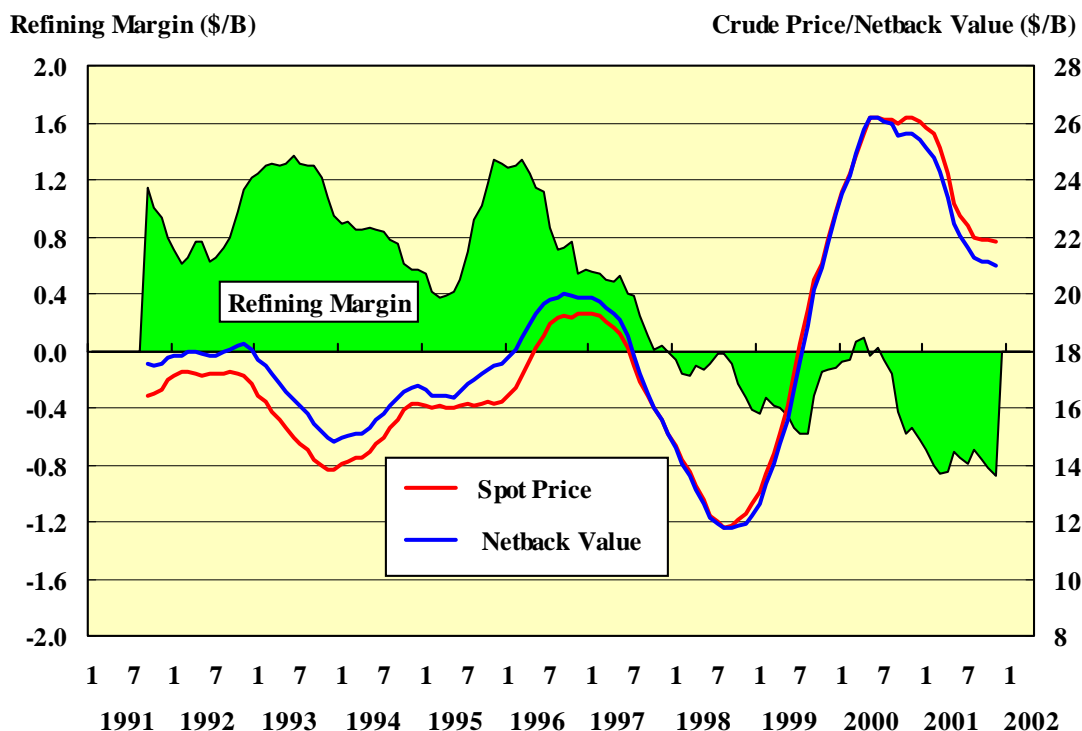
### **1. Movement of Marker Crude Values and Refining Margins Based on Oil Product Prices**

#### **(1) Dubai Crude (the Marker Crude for the Asian Market) in the Singapore Market**

The price index of the marker crude, which the oil-producing countries adopted to determine their crude oil prices under the formula for the Asian market, is the average price of Dubai crude and Oman crude prices. Since the official selling price of Oman crude is set by the Omani government retroactively, the price of Dubai crude is basically regarded as the price index of the marker crude for the Asian market. It is necessary, therefore, to study how oil product prices in the Singapore market, the only market carrying out international activities in Asia, assess Dubai crude (Fig. 1).

In order to assess the crude oil values based on international market prices of oil products, the method for calculating netback values is generally used [1]. The outline of this method is given in the reference material shown later. It is possible to calculate the original netback values, of course, from oil product prices and independently calculated product yields on crude oil processed in the market in question, but the netback values thus obtained are very likely to receive criticism that desired netback values are intentionally calculated by arbitrarily assuming product yields. For this reason, the data on prices and netback values [2], published in PIW (Petroleum Intelligence Weekly) and Oil Market Intelligence, which have enjoyed an established reputation for years among the people in the oil industry, are processed

for use in the analysis and assessment of marker crude oils in this study.



(Source) Prepared by processing the data published in "Oil Market Intelligence."

**Fig. 1 Dubai Crude Values and Refining Margins in Singapore Market (Twelve-month moving averages)**

Fig. 1 shows the movement of refining margins, based on the differential between the netback values of Dubai crude, as assessed by oil product prices in the Singapore market, and spot oil product prices. In an attempt to extract a general trend of the fluctuations by avoiding short-term fluctuations centering on seasonal fluctuations, the twelve-month moving average data is calculated. When the refining margins are in plus figures, it is economically viable to process the crude oil under the current oil product market conditions, while there is no economic viability when they are in minus figures.

The refining margins when processing Dubai crude in the Singapore market moved in a plus \$0.5 ~ 1.4/barrel range until the first half of 1997, but they worsened rapidly thereafter as the refining capacity continued to increase as a result of construction of new refineries and their expansion while oil demand became increasingly sluggish due to the Asian economic crisis. In and after 1999, as crude oil prices increased as a result of concerted oil produc-

tion cuts by OPEC and non-OPEC countries, coupled with tightened oil products supply in the U.S. as outlined later, the refining margins settled in the negative range. From the beginning of 1998 to the present, except for a short period, the refining margins when processing Dubai crude moved in a negative \$0.2 ~ 0.8/barrel range. The Asian economic crisis in 1997 ushered in a new phase to the Asian oil market environment surrounding Singapore, it can be said.

As noted in the “Asia Oil Price Analysis 3” [3], as the refining margins turned negative in and after 1998, the rate of refinery operation in Singapore dropped to 71 percent in 1999 and continued down to 65 percent in 2000. The refinery operation in Singapore at low rates began to affect the product price formation in the Singapore market.

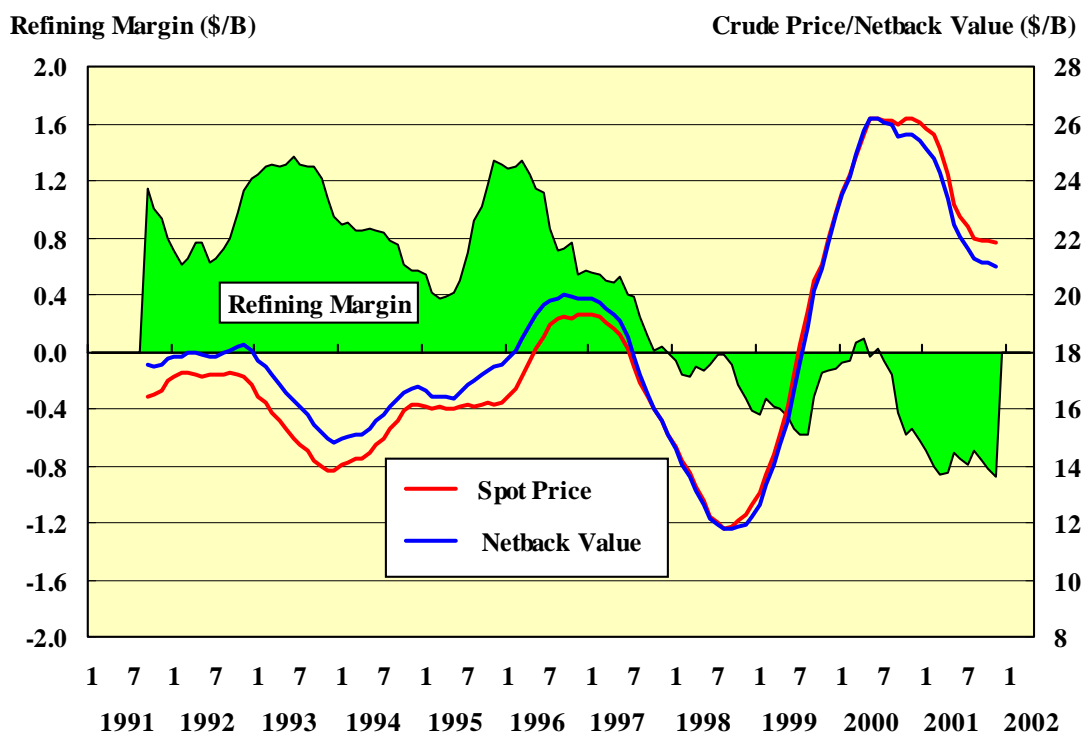
## **(2) Brent Crude (the Marker Crude for the European Market)**

The price index of the marker crude, which the oil-producing countries adopted to determine their crude oil prices under the formula for the European market, is the average price of Brent crude. In and after April of 2000, the average price of IPE Brent on the futures trading market became the price index for the marker crude, to avoid various problems posed by the spot price of Brent crude. In order to make an analysis similar to that for Dubai crude in the Singapore market as shown in section (1) above, the movement of the netback values of Brent crude and the refining margins in the Rotterdam market which represents the European market, as shown in Fig. 2, is analyzed below.

The refining margins when processing Brent crude – the marker crude for the European market – in the Rotterdam market moved in a -\$0.6 ~ 0.6/barrel range, fluctuating in plus and minus margins until 1998. In 1993, up until the end of the year, the refining margins became positive as crude oil prices dropped due to Kuwait’s return to the production quota system. In 1996, however, the refining margins became negative as crude oil prices increased sharply due to the reduction in commercial oil product inventories to low levels primarily in the U.S. In 1998, the refining margins became plus figures as crude oil prices crashed because oil demand became increasingly sluggish due to the Asian economic crisis.

The movement of the refining margins through 1998 shows that there was a fairly close interrelationship between spot prices of Brent crude and the netback values based on oil product prices in the Rotterdam market. When the relationship between crude oil prices

and oil product prices loosened slightly due to the special factors noted above, the refining



(Source) Prepared by processing the data published in “Oil Market Intelligence.”

**Fig. 2 Brent Crude Values and Refining Margins in Rotterdam Market (Twelve-month moving averages)**

margins became plus or minus figures within a narrow range, but no appreciably large dissociation was noticed until 1998. Compared to the situation in the Singapore market until the first half of 1997, when the refining margins moved in a plus \$0.5 ~ 1.4/barrel range, the situation in the Rotterdam market was different.

But in and after 1999, the refining margins in the Rotterdam market worsened rapidly and remained in large minus figures up to the latest point of time, registering at some stages very large minus figures such as -\$1.3/barrel (in August 1999) and -\$1.8/barrel (in November 2001). From the beginning of 1999 into the first half of 2000, crude oil prices soared and remained at high levels due to the coordinated production cuts by OPEC and non-OPEC countries, thus causing the refining margins to worsen. From 2001 into 2002, the sharp increase in prices of WTI crude and Brent crude, moving in relation to WTI prices, triggered by the sharp increase in oil product prices in the U.S., coupled with the coordinated production cuts by OPEC and non-OPEC countries, appeared to have caused Brent crude prices to be-

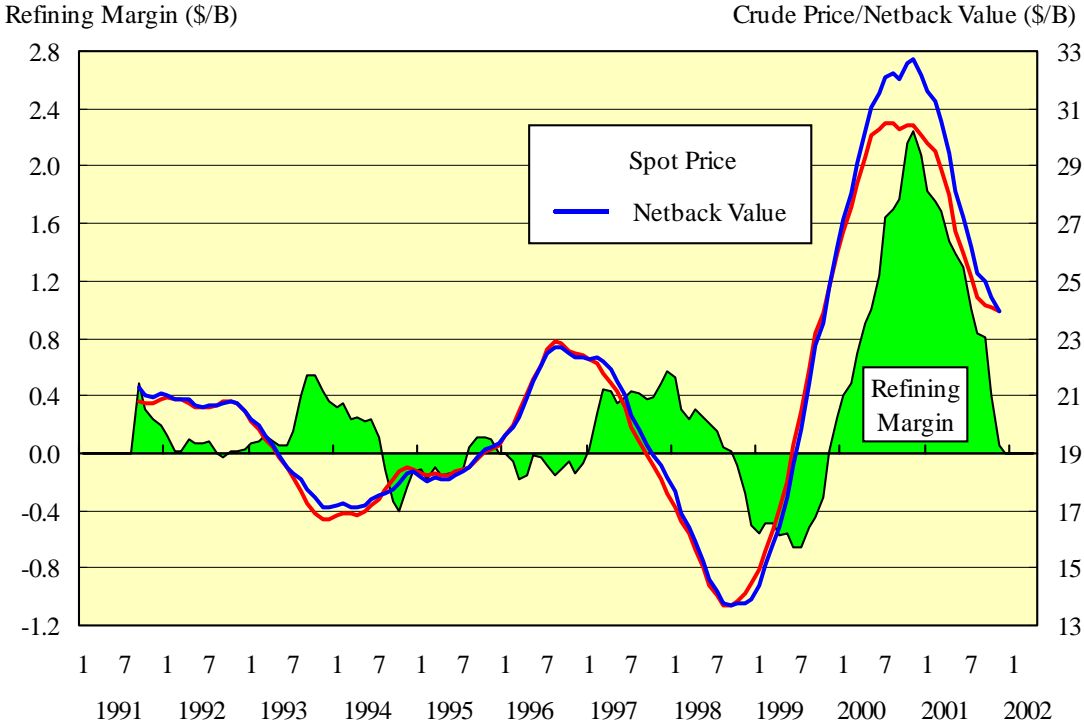
come relatively higher than the oil product prices in the Rotterdam market.

In conclusion, the refining margins in the Rotterdam market were neither too large plus nor minus figures, and spot crude oil prices stood in a fairly close relationship to the net-back values through 1998. On the other hand, in and after 1999, as the spot prices of Brent crude became relatively higher, with the refining margins showing fairly large minus figures continuously, it appears that the refineries in Rotterdam were discouraged from increasing crude oil processing.

### **(3) The U.S. Gulf Market and WTI Crude (the Marker Crude for the U.S. Market)**

The price index of the marker crude, which the oil-producing countries adopted to determine their crude oil prices under the formula for the U.S. market, is the average price of WTI crude. In the same manner outlined in the previous section, Fig. 3 shows the results of the study of the movement of the netback values of WTI crude based on the Gulf market, which represents the U.S., and the refining margins. Until 1999, the refining margins when processing WTI crude - the marker crude for the U.S. market - in the Gulf market moved in a  $-\$0.6 \sim 0.6/\text{barrel}$  range almost in the same manner as the processing of Brent crude in the Rotterdam market. Factors causing such a movement in the refining margins were as outlined in the case of the Rotterdam market, except that the refining margins in 1999, when OPEC and non-OPEC countries cut their oil production, were not so large minus figures as in the case of the Rotterdam market.

The most noticeable movement of the refining margins which took place in the U.S. Gulf market was when the refining margins were very large plus figures from 2000 into 2001. This was due to the sharp increase in oil product prices in 2000 in the U.S. As a result of the freezing cold wave which hit the northeastern part of the U.S. in January 2000, oil demand increased sharply, with the commercial oil product inventories falling to extremely low levels, thus causing oil product prices to rise sharply from 2000 into 2001. The increase in the refining margins based on a twelve-month moving average up to a high of  $\$2.2/\text{barrel}$  was really an abnormal phenomenon, compared with the movement of the refining margins in the Gulf market up to 1999, or in the Rotterdam and Singapore markets.



(Source) Prepared by processing the data published in “Oil Market Intelligence.”

**Fig. 3 WTI Crude Values and Refining Margins in the U.S. Gulf Market**  
(Twelve-month moving averages)

In summary, the interrelationship between the spot prices of WTI crude and the netback values based on oil product prices in the U.S. Gulf market was fairly close until 1999, as was the case with the Brent crude-Rotterdam market relationship. When the interrelationship between crude oil prices and oil product prices loosened subtly due to special factors, the refining margins moved in narrow plus or minus margins, but not so large a dissociation between the two as was witnessed until 1999.

In contrast, the movement of refining margins from 2000 into 2001 shows that unprecedentedly large constraints were imposed and oil product supply tightened to an extraordinary extent. The fall in commercial oil product inventories to unusually low levels in the northeastern part of the U.S. and the refining capacity shortages were the main factors of these large constraints. While OPEC repeatedly increased oil production in 2000, oil prices went up and remained at high levels due to the refining capacity shortages.

**(4) Comparison of Refining Margins in Representative Oil-Consuming Markets**

Fig. 4 compares the movements of the refining margins in Singapore, Rotterdam and the U.S. Gulf markets as outlined above. The refining margins moved in narrow ranges of  $-\$0.5 \sim 0.5/\text{barrel}$  until 1999 in the U.S. Gulf market and until 1998 in the Rotterdam market. During this period, the spot prices of marker crude oils stood in a fairly close relationship to the netback values based on oil product prices. In contrast, in the case of the Singapore market, the refining margins moved in a fairly large plus  $\$0.5 \sim 1.4/\text{barrel}$  range until the first half of 1997, signifying that the environment surrounding the Singapore market was considerably different from that in Europe and U.S. markets.

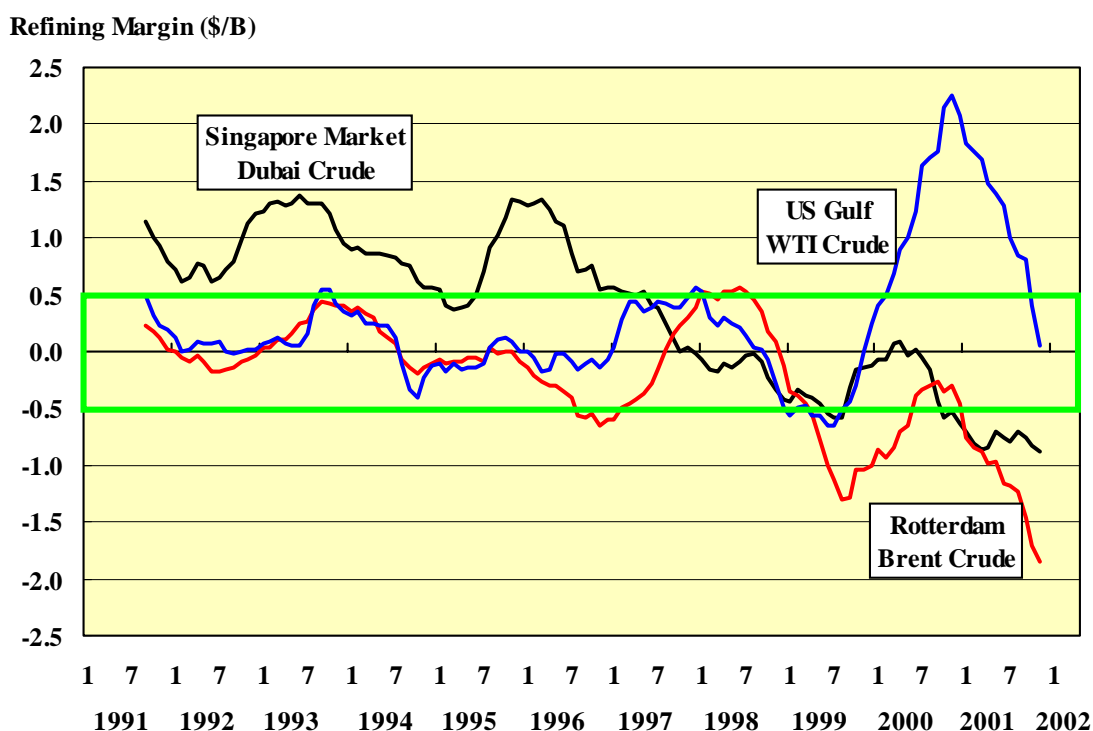
In and after the second half of 1997, the movement of the refining margins in the Singapore market remained in the  $-\$0.5 \sim 0.5/\text{barrel}$  range, similar to those in the U.S. Gulf and the Rotterdam market. From 2000 into 2001, however, crude oil prices reached high levels due to production cuts coordinated by OPEC and non-OPEC countries brought about continuously minus refining margins in the Singapore/Rotterdam markets, while unusually sharp increases in gasoline and heating oil prices in the U.S. brought about unusually large plus refining margins in the U.S. Gulf market.

It appears that the sharp increase in oil product prices in the U.S. in 2000 was caused by a weakened supply cushions (surplus capacities) such as the lowering of commercial oil product inventories and surplus refining capacities. The sharp increase in oil product prices in the northeastern part of the U.S. were reflected in the prices of WTI crude through NYMEX, which in turn were reflected in Brent crude prices in Europe and then in Dubai crude prices in the Middle East – a chain reaction in crude oil prices. While oil product prices in the U.S. and in Europe influence each other, oil product prices in the Singapore market were not strongly influenced. In order to minimize fluctuations in oil prices, it is essential to establish a mechanism under which oil product prices of the three major oil-consuming markets of the U.S., Europe and Asia mutually influence one another, so that oil product prices in the three major markets are loosely linked on a global basis, while specific oil product price structures reflecting special characteristics and supply and demand of the specific market involved may be established in each market.

To achieve this objective, it is necessary to return the Singapore market to the state which prevailed until the first half of 1997, when the Singapore market was not dissociated from U.S. Gulf and Rotterdam markets. Moreover, it is also necessary to have a system under which



a certain arbitrage functions among markets so that oil product price relations in individual



(Source) Prepared by processing the data published in “Oil Market Intelligence.”

**Fig. 4 Movement of Refining Margins in Representative Oil-Consuming Markets**

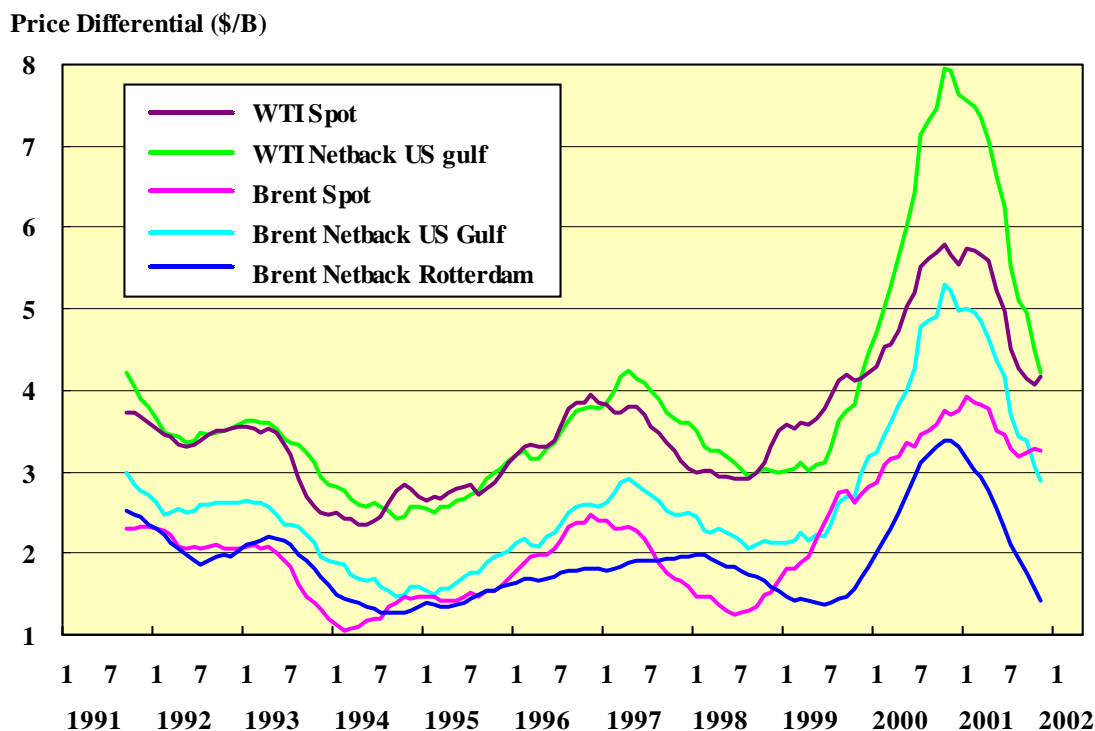
markets can be linked with one another, although such a system is not seen yet at present (see the “Asia Oil Price Analysis 3” [3]).

## 2. Inter-market Linkage with Regard to Oil Product Prices and Crude Oil Prices

### (1) Relationship between the Europe Market and the U.S. Market (West-of-Suez World)

With the problems referred to above in mind, a study is conducted in this chapter of whether a loose linkage (interrelationship) exists among markets with regard to oil product prices and crude oil prices. The movements of interrelationship between netback values in which oil product prices are consolidated and spot oil prices are compared by obtaining the netback value differentials in reference to the netback value of Dubai in the Rotterdam market (the lowest values at the latest point of time). The movements of price indices of marker crude oils representing the Rotterdam and the U.S. Gulf markets – the markets in the west of

the Suez – are shown in Fig. 5.



(Note) The netback value differentials or spot oil price differentials are obtained in reference to the netback value of Dubai crude in the Rotterdam market – the lowest value.

(Source) Prepared by processing the data published in “Oil Market Intelligence.”

**Fig. 5 Relationship between Price Indices of Marker Crude in Europe and U.S. Markets**  
(Twelve-months moving averages)

As shown in Fig. 5, the movement until the end of 1999 shows (a) spot prices of WTI crude and Brent crude, (b) the spot price of WTI and the netback value in the U.S. Gulf market, and naturally (c) netback values of WTI crude and Brent crude in the U.S. Gulf market had a certain inter-relationship among them. Compared with the interrelationship among the three above, the relationship between the netback value of Brent and spot prices of Brent in the Rotterdam market or the relationship with the netback value of WTI in the U.S. market shows some discrepancy, but nevertheless it is evident a loose price linkage existed.

Looking at the movements in and after 2000, the interrelationship between the spot prices of WTI crude and spot prices of Brent crude is somewhat weakened in relative terms, while conversely the interrelationship between the netback value of Brent crude in the Rotterdam market and the netback value of WTI in the U.S. Gulf market was strengthened.

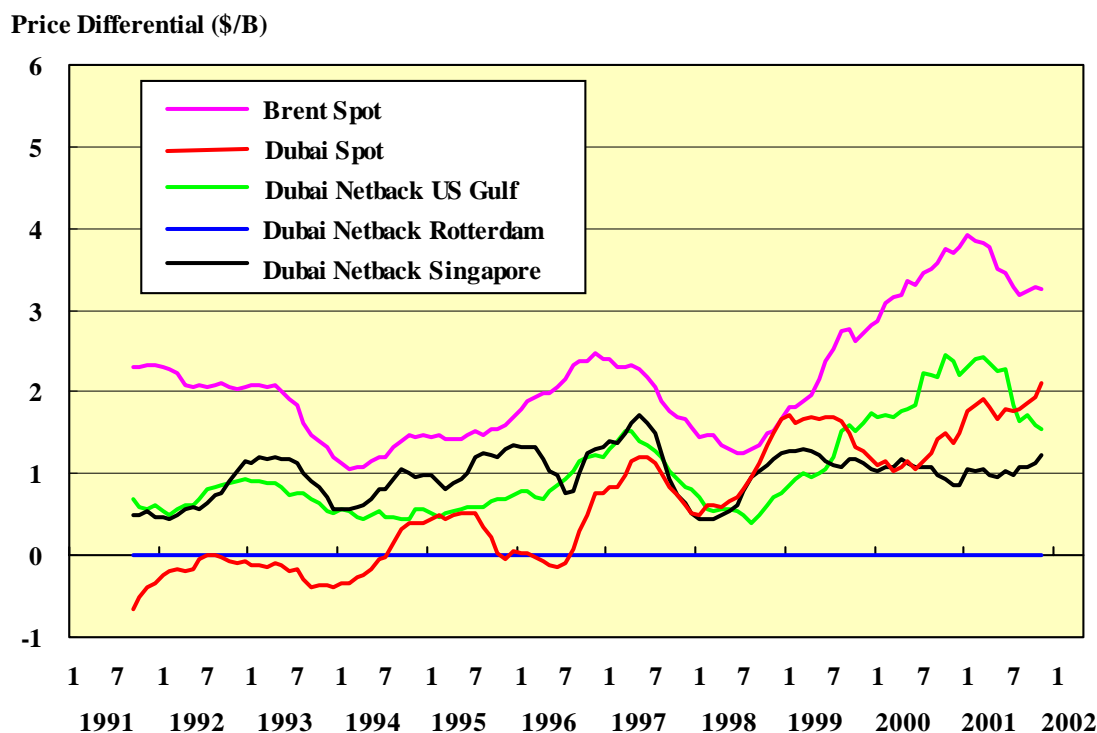
While oil product supply and demand in the respective local market is reflected, of course, it can be said that oil price relations in the West-of-Suez markets – the Europe market and the U.S. market – influence each other and are closely interrelated. This means that in the west-of-Suez world oil product prices which strongly reflect the competitive relations in the consuming areas, influence the establishment of prices of the marker crude oil.

## **(2) Relationship between the Europe/U.S. Markets and the Asian Market (East-of-Suez World)**

Next, in an attempt to see a linkage between the price indices of Dubai crude, the marker crude for the Asian market (the east-of-Suez world), and European/U.S. markets, the movements of spot prices of Brent crude and Dubai crude and the netback values of Dubai crude in the Singapore, Rotterdam and U.S. Gulf markets are summarized in Fig. 6. As was noted in the previous section, the movements of differentials in reference to the netback values of Dubai crude in the Rotterdam market are shown

The interrelationship between spot prices of Brent crude and Dubai crude (Fig. 6) is not as close as that witnessed in the interrelationship between spot prices of Brent crude and WTI crude (Fig.5). Spot prices of Dubai crude are: (a) prices obtained from the information on spot trading; and (b) prices obtained from the information on price differentials between prices of Brent crude in futures trading and prices of Dubai crude in arbitrage transactions and spot prices of Brent crude, which are assessed and published by the Platt's Oilgram Price Report. Production of Dubai crude was on the downturn in and after the mid-1990s. Prices of Dubai crude are not prices in spot trading but are largely influenced by the futures trading – isolated from the spot trading. Compared to Brent crudes prices, Dubai crude spot prices have shown a large increase in relative terms and the price differentials between Dubai and Brent narrowed rapidly toward the end of 1998.

Looking at the netback values of Dubai crude, the assessment in the Singapore market has been larger than the assessment in the Rotterdam market by around \$1/barrel, while the price differentials have remained relatively stable. The netback values of Dubai crude in the U.S. Gulf market also remained higher than those in the Rotterdam market by less than \$1/barrel until the first half of 1999, with the price differentials remaining relatively stable.



(Note) The netback value differentials or spot price differentials are obtained in reference to the netback value of Dubai crude in the Rotterdam market – the lowest value.

(Source: Prepared by processing the data published in “Oil Market Intelligence.”)

**Fig. 6 Relationship between Price Indices of Marker Crude in European/U.S. and Asian Markets**  
(Twelve-month moving averages)

As a result of the sharp increase in oil product prices in the U.S., the price differentials widened to around \$2/barrel toward 2000. Excluding the case of the U.S. Gulf market in and after the second half of 1999, the netback values of Dubai moved in such a manner that the price differentials among the three markets can be said to have remained relatively stable, but there has been no pronounced interrelationship between the Singapore, European and U.S. markets with regard to individual oil product price differentials, as analyzed in the “Asia Oil Price Analysis 3” [3].

There is no interrelationship between spot prices of Dubai crude and changes in the netback values of Dubai based on oil product prices in the Singapore/Rotterdam/U.S. Gulf markets. The movement of Dubai crude spot prices vis-à-vis the netback values of Dubai in the Rotterdam market over the period from 1991 up until recently have been such that the

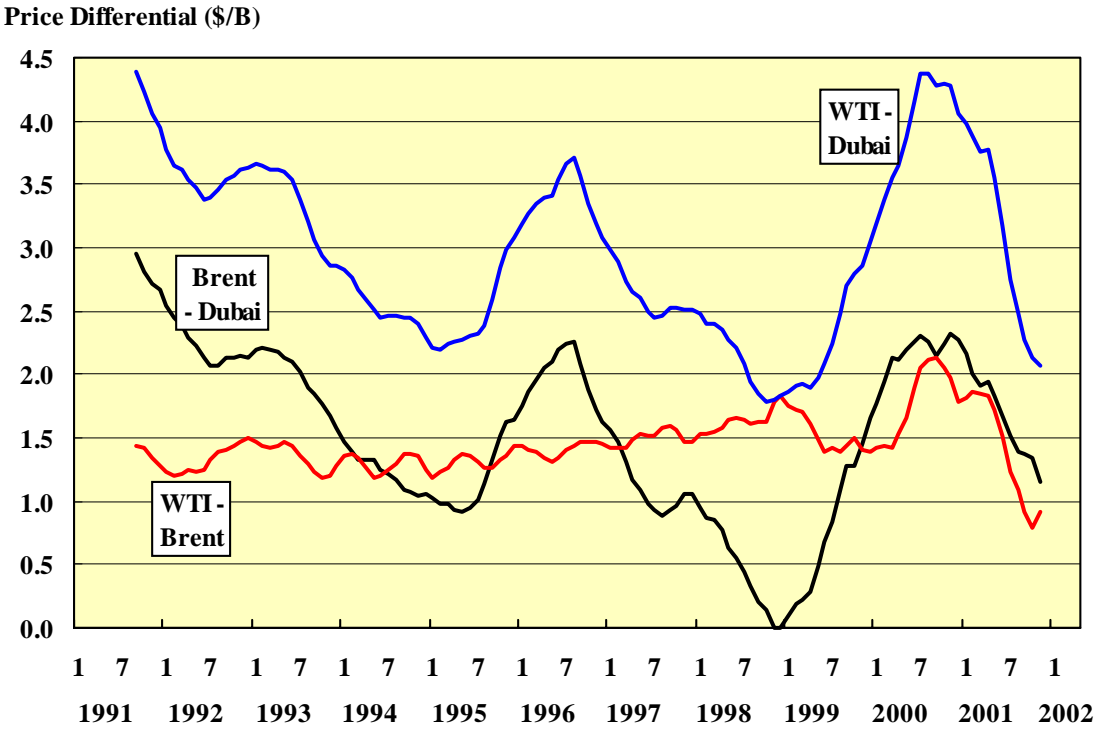
price differentials turned from minus to plus figures and continue widening in a one-sided upward trend. As a result, the re-refining margins when processing Dubai crude in the Rotterdam market have been consistently negative in and after 1996 and the refining margins when processing Dubai crude in the Singapore market also have been negative almost constantly in and after 1998. Meanwhile, in the case of the U.S. Gulf market, the refining margins turned negative in and after 1998, but turned positive in and after the end of 1999 due to the sharp increase in oil product prices. A close analysis of the netback values in the U.S. Gulf market shows that they have a closer interrelationship to the spot prices of Brent crude.

In conclusion, between the European market and the U.S. market, west-of- Suez markets, it is known that: (a) spot prices of Brent crude and WTI crude are interrelated through the crude oil market; and (b) spot prices of Brent crude and WTI crude and their netback values are interrelated in their own ways through the crude oil and oil product market. Compared to the European and U.S. markets, in the Asian market, the east-of-Suez market, spot prices of Dubai crude are neither interrelated with spot crude oil prices in the European/U.S. markets, nor closely interrelated with the netback values assessed in oil product prices. In this connection, it is an important task to establish a certain linkage between the Asian market and the European/U.S. markets through the streamlining, expansion and strengthening of the oil product market in Asia in the future.

### **3. Market's Assessment of Marker Crude Price Differentials**

#### **(1) Marker Crude Price Differentials based on Crude Oil Market**

In order to understand the price relationships among marker crude, which play important roles in determining prices of crude oil supplied to the three major oil-consuming markets of the U.S., Europe and Asia, it is necessary to analyze price differentials with regard to spot prices of marker crude. Fig. 7 shows the movements of price differentials among spot prices of Dubai crude (the marker crude for the Asian market), Brent crude (the marker crude for the European market) and WTI crude (the marker crude for the Asian market). The price differentials are calculated based on a twelve-month moving average to see major trends, excluding monthly, short-term movements.



**Fig. 7 Marker Crude Spot Price Differentials**  
(Twelve-month moving averages)

The price differentials -- WTI crude over Brent crude -- moved in a \$1.2 ~ 1.8/barrel range (with an average of around \$1.5/barrel), in a moderate and an upward trend over the period 1991 ~ 1999, as shown in Fig. 7. The differentials moved within a narrow margin of only \$0.6/barrel. The differentials were disrupted from 2000 into 2001, due primarily to a temporary tightening of oil products supply in the U.S. It can be said that the price relationships between the marker crude oils, which play important roles in determining crude oil prices for the European and the U.S. markets, had a fairly stable interrelationship from 1991 and 2002 except for the period in and after 2000.

In contrast, the price differentials between Dubai crude, which plays an important role in determining crude oil prices for the Asian market, and other marker crude oils – Brent crude and WTI crude – demonstrated a very drastic movement, as shown in Fig. 7. During the period 1991 ~ 2001, the price differentials - Brent crude over Dubai crude - moved in a \$0.0 ~ 3.0/barrel range, while the price differentials - WTI crude over Dubai crude - moved in a \$1.8 ~ 4.5/barrel range, moving within quite a wide margin of around \$3/barrel. Considering that prices of Brent crude and WTI crude maintained a close interrelationship, it is thought

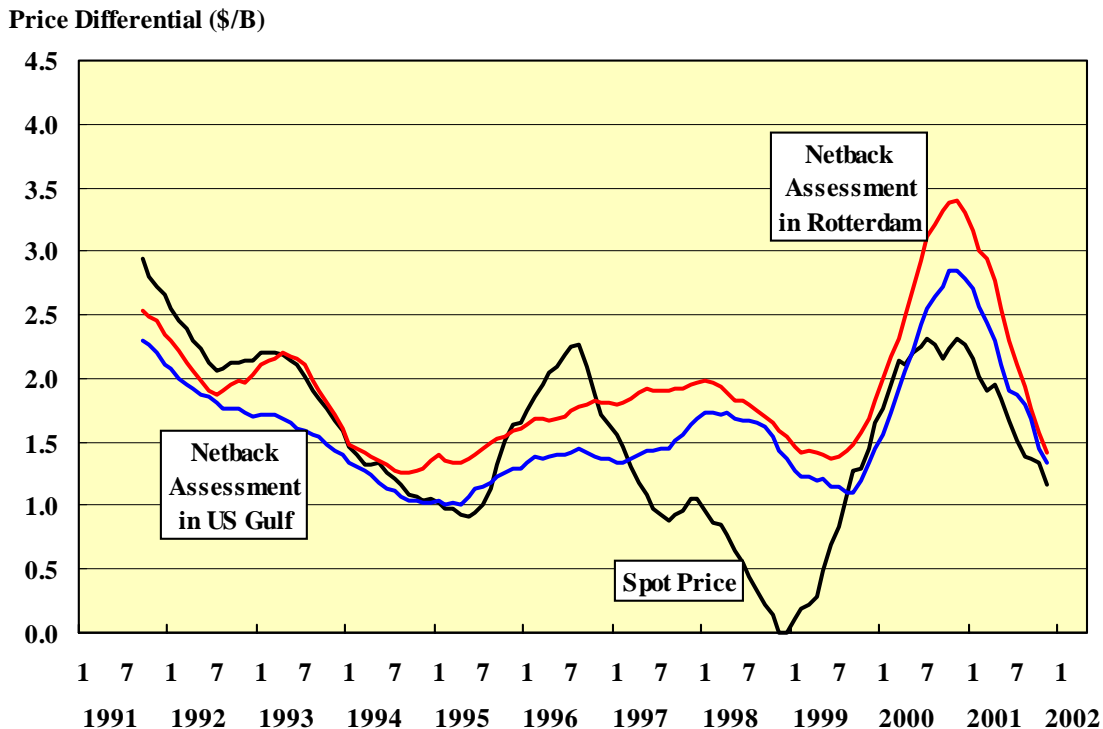
that there must be some special factors that brought about such a drastic movement in the formation of spot prices of Dubai crude.

Among the factors influencing price differentials among crude oils are the differentials due to oil quality and product yield and the differentials due to transportation cost – the factors which are considered to be major ones in spot trading of crude oil. In cases of large price differentials among oil products and sharp increases in tanker rates, it is essentially possible that price differentials among crude oils change. However, it is difficult to believe that these factors are responsible for movements of price differentials in a wide margin of \$3/barrel. If these factors cause such drastic movements, WTI crude and Brent crude could also show a similar movement of price differentials.

The special characteristics of Dubai crude appear to lie in the fact that the assessment of crude is based on paper transactions in the form of forward delivery in which the price differential between Dubai crude and Brent crude is determined to assess Dubai crude in accordance with the practice introduced in and after the middle of the 1990s, not reflecting the spot transactions. As a result of a steady decline in production of Dubai crude in and after the middle of the 1990s, followed by a rapid decline in spot transactions, the price formation of Dubai crude had no option but to depend on paper transactions. Since different players are engaged in spot transactions and paper transactions of Dubai crude, it is possible that physical bottleneck in Dubai crude is being utilized for profit sources for paper transactions. Looking at the price formation of Dubai crude, the market-related parties' confidence in Dubai crude – a necessary prerequisite for Dubai being the marker crude for the Asian market – is totally lost, thus making it a necessary to change the marker crude.

## **(2) Oil Product Market's Assessment of the Price Differentials between Brent Crude and Dubai Crude**

We will examine how netback values based on oil product prices assess the price differentials between Brent crude and Dubai crude in this section. Since the net-back values of Brent crude and Dubai crude based on the Rotterdam market and the U.S. Gulf market are obtained, the calculated price differentials are compared with the price differentials obtained from spot prices of crude oil, as shown in Fig. 8. In these calculations, the twelve-month moving average method was used to avoid short-term fluctuations.



**Fig. 8 Oil Product Market’s Assessment of Price Differentials between Brent and Dubai (Twelve-month moving averages)**

Looking at the price differentials based on oil product prices in the Rotterdam market, the price differentials of Brent crude over Dubai crude showed a movement in a \$1.3 ~ 2.3/barrel range during the period 1992 ~ 1999. In the case of the U.S. Gulf market, the price differentials moved in a \$1.0 ~ 2.0/barrel range. In 1991, there was the after-effect of the Gulf crisis, and in and after 2000 the problem of a sharp increase in oil product prices primarily in the U.S. loomed. Exclusively these periods, it is plausible that the movement of the price differentials of marker crude oils showed a margin of around \$1/barrel in the normal situation as a result of variations in oil product prices and in the transportation cost.

In contrast, the price differentials in spot prices of Brent crude and Dubai crude showed quite an unusual movement during the period 1995 ~ 1999, as shown in Fig. 8. Notably, the sharp reduction in the price differentials witnessed from the beginning of 1997 into the first half of 1999 departs remarkably from the price differentials assessed from oil product prices and is an unusual phenomenon. Brent crude, which is low-sulfur and light, and Dubai crude, which is high-sulfur and medium/heavy, obviously should have price differentials in terms of quality differentials, and it is unthinkable that the price differentials between the



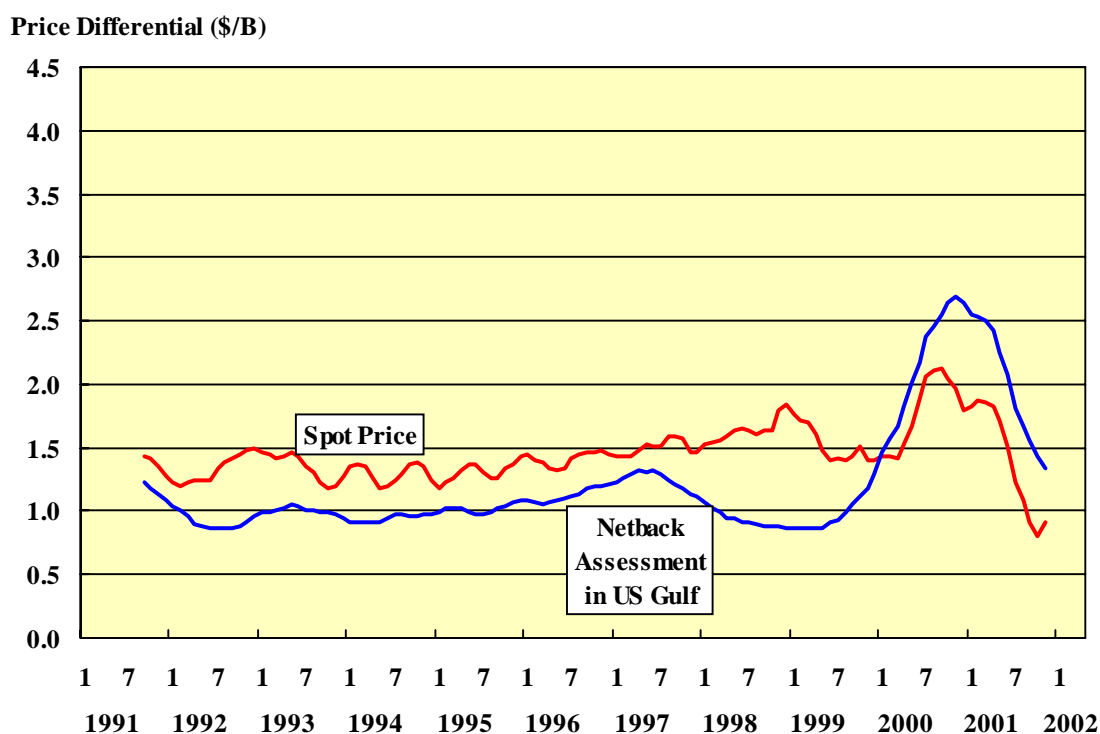
two become almost zero, when taking into account the quality differentials of the two crude oils. After all, a sharp decline in spot transactions of Dubai crude due to a decline in its production is believed to have resulted in the formation of unreliable spot prices of Dubai crude.

### **(3) Oil Product Market's Assessment of the Price Differential between Brent Crude and WTI Crude**

While the price differentials between WTI crude and Brent crude based on spot crude oil prices have maintained a close interrelationship except for the period in and after 2000, in which oil product prices increased sharply, what movement did the netback value differentials based on oil product prices show, then? The price differentials between WTI crude and Brent crude, as assessed by oil product prices in the U.S. Gulf market are shown in Fig. 9, along with the price differentials based on spot crude oil prices. Since WTI crude is not exported, the assessment of WTI crude in the Rotterdam market cannot be obtained.

The price differentials between WTI crude and Brent crude, as assessed by the oil product prices in the U.S. Gulf market, as shown in Fig. 9, basically showed a movement in a range of around \$1/barrel. The differentials widened to around \$1.3/barrel in the first half of 1997 and to a maximum of around \$2.7/barrel when oil product prices increased sharply primarily in the U.S. in 2000. Compared with the movement during the other periods, it is well known what an unusual phenomenon the sharp increase in oil product prices in 2000 was. The more closely we watch the price relationships between WTI crude and Brent crude in the European/U.S. markets, the more clearly we understand how unusual the price formation of Dubai crude is.

While Dubai crude is the marker crude which plays an important role in determining the price of crude oil directed to the Asian market, production of Dubai crude has continued to decline since the middle of the 1990s and today falls short of playing its role of forming the highly reliable price, reflecting the global crude oil price trends and oil supply and demand in Asia. Under such circumstances, it is becoming an unavoidable and a burning task to select a new marker crude for the Asian market in place of Dubai crude. Furthermore, to support the price formation of the marker crude for the Asian market, it is indispensable to streamline, expand and strengthen the oil product market in Asia, with a high degree of transparency, fluidity and reliability. In addition, it is also important to build up a global link which loosely



**Fig. 9 Oil Product Market’s Assessment of Price Differentials between Brent Crude and WTI Crude**  
(Twelve-month moving averages)

links oil prices in the Asian market with the Europe and U.S. markets, west of Suez, under which the three markets mutually influence one another in terms of crude oil and oil products supply and demand.

**Concluding Remarks**

Asia has only one international oil product market in Singapore it is important to invigorate trading activities, streamline and strengthen the oil product market. Conditions for streamlining the market include the promotion of deregulation measures in each country’s domestic market and creation of an environment in which oil product trading activities can be freely carried out. It is also necessary to introduce new systems such as the spot trading market and the futures trading market, which have matured and grown in the European and U.S. markets, to increase the fluidity and transparency of the market. Asia has a variety of

oil-consuming areas and the current Singapore market does not fully represent these oil-consuming areas. Northeast Asia, comprising of Japan, ROK, Taiwan and China, is a major oil-consuming region, comparable with the European and U.S. markets. It is of primary importance to expand the oil product trading in this region. There is a special necessity for a variety of oil-consuming areas to work in concert through the streamlining and expansion of the oil product market and to strengthen and support the oil product price formation in the Singapore market.

When China, which joined the World Trade Organization, will lift its restrictions on oil product imports, it will hold the key to the expansion of Asia's oil product trading. Moreover, China is expected to develop into a major oil-consuming country in the future and is currently is Asia's representative oil-producing country. Although it is not likely to happen in the immediate future, China's crude oil production is expected to reach around 8 million B/D, should China liberalize its oil market through deregulation measures, in which case China will be an oil-producing country representing the Asian region. The possibility of Chinese oil becoming the marker crude for the Asian market, thus playing a similar role to Brent crude in the European market and WTI crude in the U.S. market cannot be ruled out. From such perspectives, the development of Sakhalin and East Siberian oil/gas resources to secure new oil/gas supply sources in neighboring areas, as well as export of Alaskan crude will become important options.

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## ANNEX

### Method of Calculating Netback Values Based on Oil Product Prices

**Table A1 Calculation of Product Values on a Gross Basis**

Oil Product	Price of Oil Product	Yield of Oil Product	Yeild Value
Gasoline	P1	Y1	$P1 * Y1$
Naphtha	P2	Y2	$P2 * Y2$
Jet Fuel · Kerosene	P3	Y3	$P3 * Y3$
Gas Oil · Heating Oil	P4	Y4	$P4 * Y4$
Residual Oil	P5	Y5	$P5 * Y5$
Fuel Oil Sulfur Adjustment			a1
Octane Adjustment			a2
<b>Gross Value of Oil Product</b>	$\sum Si (Pi * Yi) + \sum Sj aj$		

When obtaining the netback values from spot prices of oil products, these spot prices are formed with regard to oil products obtained from the last barrel in marginal operations, using surplus refining capacities. Therefore, assumed product yields are set at standard figures obtainable from marginal refining operations, processing crude oil specified.

By multiplying spot prices of individual products – gasoline, naphtha, kerosene, gas oil and residual fuel – by yields of corresponding products, as shown in Table A1 to obtain yield values of individual products. These yield values are added up to obtain the total. In addition, adjustment factors reflecting quality differentials such as the sulfur content of residual fuel, the octane number of gasoline, etc. are added to obtain the gross value of oil products.

From these gross values of oil products are deducted the refining cost and the cost of transportation back to the crude oil loading point to obtain the value of the crude oil in question at the shipping point (in the oil-producing country), as assessed by oil product prices on the spot market involved. This value is the netback value, as it is called, and serves as one of crude oil price indicators. Since marginal operations are assumed in this case, processing the last barrel of crude, using the surplus refining capacities, the refining cost is assessed as an incremental variable expense.