

Decomposition Analysis of the Soaring Crude Oil Prices - Analyzing the Effects of Fundamentals and Premium -

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Introduction

The oil prices have been rising for four years. While this has not caused a significant mix-up unlike the oil crisis in the past, there is apprehension that this rise in the oil prices, in combination with the increases in the prices of primary products, may adversely affect the global economy.

The current oil prices are considered to be too high compared to supply and demand balance. Some experts express this situation as “the actual oil prices are around xx dollars at best.” However, the extent to which each of the factors affects the rise in the oil prices is not clearly known. In analyzing the effects of the factors, this paper used an oil prices model to divide the oil prices into two factors quantitatively, i.e. fundamental elements (supply-demand balance, hereafter referred to as the fundamental prices), and prices that mainly consist of premium (hereafter referred to as the premium). In analyzing the fundamental prices, the paper further classified the factors into the following groups: trend factor, non-trend supply factor, and non-trend demand factor.

1. Changes in the Oil Prices

After the second oil crisis, the nominal oil prices were at a level around 20 dollars per barrel on average. Look at the changes in the WTI¹ prices, today’s repetitive indicator for the oil prices. In the 1990s and afterward (Figure 1), it once rose to as high as 40 dollars during the Gulf War in 1990 but subsequently dropped and stayed at 20 dollars. In 1998, the oil prices dropped to as low as 11 dollars influenced by the Asian financial crisis in the previous year. With a sense of crisis for the low prices, OPEC reduced oil production, and Russia and some other countries acted in concert with OPEC to tighten supplies, which caused the oil prices to rise and reached a level as high as 37 dollars at

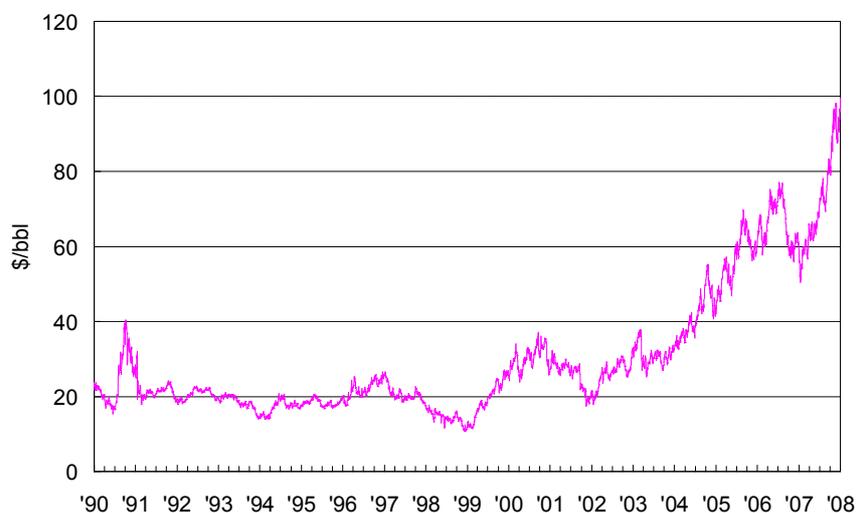
Note: As a rule, this paper is based on information up to 4 January 2008.

¹ West Texas Intermediate. It is used as a synonym for the light sweet crude oil listed on the New York Mercantile Exchange (NYMEX). Its (near) futures prices are referenced as the WTI prices. Hereafter, the oil prices refers to the WTI prices (closing prices).

one time in 2000. After that, the oil prices began to soften, which fell into the 20-dollar range at the beginning of 2002.

The current high oil prices originated around 2004: the oil prices have stayed at high levels for four years. In August 2006, it rose to 77 dollars, the highest-ever at that time. Then the oil prices once fell to as low as 50 dollars in January 2007 influenced by the huge loss of Amaranth Advisors, a major hedge fund in the U.S., in the natural gas market and some factors. In 2007, the oil prices consistently increased, reaching 98 dollars right before 100 dollars in November. In December, it dropped below 90 dollars from time to time; in January 2008, it finally hit 100 dollars.

Figure 1: Changes in Oil Prices



Source: U.S. Department of Energy

2. Factors behind the Rises in the Oil Prices

The current high oil prices are considered to have been caused by a combination of factors, such as the increased demand for oil in U.S., China, India and other developing countries; constraints on the supply capacities, such as OPEC surplus production capacity; and the influx of large-amount funds into the oil-futures market. The following pages briefly describe (1) demand, (2) supply, (3) insecure supply/geopolitical risks, and (4) futures market in relation to the changes in the oil prices.

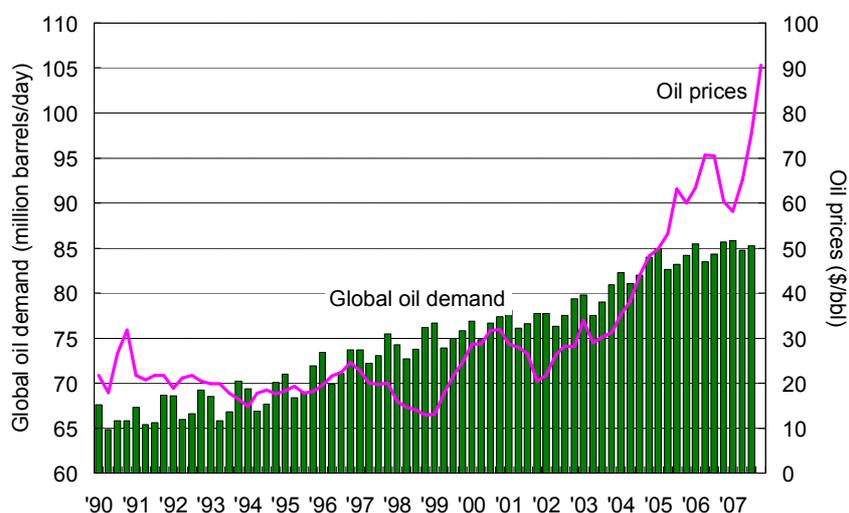
(1) Demand

The demand for oil has been steadily growing against the backdrop of the expanding global economy, showing an increase from 66 million barrels/day in 1990 to as much as 85 million barrels/day in 2007. The growth in demand during this period, however, was

not consistent. Influenced by economic situation and other factors, some years saw divergence from the trends in oil demand and significant fluctuations in the oil prices.

In 1998, the oil prices dropped to as low as 11 dollars partially because the increase in demand compared with the previous year was only 600 thousand barrels/day—about one third of the increase in the previous year. This resulted from some factors including the decrease in demand due to the Asian financial crisis in the previous year. The year 2004 saw an upsurge in demand, including an increase of 900 thousand barrels/day in demand in China and an increase of 700 thousand barrels/day in the U.S., which probably affected the oil prices to a large extent. While the increase in demand for oil subsequently levelled off at the previous level, the oil prices have been on the rise.

Figure 2: Changes in Global Oil Demand and Prices

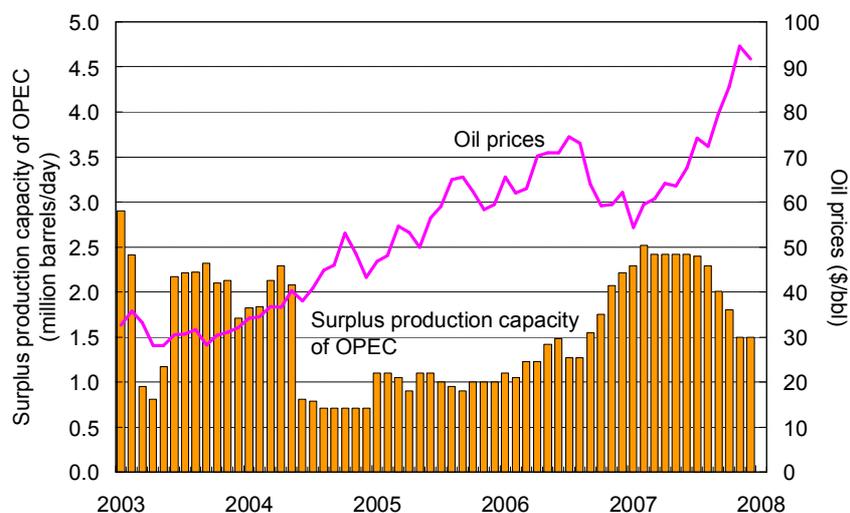


Source: *Oil Market Report* by IEA (global oil demand), U.S. Department of Energy (oil prices)

(2) Supply

The supply of oil has been increasing in correspondence with the increasing demand without creating a critical situation where the demand cannot be satisfied. After the upsurge in demand in 2004, however, a situation where the supply-demand balance was compromised lasted for a while. During this period, Saudi Arabia and other OPEC countries increased oil production to redress the supply-demand balance, which resulted in a sharp drop in surplus production capacity. Under normal conditions, redressing the supply-demand balance must help lower the oil prices. However, the very low surplus production capacity of less than 1% received attention, which did not level off the oil prices but raised them instead.

Figure 3: Changes in Surplus Production Capacity of OPEC and Oil Prices

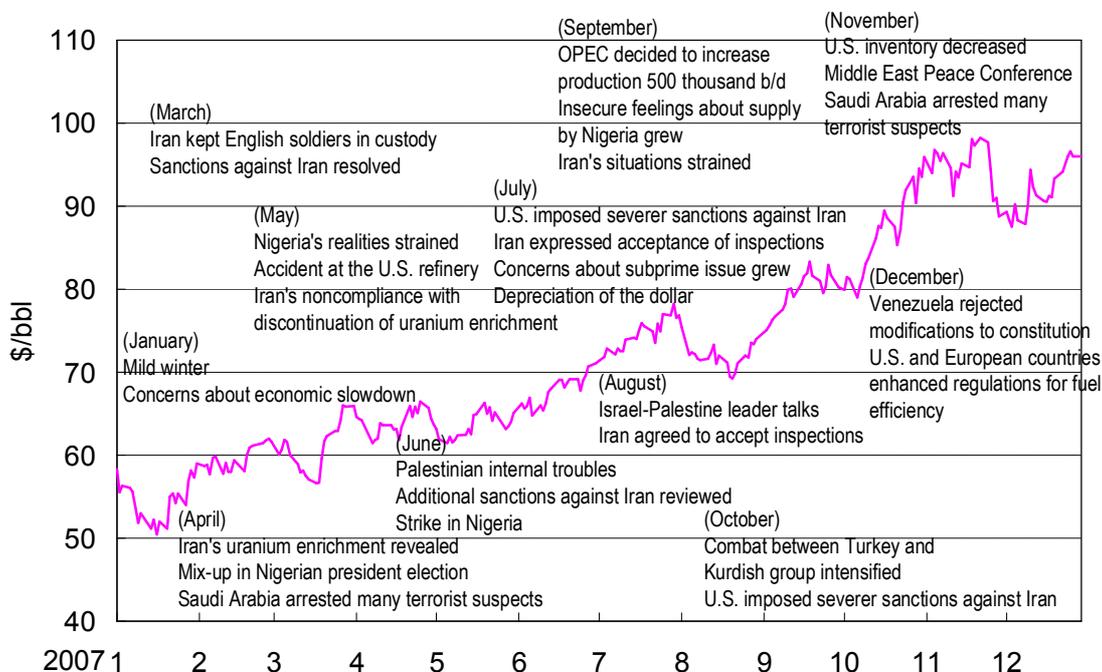


Source: U.S. Department of Energy

(3) Insecure Supply and Geopolitical Risks

Insecure feelings about the supply of oil and petroleum products also affect the oil prices.

Figure 4: Main Events in 2007 along with Changes in Oil Prices



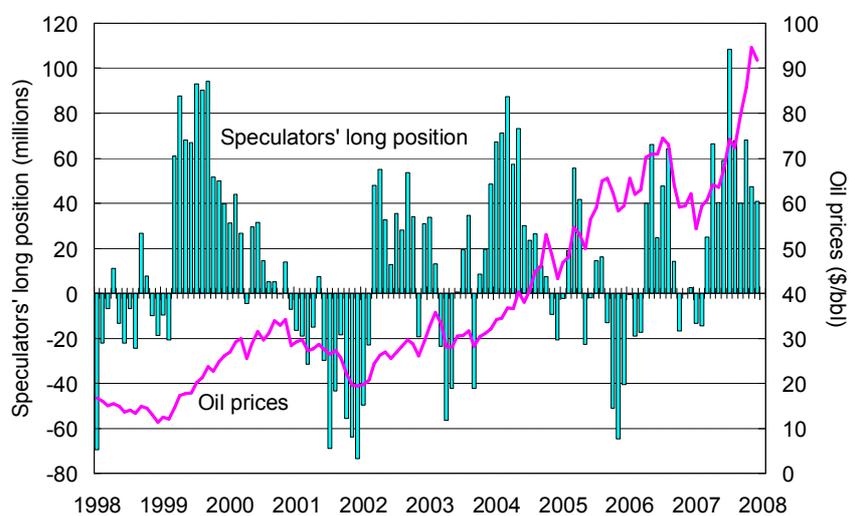
Source: U.S. Department of Energy (oil prices)

In the beginning of 2007, it was considered that the mild winter in that year and concerns about economic slowdown would lower oil prices. In the spring and afterward, the uncertain state of affairs in the Middle East, including Iran’s nuclear issue, Palestinian internal troubles, and the armed strife between Turkish troops and the Kurdistan Workers Party (PKK), were considered to compromise the supply of oil, causing a rise in the oil prices. In addition, accidents at U.S. oil refineries in full operation and the low inventory level were associated with an insecure supply, which was also considered to raise the oil prices. None of the events listed did more than cause insecurity, creating no actual disruption in oil supplies.

(4) Futures Market and Influx of Funds

In the futures market, oil-futures trading at New York Mercantile Exchange (NYMEX) are expanding faster than actual spots. While the futures markets are designed to hedge price fluctuation risks, oil is becoming a commodity, making the futures market something like an alternative investment² target. As a result, long position by speculators (“non-commercial” and “non-reportable”) conspicuously leads to a rise in the oil prices in more cases.

Figure 5: Changes in Speculators’ Position in NYMEX and Oil Prices



Note: The speculators include non-commercial and non-reportable.

Source: Calculated from data from U.S. Commodity Futures Trading Commission (speculators’ position), U.S. Department of Energy (oil prices)

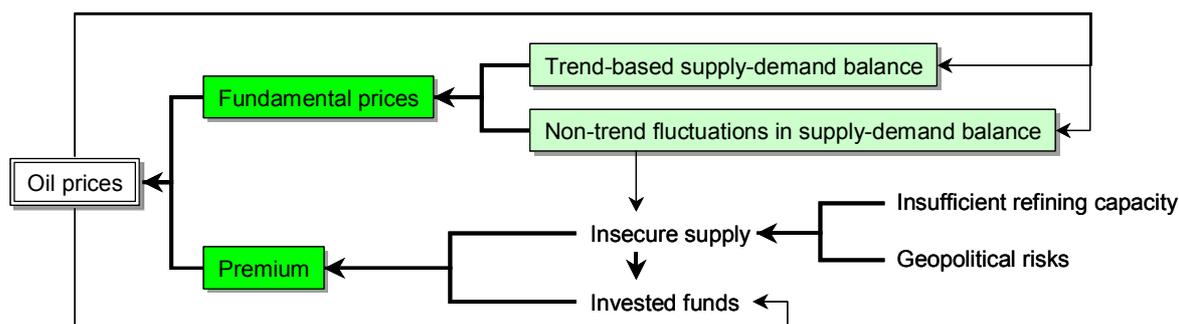
Looking at the current situation, the subprime lending problem originated the

² Investments in untraditional asset; commodities, real estates, hedge funds, etc.

deteriorated stock market and the monetary easing to address this situation is expanding the influx of funds from the financial market. In addition, it is also considered that fund influxes of a long-only-type based on pension funds and others that involve long-term investments are the impetus to the rises in the oil prices. In the second half of 2007, the dollar's depreciation became conspicuous. As a result, the oil prices appeared to be comparatively low, which also applied pressure to the rise in the oil prices.

The factors listed above are summarized and categorized in Figure 6. In other words, the factors that affect the oil prices can be broadly divided into two groups: fundamental prices based on the supply-demand balance; and premium resulting from insecure supply and influxes in funds, etc. In addition, the fundamental prices are influenced by trend-based supply-demand balance and non-trend fluctuations in the supply-demand balance.

Figure 6: Factors that Affect Oil Prices



The following pages analyze the effects of the trend factor; non-trend, supply-demand fluctuation factors; and premium using a model³.

3. Building an Oil Prices Model

Usually, quantitative analyses of the oil prices use a model. The most commonly used method is a regression analysis that uses adequate independent variables. Using the estimation period from 1998 to 2002 when the oil prices were considered to reflect the fundamentals, Morita (2005) made a regression analysis to estimate the degrees of the effects of the independent variables (number of oil stock days in the U.S., number of gasoline stock days in the U.S., fluctuations in the inventory amount of heating oil in the U.S., number of oil stock days in the OECD countries, and oil prices in the previous

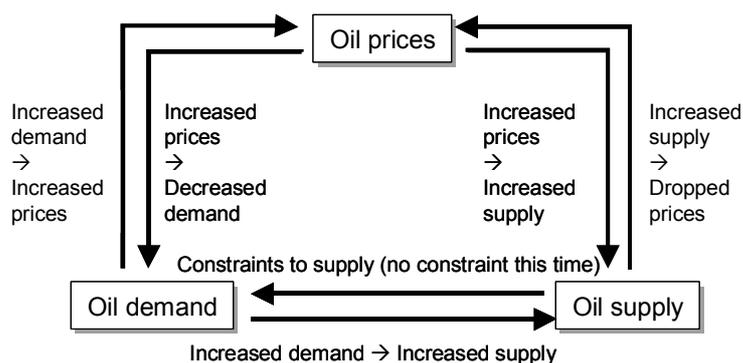
³ If you are more interested in the results than in the model and analytical method, then see section 5 “Results of Decomposition Analysis of the Oil Prices.”

week). He also estimated fundamental oil prices during the period from January 2003 to October 2004 by substituting actual figures into the independent variables in the built model.

However, it is difficult to apply this method now because the oil prices have been at high levels for as long as four years. If the estimation period ends at around 2003 when it is considered that the oil prices were mainly determined by the fundamentals, then the subsequent changes in the oil market cannot be incorporated. It is not possible to make an analysis with consideration, for example, of the effect of the surges in demand for oil in the U.S. and China on the oil prices as well as the effect of on the jump in the oil prices relative to the supply of and demand for oil.

For these reasons, this paper does not represent the oil prices with a single equation but models the entire process where the demand for oil, supply of oil, and the oil prices are determined in correlated with one another.

Figure 7: Model Conception



Since the prime purpose of the paper is decomposition analysis of the oil prices, a structural vector autoregressive (structural VAR) model, one of the multivariate time-series models, is used as the model.

As one example of the autoregressive (AR) models that underlie vector autoregressive (VAR) models, AR(p) model, in which the oil prices in the current term are expressed by the past oil prices during the period from the previous term back to the p th previous term, is shown in Equation (1)⁴:

$$\begin{aligned}
 \text{Current price} &= a_1 \times \text{previous price} + a_2 \times \text{2nd previous price} + \dots \\
 &+ a_p \times p\text{th previous price} \\
 &+ \text{error}
 \end{aligned}
 \tag{1}$$

⁴ For simplification, constant terms were omitted. The same applies to the following.

This equation is based on the idea that the current prices include full information and that past oil prices determine the current prices. In this point of view, it is based on the same premise as for technical analyses.

VAR may be considered as an extended version of AR, representing how multiple variables are determined in correlation with one another. For example, VAR(p) consisting of the oil prices and demand for oil provides simultaneous equations like

$$\left\{ \begin{array}{l} \text{Current price} = a_1 \times \text{previous price} + a_2 \times \text{2nd previous price} + \dots \\ \quad + a_p \times p\text{th previous price} \\ \quad + b_1 \times \text{previous demand} + b_2 \times \text{2nd previous demand} + \dots \\ \quad + b_p \times p\text{th previous demand} \\ \quad + \text{error} \\ \text{Curent demand} = c_1 \times \text{previous price} + c_2 \times \text{2nd previous price} + \dots \\ \quad + c_p \times p\text{th previous price} \\ \quad + d_1 \times \text{previous demand} + d_2 \times \text{2nd previous demand} + \dots \\ \quad + d_p \times p\text{th previous demand} \\ \quad + \text{error} \end{array} \right. \quad (2)$$

A structural VAR is a VAR with even the relations between variables in the current terms explicitly incorporated into it. Similarly, a structural VAR(p) consisting of the oil prices and demand for oil provides equations like

$$\left\{ \begin{array}{l} \text{Current price} = a_1 \times \text{previous price} + a_2 \times \text{2nd previous price} + \dots \\ \quad + a_p \times p\text{th previous price} \\ \quad + b_0 \times \text{current demand} + b_1 \times \text{previous demand} \\ \quad + b_2 \times \text{2nd previous demand} + \dots + b_p \times p\text{th previous demand} \\ \quad + \text{error} \\ \text{Curent demand} = c_0 \times \text{current price} + c_1 \times \text{previous price} \\ \quad + c_2 \times \text{2nd previous price} + \dots + c_p \times p\text{th previous price} \\ \quad + d_1 \times \text{previous demand} + d_2 \times \text{2nd previous demand} + \dots \\ \quad + d_p \times p\text{th previous demand} \\ \quad + \text{error} \end{array} \right. \quad (3)$$

This paper uses structural VAR instead of easy-to-handle (reduced) VAR because structural VAR provide advantages that they can express what effect each variable in the current term has on another (Even VAR can express the relations in the preceding terms).

Given below is an explanation of the relation between VAR and structural VAR using general matrixes because it is also associated with the model estimation method and

decomposition analysis.

The general form of VAR is:

$$\mathbf{y}_t = R_1 \mathbf{y}_{t-1} + R_2 \mathbf{y}_{t-2} + \dots + R_p \mathbf{y}_{t-p} + \mathbf{u}_t \quad (4)$$

On the other hand, the general form of structural VAR is:

$$S_0 \mathbf{y}_t = S_1 \mathbf{y}_{t-1} + S_2 \mathbf{y}_{t-2} + \dots + S_p \mathbf{y}_{t-p} + \mathbf{v}_t \quad (5)$$

where, \mathbf{y} , R and S , and \mathbf{u} and \mathbf{v} represent an endogenous variable vector, coefficient matrixes, and shock⁵ (error) vectors, respectively.

This paper does not directly estimate a structural VAR; it once obtains a VAR, then estimates S_0 , from identification constraints which it attains a structural VAR. To be more specific, multiplying Equation (5) from the left by S_0^{-1} provides:

$$\mathbf{y}_t = S_0^{-1} S_1 \mathbf{y}_{t-1} + S_0^{-1} S_2 \mathbf{y}_{t-2} + \dots + S_0^{-1} S_p \mathbf{y}_{t-p} + S_0^{-1} \mathbf{v}_t \quad (6)$$

Because Equations (4) and (6) are synonymous with each other, the coefficient matrix of the VAR and that of the structural VAR are related to each other as:

$$R_1 = S_0^{-1} S_1, \dots, R_p = S_0^{-1} S_p, \mathbf{u}_t = S_0^{-1} \mathbf{v}_t \quad (7)$$

This paper models the global supply and demand for oil and oil prices.

As actual endogenous variables \mathbf{y} , the growth in global demand for oil compared with the previous year, growth in global supply of oil compared with the previous year, and the logarithm of the real oil prices are used⁶. The oil prices were deflated using the GDP deflator of the U.S., the world's largest oil-consuming country.

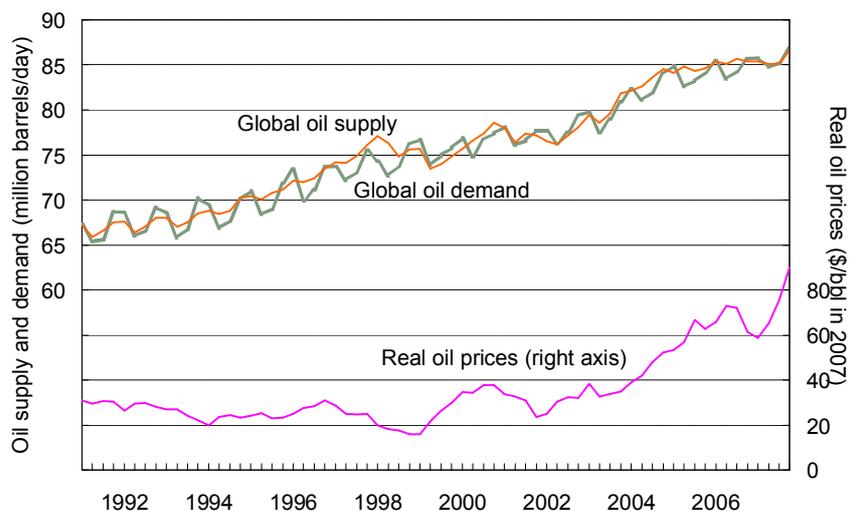
$$\mathbf{y} = \begin{pmatrix} \text{Growth in global oil demand compared to the same period of the previous year} \\ \text{Growth in global oil supply compared to the same period of the previous year} \\ \text{log real oil price} \end{pmatrix}$$

⁵ It is also referred to as the innovation in time-series analyses.

⁶ The sources of the data used are as follows:

Global demand for oil: Oil Market Report from IEA, Global supply of oil: Oil Market Report from IEA (the figures for the 4th quarter 2007 were estimated values), Oil price: U.S. Department of Energy, GDP deflator: U.S. Department of Commerce (the figures for the 4th quarter 2007 were estimated values)

Figure 8: Changes in Global Supply of and Demand for Oil and Real Oil Prices



Source: Calculated from *Oil Market Report* from IEA (global supply of and demand for oil), data from U.S. Department of Energy (oil prices), and others

Built based on quarters because the data was limited, the model used the estimation period from the first quarter in 1992, where the effect of sporadic rises in prices caused by the Gulf War was eliminated, to the fourth quarter in 2007, the most recent period. As the lag length p , a single term was adopted according to the information criterion⁷, etc. In a matrix form, it is represented as:

$$y_t = R_1 y_{t-1} + u_t \tag{8}$$

$$S_0 y_t = S_1 y_{t-1} + v_t \tag{9}$$

Table 1 outlines the estimated VAR model:

⁷ Guidelines for selecting from more than one candidates for the model that is considered to be excellent from the viewpoints of best fit and degree of freedom.

Table 1: Overview of the VAR Model

		Independent Variables				R^2
		Oil Demand _{.1}	Oil Supply _{.1}	Oil Prices _{.1}	Constant Term	
Equations	Demand	0.427 (3.59)	0.172 (2.43)	-0.00136 (-0.46)	0.0110 (1.07)	0.792
	Supply	0.124 (0.76)	0.724 (7.48)	0.00234 (0.58)	-0.00559 (-0.40)	0.763
	Prices	3.88 (3.04)	-2.78 (-3.65)	1.00 (163.30)		0.999

Note: The figures inside the parentheses are t values.

Representative examples of the identification constraints⁸ for obtaining a structural VAR include same-point constraints, which describe the relations between the variables at the same point (current term), and long-term constraints, which describe long-term relations. Here, the following same-point constraints were used with consideration for the energy properties.

- The oil supply in the current term does not directly affect the oil demand in the current term.
 - ← It is not the supply amount that determines the oil demand amount.
- The oil demand or prices in the current term do not directly affect the oil supply in the current term.
 - ← The oil supply is not instantly adjusted. Production boost and reduction require time.
- The oil demand in the current term does not directly affect the oil prices in the current term.
 - ← The information about the oil demand amount is obtained with a delay.

These identification conditions provided the following S_0 and S_0^{-1} :

⁸ The VAR in Equation (8) has 15 parameters in total, nine of which are related to R and the remaining six related to the variance-covariance matrix of the error u . On the other hand, the VAR in Equation (9) has 24 parameters in total, nine of which are related to S_0 , another nine related to S_1 , and the remaining six related to the variance-covariance matrix of the error v . In other words, the 24 parameters for structural VAR must be derived from the 15 parameters for VAR. To this end, the parameters for structural VAR must be able to be uniquely defined by adding some constraints ($24 - 15 = 9$ parameters) to the structural VAR. In addition to the six constraints that the variance-covariance matrix of the error v must be the unit matrix I , this paper added three constraints.

$$S_0 = \begin{pmatrix} 115 & 0 & -3.40 \\ 0 & 79.9 & 0 \\ 0 & -11.3 & 10.1 \end{pmatrix}, S_0^{-1} = \begin{pmatrix} 0.00868 & 0.000410 & 0.00291 \\ 0 & 0.0125 & 0 \\ 0 & 0.0139 & 0.0986 \end{pmatrix}$$

Now, the structural VAR is ready.

4. Methodology of Decomposition Analysis of the Oil Prices

Based on the built oil prices model, the factors behind the oil prices are decomposed. By repeating substitutions into the right side, the VAR mode with a lag length of 1 used in this paper can be rewritten as Equation (10) shown below:

$$\begin{aligned} \mathbf{y}_t &= R_1 \mathbf{y}_{t-1} + \mathbf{u}_t \\ &= R_1 (R_1 \mathbf{y}_{t-2} + \mathbf{u}_{t-1}) + S_0^{-1} \mathbf{v}_t \\ &= R_1 (R_1 (R_1 \mathbf{y}_{t-3} + \mathbf{u}_{t-2}) + S_0^{-1} \mathbf{v}_{t-1}) + S_0^{-1} \mathbf{v}_t \\ &= \dots \\ &= R_1^k \mathbf{y}_{t-k} + R_1^k S_0^{-1} \mathbf{v}_{t-k} + \dots + R_1 S_0^{-1} \mathbf{v}_{t-1} + S_0^{-1} \mathbf{v}_t \end{aligned} \quad (10)$$

The structural VAR provides Equation (11) shown below:

$$\begin{aligned} S_0 \mathbf{y}_t &= S_1 (S_0^{-1} S_1)^{k-1} \mathbf{y}_{t-k} + S_1 (S_0^{-1} S_1)^{k-1} S_0^{-1} \mathbf{v}_{t-k} + \dots + S_1 S_0^{-1} \mathbf{v}_{t-1} + \mathbf{v}_t \\ &= S_1 R_1^{k-1} \mathbf{y}_{t-k} + S_1 R_1^{k-1} S_0^{-1} \mathbf{v}_{t-k} + \dots + S_1 S_0^{-1} \mathbf{v}_{t-1} + \mathbf{v}_t \end{aligned} \quad (11)$$

To be more specific, the oil prices (and oil supply and demand) in term t can be expressed using the oil supply, demand, and prices in the k th previous term and shocks \mathbf{v} to the oil supplies, demands, and prices in the following terms. Here, the term immediately before the term when the oil prices are considered to have come off the fundamentals is used as the origin (Term $t-k$). This allows you to regard the oil prices derived from the model as trend-based oil prices free of shocks.

In addition, by changing the combination of shocks to extend model to more cases, you can understand the degrees of the effects of the following four factors:

- (1) Trend factor = prices under a trend-based supply-demand balance
 - Prices under a situation free of all supply, demand, and price shocks
- (2) Non-trend demand factor = factors ascribable to non-trend fluctuations in demand like the surges in demand in the U.S. and China in 2004, and other.
 - Calculated from the demand shock
- (3) Non-trend supply factor = factors ascribable to non-trend fluctuations in supply like reduction by hurricanes, unexpected production boost/reduction.
 - Calculated from the supply shocks

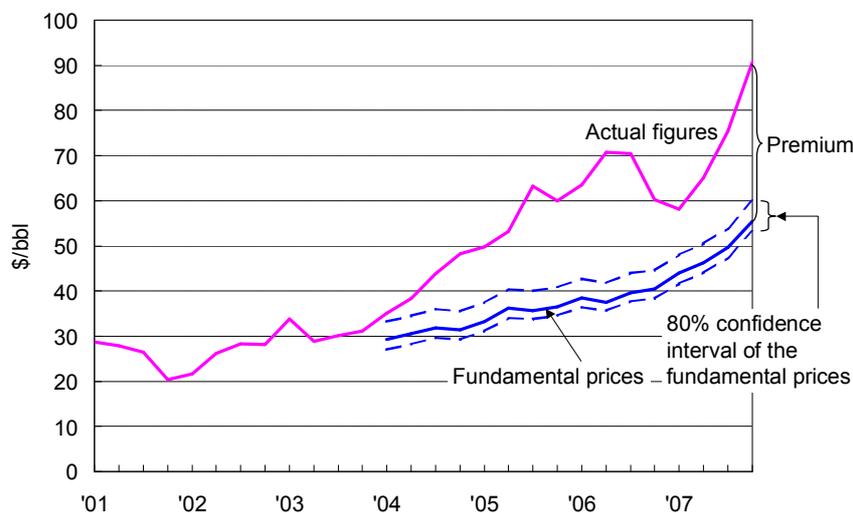
- (4) Premium = factors unexplainable with the supply-demand balance
 → Calculated from the price shocks

As Equation (11) clearly indicates, simulation results based on a structural VAR depend on origin point specification (same for a VAR). To consider and evaluate the effect of the changes in the simulation result due to differences in the origin point, 10 simulations are made using the origin point of the third quarter in 2001, which is 10 terms before the third quarter in 2003—the term immediately before the current rise in the oil prices swung into full gear: the average figures and deviations of the simulation results are used to make an assessment.

5. Results of Decomposition Analysis of the Oil Prices

Figure 9 shows the estimation results of the fundamental prices and premiums of oil in the period beginning with the first quarter in 2004 where the current rise in the oil prices swung into full gear. In the most recent terms (the third and fourth quarter in 2007), the fundamental prices are estimated around 50 to 60 dollars.⁹ On the other hand, it is estimated that the premium has risen up to around 40 dollars at maximum, indicating that the current oil prices are quite different from the fundamental prices.

Figure 9: Changes in Fundamental Prices and Premium



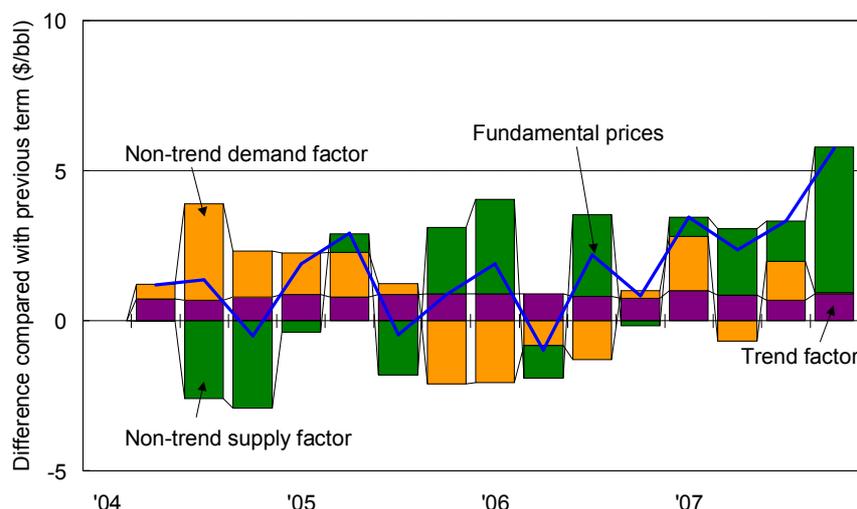
Note: The 80% confidence interval¹⁰ is a range that includes the eight near-average results among the 10 simulations based on different origin points. It is the “width” of the estimation.

⁹ For the fourth quarter in 2007, estimated data was used because the data on oil supply was not obtained. It should be noted that the results include errors ascribable to data estimation in addition to errors resulting from model analyses.

¹⁰ It is different from a precise confidence interval based on probability distribution.

Figure 10 shows the results of decomposition analysis of the fundamental prices fluctuations compared with the previous term into the trend factor, non-trend demand factor, and non-trend supply factor. The fundamental prices rises a little less than two dollars every term on average; it is estimated that the trend factor is responsible for a little less than one dollar rise and that the non-trend supply and demand factors together drove a little less than one dollar rise. The non-trend supply and demand factors are not very large in terms of average, which significantly fluctuate depending on the term reflecting the supply and demand situation. In 2004, reflecting the upsurge in demand, the non-trend demand factor helped the oil prices to rise more than five dollars. On the other hand, the year 2007 saw almost no increase in supply; it is estimated that the non-trend supply factor contributed to about a nine-dollar rise in the prices.

Figure 10: Decomposition Analysis of the Fundamental Prices Fluctuations



6. Effect of Increases in Supply and Demand on the Oil Prices

This section evaluates the effect of increases in the supply of and demand for oil on the oil prices using the oil prices model. To be more specific, a simulation (impulse response) where the oil supply and demand are individually given independent shocks is performed to estimate how increases of one million barrels/day in supply of and demand for oil will change the oil prices.

With the calculation result, it is estimated that the increase of one million barrels/day in demand for oil will contribute to up to about a six-dollar rise in the oil prices and that the increase of one million barrels/day in supply of oil will contribute to up to about a five-dollar drop in the prices of oil. The increases of one million barrels/day have the almost same magnitude both in supply and demand. The difference is how quickly the

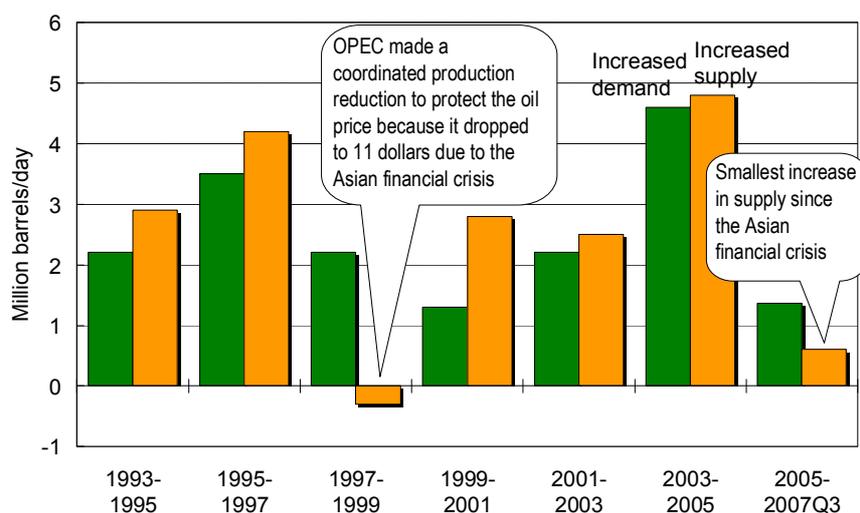
effects appear: it was observed that the increase in demand raised the prices 4 dollars in the first two terms while the increase in supply dropped the prices only about 2 dollars in the first two terms. This means that countering the high oil prices by adjusting the supply requires production boosts ahead of the rise in the prices as early as possible.

Summary

It is estimated that the most recent fundamental oil prices are around 50 to 60 dollars and that the premium is around 40 dollars at maximum. These results were almost the same as the values conceptually presented by oil experts and others. In addition, it is estimated that, in 2007, the non-trend supply and demand factors contributed to about 2-dollar and about 9-dollar rises in the oil prices, respectively.

OPEC states that the current high oil prices are the result of the influxes of large amounts of investment funds and other factors and that it supplies a sufficient amount. While the oil prices certainly reflect a large premium, it was recognized that the non-trend supply factor also had the effect of raising the prices. In fact, in 2005 and afterward, the increase in supply was about 800 thousand barrels/day less than the demand (Figure 11). It is estimated that the supply-demand balance was compromised at least by this difference, which acted as part of the non-trend supply factor, leading to rises in the prices.

Figure 11: Increases in Supply and Demand by Period



Source: Calculated from *Oil Market Report* from IEA

While the global economy has somehow withstood the rises in the oil prices, the subprime lending problem and other factors are slowing growth. The worst scenario we

should fear is stagflation where recession and inflation advance in parallel. Those who are most affected by rises in the oil prices and slowdowns in economic growth are the so called weak. From this viewpoint, the oil prices remaining at high levels are not desirable. Although the current oil prices contain a large premium, it is the actual supply-demand balance that is causing the rises in the prices ascribable to an insecure supply. It is desired that, toward correction of the situation where the oil prices are too high, the consumers should make self-help efforts, and the suppliers should further secure stable supply.

In Closing

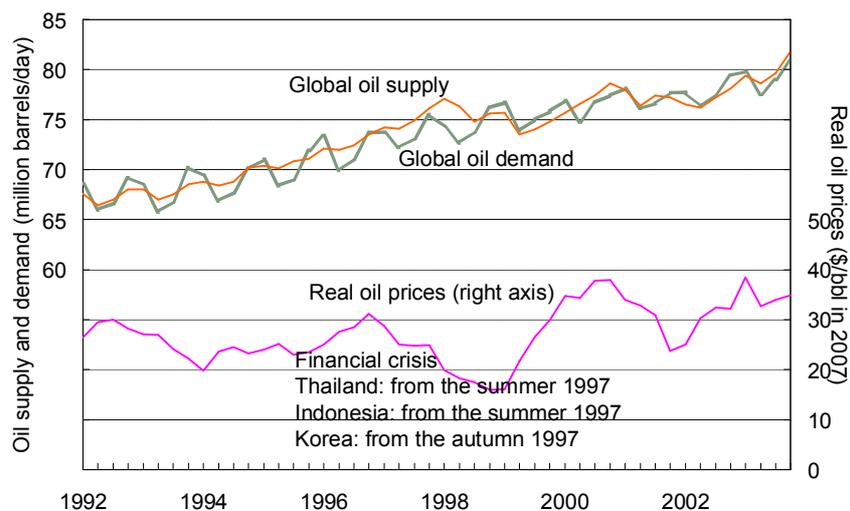
This paper tried to analyze the rising oil prices by building a simple oil prices model with the objective of decomposition analysis. Greater emphasis was placed on clarity and simplicity of the method of analysis and the results of the evaluation instead of using more explanation factors to complicate the model. For this reason, prime importance was placed on the behaviour of the entire model, which may sacrifice statistical precision to some extent. On the other hand, considering the fact that too many factors affect the oil prices in reality, the decomposition into only the fundamental prices (trend factor and non-trend supply and demand factors) and the premium may be considered too broad. It may be considered that trends can be interpreted in different ways, or that the paper is somewhat superficial from the viewpoint of the oil business segment.

The paper intended to evaluate the premium more explicitly compared with analyses based on a simple regression model. The paper, however, did not positively handle impact of being financial products and others, which are said to have effects upon the oil prices. In the future, I would like to analyze the oil prices from the viewpoint of the financial engineering or the behavioural finance.

Supplemental Explanation: Decomposition Analysis of the Oil Prices after the Asian Financial Crisis

Based on the built oil prices model, a similar decomposition analysis was performed against the oil prices decline phase after the Asian financial crisis in 1997 and the subsequent rebound phase¹¹.

Figure 12: Changes in Global Oil Supply and Demand and Real Oil Prices

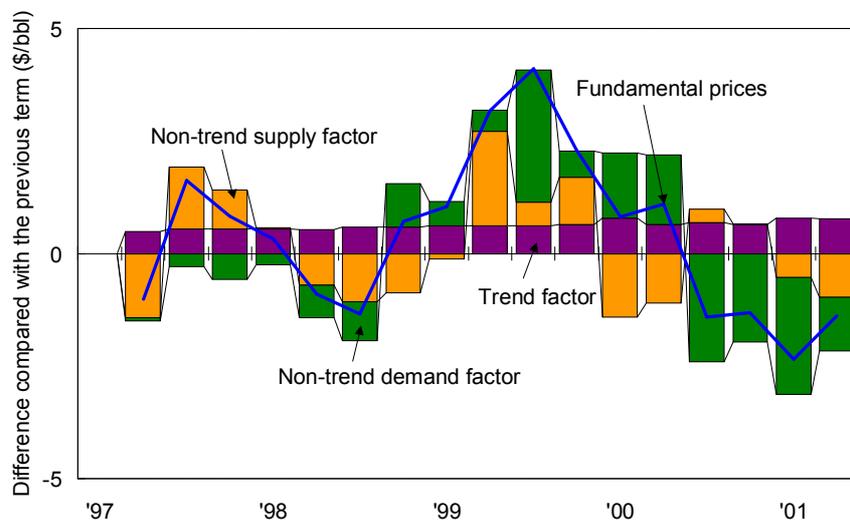


Source: Calculated from *Oil Market Report* from IEA (global supply of and demand for oil), data from U.S. Department of Energy (oil prices), and others

The drop in the oil prices down to as low as about 10 dollars in 1998 is considered to have been caused by soft oil demand due to the slowdown in economic growth after the Asian financial crisis, the subsequent production boost by OPEC, and other factors. It is true that, with the Asian financial crisis, the non-trend demand factor started to have an effect of lowering the fundamental prices; in 1998, the non-trend supply factor also contributed to the decline (Figure 13).

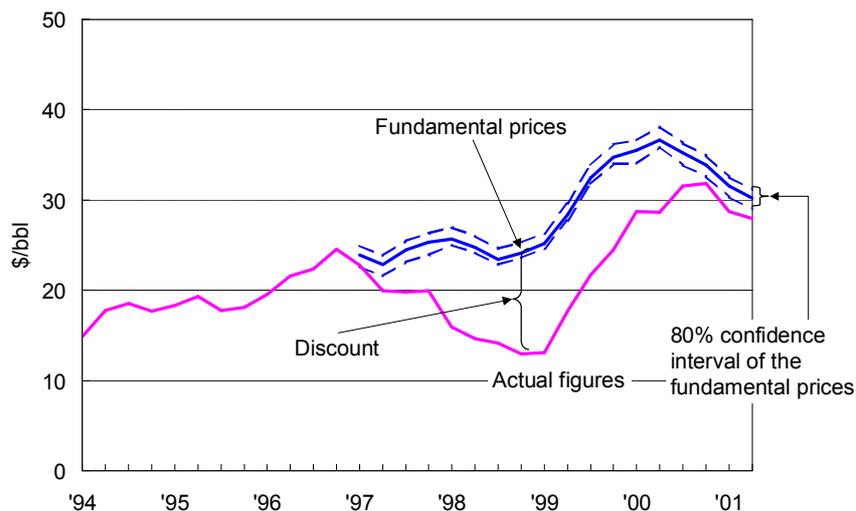
¹¹ The origin points of the calculations are 10 points from the third quarter 1995 through the fourth quarter 1997.

Figure 13: Decomposition Analysis of the Fundamental Prices Fluctuations after the Asian Financial Crisis



Despite the non-trend demand factor, the fundamental prices stayed in the middle of the 20-dollar range even in 1997 to 1998. Discount not on the fundamental prices significantly contributed to the prices drop to nearly 10 dollars (Figure 14). On the other hand, the subsequent rises in the oil prices until 2000 may be regarded as a process that corrected the excessive discounts.

Figure 14: Changes in Fundamental Prices and Discount after the Asian Financial Crisis



Note: The 80% confidence interval is a range that includes the eight near-average results among the 10 simulations based on different origin points. It is the “width” of the estimation.

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