An Empirical Analysis of Macrocosmic Response to Crude oil price volatility in China by using the Input-output Models

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Abstract.

Although the use of the input-output price model has been widely appreciated in public macroeconomics calculation way, the dynamic model is no less wide spread and is used more in theory and than in practice. From 1998 Chinese government reforms the price system of the domestic crude oil. When we exam the macroeconomic responses to oil price volatility, the initial model is out of data. In this paper a number of methodological refinements are proposed, including the formulation, for the first time, of an extended price model, based on the discrete time functions. The contribution of this paper is twofold. First, we develop a new model of input output (IO) price analysis based on the discrete time functions to measure the impact of oil price. Second, we apply the price volatility model (PVM) to explain the macroeconomic responses between Jun 04,1999 and Jun 04,2004 try to identify the volatility rate of price in the other 9 sections effects resulting from changes in oil price. This process enables us to establish the feedback measure not only between the oil prices and the price system but also between theory and application. It is a great advantage and an important tool for planners and decision-makers.

Keywords: Input-output price models; dynamic; discrete time functions; crude oil price

1. Introduction

Oil prices remain on important determinant of global economic performance. The magnitude of the direct effect of a given price increase depends on the share of the cost of oil in national income, the degree of dependence on imported oil and the ability of end-users to reduce their consumption and switch away from oil. Naturally, the bigger the oil-price increase and the longer higher prices are sustained, the bigger the macroeconomic impact. In this paper, we want to develop a price dynamic model to measure the impact of the price volatility of crude oil. China became the second largest oil consuming country, surpassing Japan in 2003, and has accounted for 40 percent of the world's oil-demand growth between 2000 and 2004. Beijing now imports one-third of the oil it consumes. From 1998 the benchmark price of domestic crude oil

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will be in line with the monthly FOB price plus tariff of similar crude oil on the international market and will be announced at the beginning of each month by the State Development Planning Commission (SDPC) of China.

Input output analysis is an important tools to measure the macroeconomic responses to oil price volatility in China. It is now nearly 60 years since economists first tried to formulate an input-output price model. The first version of Leontief 's physical model was not associated with an explicit price model (Leontief, 1966). The first version of the dynamic IO price model, in which the sales of each industry must just cover its current costs plus the full cost of required new capital goods, was formulated by Hawkins(Hawkins,1948).Leontief himself ignored the dynamic price theory in the first published version of his dynamic quantity theory (Leontief,1953).According to the first definition of the dynamic price theory as spelled out by Georgescu(Georgescu,1951),the price of each commodity must cover its current costs plus interest on the value of the capital equipment required per unit of output. Solow (Solow, 1959) referred to it as Roegen 's doctrine and felt it was more reasonable than Hawkins' model (Bazzazan.F, 2003). The result was a system of price and quantity variables for both the open and the closed economy under the assumption of fixed technical coefficients and full utilization and transferability of capital goods from one sector to another. From the above price model, we can see that the vast majority of price models rely on the fixed technical coefficients and the assumption that wages are apart of value added and value added is fixed even if the price of goods is changed, whereas in the real world the opposite is true.

The main aim of this paper is to provide answers to the following questions:

• What scope is there to develop an IO price model based on the discrete time functions, with the variable in technical and value added coefficients?

• What difference does such model development make when it comes to the measurement of impacts to crude oil price volatility in China?

In answering these questions we will focus initially upon the development of extended static and dynamic input-output price models. We will then turn our attention to constructing the models with available and adjusted data. Finally, we will test the models in an investigation of the price impacts of crude oil price volatility at the national level in China.

2. Dynamic prices model by using IO analysis based on the discrete time function.

The Dynamic prices model by using IO analysis based on the discrete time function model can be divided into three parts: forming model, impact model, and volatility model.

2.1 The price forming model

The Leontief price model is defined as a set of simultaneous linear equations in which the price each productive sector of the economy receives per unit of its output must be equal to the total costs incurred in the course of its production. Each equation describes the balance between the price received and the payment made by each endogenous sector per unit of its products. These costs usually comprise wages, interest on capital and entrepreneurial revenues credited to households, taxes paid to the government, and other payments by sectors (Leontief, 1986). The simple Leontief price forming model is expressed as follows:

$$P = (I - A^T)^{-1}(A_g + A_v + A_m) \quad (1)$$

$$A_g + A_v + A_m = V \quad (2)$$

Then:

$$P = PA + V \quad (3)$$

Where, P is a vector of commodity prices, A is the direct input coefficient, A_g is the coefficients of fixed assets depreciation, A_v is coefficients of labor income & welfare, A_M is the coefficients of social profits & Taxes. V is the added value coefficients.

Model (1) is a kind of static price model. By adding the discrete time function in it, we can get the dynamic price model. We put t into some time span and the backward lag is Δt . $t + \Delta t$ denotes the time span from the end of t to the end of $t + \Delta t$.

The dynamic price model can be shown as follows:

$$P(t) = P(t)A(t) + V(t) \qquad (4)$$

2.2 The price impact model

The construction of an extended dynamic price model requires a number of assumptions to be made. These assumptions can be summarized as follows:

• The assumption of the small and single country is the presupposition of our model. We assume China is a single and small country in the international market and the domestic price of crude oil hardly affect the price in the other countries. The assumption is accord to the real market where the domestic price of crude oil in the certain month is determined by the price in the international market in the before month.

• A distinction is made between crude oil sector and non crude oil sectors.

• A further distinction is made between the price in the sector adjusting the price forwardly and sectors change the price passively.

The partitioned matrix is used then (3) can be rewritten as follows:

$$p = (p_1 \quad p_2) = (p_1 \quad p_2)\begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix} + (v_1 \quad v_2) \qquad (5)$$

Thus:

$$\begin{aligned} P_1 &= P_1A_{11} + P_2A_{21} + V_1 \\ P_2 &= P_1A_{12} + P_2A_{22} + V_2 \end{aligned} \qquad (6)$$

Where, P is the price vector in sector n, P_1 is the price vector in sector We assume the front K sectors is the sectors adjust the price forwardly, as well as the first kind sectors; the back $n-k$ sectors is the sectors change the price passively, as well as the second kind sectors. P_1 is the price vector in the front K sectors. P_2 is price vector in the back $n-k$ sectors. The technical coefficients matrix is divided into four parts according to the sectors in the sectors K and $n-k$, V_1 is the added value coefficient vector in the sectors K. V_2 is the added value coefficient vector in the sectors $n-k$.

2.3 The price volatility model

We select the starting time point as t_0, then:

$$\begin{aligned} P_1(t_0) &= P_1(t_0)A_{11}(t_0) + P_2(t_0)A_{21}(t_0) + V_1(t_0) \\ P_2(t_0) &= P_1(t_0)A_{12}(t_0) + P_2(t_0)A_{22}(t_0) + V_2(t_0) \end{aligned} \qquad (7)$$

Where, $P_1(t_0)$ is the price vector in the front K sectors at time t_0, $P_2(t_0)$ is price vector in the back $n-k$ sectors at time t_0, $A_{11}(t_0)$ is the technical coefficients of the front sector K to the front sector K at time t_0, $A_{12}(t_0)$ is the technical coefficients of the front sector K to the back $n-k$ sectors, $A_{21}(t_0)$ is the technical coefficients of the back $n-k$ sectors to the front sector K at time t_0, $A_{22}(t_0)$ is the technical coefficients of the back $n-k$ sectors to the back $n-k$ sectors at time t_0, V_1 is the added value coefficient vector in the sectors K at time t_0. V_2 is the added value coefficient vector in the sectors $n-k$ at time t_0.

We assume:

$$\begin{aligned} P(t) &= P(t_0) + \Delta P(t) \\ A(t) &= A(t_0) + \Delta A(t) \\ V(t) &= V(t_0) + \Delta V(t) \end{aligned} \qquad (8)$$

$\Delta P(t)$ is the price volatility vector at time t, $\Delta A(t)$ is the technical volatility coefficients at time t, $\Delta V(t)$ is the added value volatility coefficient row vector at time t.

The backward lag between t and t_0 can be selected at discretion, in our empirical model in China the basic unit of t is one month and $t - t_0 = 1$ month. Commonly the more time in the back lag ,the more change will occur in the volatility parameter in $\Delta P(t)$, $\Delta A(t)$, $\Delta V(t)$.

Then:

$$P_1(t_0) + \Delta P_1(t) = [P_1(t_0) + \Delta P_1(t)]A_{11}(t) + [P_2(t_0) + \Delta P_2(t)]A_{21}(t) + V_1(t) \qquad (9)$$

$$P_2(t_0) + \Delta P_2(t) = [P_1(t_0) + \Delta P_1(t)]A_{12}(t) + [P_2(t_0) + \Delta P_2(t)]A_{22}(t) + V_2(t) \qquad (10)$$

Where, $\Delta P_1(t)$ is the price volatility at the time t in the front K sectors.

$\Delta P_2(t)$ is the price volatility at the time t in the back $n-k$ sectors.

At the time point of t, because $\Delta P_1 \neq 0$, $P_1(t_0) + \Delta P_1(t)$ is the price adjusted forwardly by the international market price ,so the equation (9)don’t come into existence. The explain of the economic meanings come from the first assumption above of small and single country. It means

$P_1(t_0)+\Delta P_1(t)$ is not the input output equilibrium price in the front K sectors. While the back $n-k$ sectors are regarded as the sector adjusting the price passively, equation (10) can come into existence.

Thus:

$$\Delta P_2(t)[I-A_{22}(t)] = P_1(t_0)A_{12}(t)+\Delta P_1(t)A_{12}(t)+P_2(t_0)A_{22}(t)+V_2(t)-P_2(t_0) \qquad (11)$$

If $[I-A_{22}(t)]$ is reversible (we can get the result from the common economic system).

We discuss as follows:

When $\Delta A(t)=0$， $\Delta V(t)=0$ (12)

The meanings are the direct input coefficient and the added value coefficients hold the line in short time interval. Then:

$$\Delta P_2(t)[I-A_{22}(t_0)] = \Delta P_1(t)A_{12}(t_0) \qquad (13)$$

In this section we explore further development of the extended price volatility models in order that they may be used to measure the impacts of crude oil price volatility. The model will also provide a measure of the impacts of crude oil price volatility on production prices with the volatility of the direct input and the added value coefficient.

(13) come from three assumption: Ⅰ.China is a single and small country in the international crude oil market.Ⅱ. the technical coefficients (A) will not change .Ⅲ. the value added coefficients (V) will not change. The Ⅱand Ⅲ can’t be accord to the fact at all. In our price model, when the time span is long, the price in the other sector will changed greatly. And the volatility of price in the international market will affect the price in the domestic market. Many sectors will adjust their structure of the production by choosing the cheaper resources. Then the technical coefficient of crude oil will changed greatly. Generally, longer the time span is, greater the change of the technical coefficient will be, as well as the value added coefficients.

When $\Delta A(t)=0$ $\Delta V(t)\neq 0$ (14)

The economical meanings of this formula are that the economical and technological structure will not be changed in short times. In our price model, we follow this assumption when the analysis span is shorter than 12 months. Because our calculation base is Input-output table in July, 1999, we will use the (14) to calculate the data from July, 1999 to July, 2000.

Then:

$$\Delta P_2(t)[I - A_{22}(t_0)] = \Delta P_1(t) A_{12}(t_0) + \Delta V_2(t) \qquad (15)$$

When $\Delta A(t) \neq 0 \qquad \Delta V(t) \neq 0 \qquad (16)$

In our price model, we follow this assumption when the analysis span is longer than 12 months.

Then:

$$\Delta P_2(t)[I - A_{22}(t_0) - \Delta A_{22}(t)] = P_1(t_0)\Delta A_{12}(t_0) + \Delta P_1(t) A_{12}(t_0) + \Delta P_1(t)\Delta A_{12}(t) + P_2(t_0)\Delta A_{22}(t) + \Delta V_2(t)$$

(17)

We can get $P_1(t_0)$ and $P_2(t_0)$ from (7),When $[I - A_{22}(t_0)]$, $[I - A_{11}(t_0)]$, $[I - A_{22}(t_0) - \Delta A_{22}(t)], \{I - A_{12}(t_0)[I - A_{22}(t_0)]^{-1} A_{21}(t_0)[I - A_{11}(t_0)]^{-1}\}$ is reversible (we can get the result from the common economic system).(17) can be rewritten as follows:

$$\begin{aligned}
&\Delta P_2(t) = \{\{V_2(t_0)[I - A_{22}(t_0)]^{-1} A_{21}(t_0)[I - A_{11}(t_0)]^{-1} + V_1(t_0) \\
&[I - A_{11}(t_0)]^{-1}\}[I - A_{12}(t_0)[I - A_{22}(t_0)]^{-1} A_{21}(t_0)[I - A_{11}(t_0)]^{-1}]^{-1} \\
&\Delta A_{12}(t_0) + \Delta P_1(t) A_{12}(t_0) + \Delta P_1(t)\Delta A_{12}(t) + \{\{V_2(t_0)[I - A_{22}(t_0)]^{-1} \\
&A_{21}(t_0)[I - A_{11}(t_0)]^{-1} + V_1(t_0)[I - A_{11}(t_0)]^{-1}\}[I - A_{12}(t_0)[I - A_{22}(t_0)]^{-1} \\
&A_{21}(t_0)[I - A_{11}(t_0)]^{-1}]^{-1} A_{12}(t_0)[I - A_{22}(t_0)]^{-1} + V_2(t_0)[I - A_{22}(t_0)]^{-1}\} \\
&[I - A_{22}(t_0) - \Delta A_{22}(t)]^{-1}\Delta A_{22}(t) + \Delta V_2(t)\}
\end{aligned} \qquad (18)$$

We can see from the analysis process that (18) can be used to calculate the result from July 2000 to July 2004 because the change of V and A in our price model.

We discuss the equation (18):

When $\Delta A_{12}(t) \neq 0$, $\Delta A_{22}(t) = 0$ (19)

The economical meanings of the assumption is that the technological coefficients of non crude oil sector assuming oil crude will change, while the technological coefficients of non crude oil sector assuming other resources will not change.

Then:

$$[I - A_{22}(t_0)]\Delta P_2(t) = P_1(t_0)\Delta A_{12}(t_0) + \Delta P_1(t) A_{12}(t_0) + \Delta P_1(t)\Delta A_{12}(t) + \Delta V_2(t) \qquad (20)$$

Thus:

$$\begin{aligned}
&\Delta P_2(t) = \{\{V_2(t_0)[I - A_{22}(t_0)]^{-1} A_{21}(t_0)[I - A_{11}(t_0)]^{-1} + V_1(t_0)[I - A_{11}(t_0)]^{-1}\} \\
&[I - A_{12}(t_0)[I - A_{22}(t_0)]^{-1} A_{21}(t_0)[I - A_{11}(t_0)]^{-1}]^{-1} \Delta A_{12}(t_0) \\
&+\Delta P_1(t) A_{12}(t_0) + \Delta P_1(t) \Delta A_{12}(t) + \Delta V_2(t)\}[I - A_{22}(t_0)]^{-1}
\end{aligned} \tag{21}$$

The assumption of (21) can be extended. When the price of crude oil sector changes its price accord to the international market, there are other k-1 sectors changing their price forwardly. Then the price volatility rate of the left n-k sectors can be calculated from (21).

3. Empirical Analysis of the Macroeconomic Responses to oil price volatility in China

After China's oil prices are pegged to the international market, the wellhead price of domestic crude oil will be about equal to that of imported products. This new pricing system is a final move to free China's oil industry from the planned economy and the start of what may be fierce competition on the international market. The dynamics of change in China price system are consequently a project with a long time span, distinctive character and complex structure. The empirical analysis of the macroeconomic responses to oil price volatility in China can give the useful decision support.

3.1 Data issue

3.1.1 Crude oil price volatility rate data

Information about oil prices is available with a higher frequency such as on monthly or even daily basis. Because our model select the lag as one month, monthly oil price data have the advantage of a large number of observations, and hence allow for a more thorough testing of the corresponding impact. The oil prices in international market between Jun.04 1999 to Jun.04 2004 can be shown in Figure 1.The data in the figure suggests that oil prices in international market exhibit volatility clustering just by eyeballing the data. Here, we take a formal approach by exploring some summary statistics of the monthly oil price data .The all countries spot price FOB is weighted by estimated Export volume. The volatility rate is based as the data on Jun.04, 1999.

3.1.2 Foreign Trade Input -Output (IO) tables of China.

The process outlined in this work presents requirement for IO tables. A foreign trade IO tables of China for 1995 （Chen,2004）is modified and shorten to 19 sectors and is the main data resource for our calculation. The import production has been outlines separately along with the quantities used in the intermediate input and final demand in Foreign Trade Input -Output (IO) tables of China. The style of the table can be showed in table 1:

3.2 The price volatility model

We use the following formula:

$$\begin{aligned} &\sum_{i=1}^{n} X_{ij}^{D} + Y_i^{D} = X_i \qquad (\mathrm{i}=1,2,\ldots\ldots,\mathrm{n}) \\ &\sum_{i=1}^{n} X_{ij}^{M} + Y_i^{M} = M_i \qquad (\mathrm{i}=1,2,\ldots\ldots,\mathrm{n}) \end{aligned} \qquad (22)$$

Where, X_{ij} is the square matrix ($n \times n$) of the inter-branch flows of intermediate uses . Each element of this matrix is the output of the branch i earmarked for branch j, and is the input of the branch j to branch i, X_i is the column vector ($n \times 1$) of gross output (total production). Y_i is the column vector ($n \times 1$) of the final demand , M_i is the column vector ($n \times 1$) of the export. The superscript D is the domestic production and M is export production.

The table has the advantage of a large number of observations, and hence allow for a more thorough testing of the importance of lags in determining variances. The time series on oil prices can go back up to Jun.04, 1999.We will apply our volatility measure on monthly data that captures a longer time span and use our measure to explain the macroeconomic response. Given our main objective, the analysis of the impact of oil price. Given our main objective, the analysis of the impact of oil price volatility on the relationship between oil price and other sectors price, we need to establish the price volatility model due to the real status in China.

We regard the price in the sector of Crude oil in the foreign trade IOO tables as the average price of the crude oil. The price-forming model can be shown as:

$$P=\left(P_1\ ,\ P_2\right)=\left(P_1\ ,\ P_2\right)\begin{pmatrix}A_{11}^D & A_{12}^D\\ A_{21}^D & A_{22}^D\end{pmatrix}+\left(P_1^M\ ,P_2^M\right)\begin{pmatrix}A_{11}^M & A_{12}^M\\ A_{21}^M & A_{22}^M\end{pmatrix}+\left(A_1^V\ ,A_2^V\right) \qquad (23)$$

Here, the superscript D is the domestic production and M is export production. P is a vector of commodity prices, A is the direct input coefficient. A^V is the value added coefficient.

We assume the front K sectors are the sectors adjust the price forwardly, as well as the first kind sectors; the back $n-k$ sectors are the sectors adjust the price passively, as well as the second kind sectors.

The corresponding model of the price-forming model can be shown as:

$$\begin{aligned}P^D{}_1&=P^D{}_1A_{11}+P_2{}^DA_{21}+P^M{}_1A_{11}+P_2{}^MA_{21}+V_1\\ P^D{}_2&=P^D{}_1A_{21}+P_2{}^DA_{22}+P^M{}_1A_{12}+P_2{}^MA_{22}+V_2\end{aligned} \qquad (24)$$

Select the basic time point t_0, the model based on the discrete time functions can be shown as:

$$\begin{aligned}P^D{}_1(t_0)&=P^D{}_1(t_0)A_{11}(t_0)+P_2{}^D(t_0)A_{21}(t_0)+P^M{}_1(t_0)A_{11}(t_0)+P_2{}^M(t_0)A_{21}(t_0)+V_1(t_0)\\ P^D{}_2(t_0)&=P^D{}_1(t_0)A_{21}(t_0)+P_2{}^D(t_0)A_{22}(t_0)+P^M{}_1(t_0)A_{12}(t_0)+P_2{}^M(t_0)A_{22}(t_0)+V_2(t_0)\end{aligned} \qquad (25)$$

We assume that:

$$\begin{aligned}P^M(t)&=P^M(t_0)+\Delta P^M(t)\\ P^D(t)&=P^D(t_0)+\Delta P^D(t)\\ A(t)&=A(t_0)+\Delta A(t)\\ V(t)&=V(t_0)+\Delta V(t)\end{aligned} \qquad (26)$$

Due to the real status in China, there is another assumption:

• There is only one sector adjust the price forwardly.

We assume China is a single and small country in the international market and the domestic price of crude oil hardly affect the price in the other countries. The assumption is accord to the real market where the domestic price of crude oil in the certain month is determined by the price in the international market in the before month. Then we get the formula as follows:

$$P(t)=\bar{P}_I(t-1) \qquad (27)$$

Where, $P(t)$ is the domestic price of crude oil in the certain month, $\bar{P}_I(t-1)$ is the international market price in the before month.

• Due to the assumption of single and small country, we can make another assumption that the import prices in the second kind of sectors are not affected by the import price of crude oil. That can be shorten as $\Delta P^{D}{}_{1}(t)$ is affected by $\Delta P^{M}{}_{1}(t)$ entirely, $\Delta P^{M}{}_{2}(t)$ is hardly affected by $\Delta P^{M}{}_{1}(t)$.

• The time lag in our model is one month, which is outlined as $t - t_0 = 1$ (month). Then:

$$P^{D}{}_{1}(t) = P^{D}{}_{1}(t_0) + \Delta P^{D}{}_{1}(t) = P^{M}{}_{1}(t_0) \qquad (28)$$

$$\Delta P^{M}{}_{2}(t) = 0 \qquad (29)$$

We assume that:

$$\Delta P^{M}{}_{1}(t) = \alpha P^{M}{}_{1}(t_0)$$
$$\Delta P^{D}{}_{2}(t) = \beta P^{D}{}_{2}(t_0) \qquad (30)$$

α (%) is the growth rate of the international market price of the crude oil (see Table 2). β is the volatility rate of the domestic price of the non-oil sectors. The data of α can be regards as the empirical data. β is a row vector. If $I - A_{22}(t)$, $P_2^{\ D}(t_0)$ is reversible, then:

$$\beta = \{P^{M}{}_{1}(t_0)[A_{21}(t) + A_{12}(t) + \alpha A_{12}(t)] + P_2^{\ D}(t_0)[A_{22}(t) - I] + P_2^{\ M}(t_0)A_{22}(t) + V_2(t)\}[I - A_{22}(t)]^{-1} P_2^{\ D}(t_0)^{-1}$$

(31)

Then we can get the main month price volatility rate (β) in 9 sectors between Jun 04,1999 and Jun 04,2004 in Table 2.

4. Conclusion

This paper focuses on the Leontief price model, investigating ways in which it can be extended and exploring the effects of such extensions in a policy analysis context. The economies of oil-importing developing countries would suffer most from higher oil prices because our economies are more dependent on imported oil. In addition, energy-intensive manufacturing generally accounts for a larger share of their GDP and energy is used less efficiently. The economic stimulus provided by higher oil price would be outweighed by the depressive effect of higher prices on economic activity.

Table 1. Foreign Trade Input Output (IO) tables of China

<table>
<tr><td colspan="3" rowspan="2"></td><td>Intermediate Demands</td><td colspan="6">Final Demands</td><td>Total output and import</td></tr>
<tr><td>1，2，…，n</td><td>Consumption</td><td>Capital goods</td><td colspan="2">Export</td><td>Total</td><td></td></tr>
<tr><td rowspan="4">Input</td><td>Intermediate input of domestic production</td><td>1
2
.
.
n</td><td>X_{ij}^{D}</td><td></td><td></td><td></td><td></td><td>Y_i^{D}</td><td>X_i</td></tr>
<tr><td>Intermediate input of import production</td><td>1
2
.
.
n</td><td>X_{ij}^{M}</td><td></td><td></td><td></td><td></td><td>Y_i^{M}</td><td>M_i</td></tr>
<tr><td colspan="2">Primary input</td><td>V_j</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Total input</td><td>X_j</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Table 2. Crude Oil price volatility rate and the other 9 sectors price volatility rate

Date	Crude Oil Price (US$ per barrel)	Growth rate of Crude oil (%)	Price volatility rate of each sector								
			Oil & Refineries	Electricity	Agriculture	Chemical Industries	Building Materials	Ferrous Metals	Heavy Mach. & Electronics	Passenger Transport	Commerce
Jun 04, 1999	14.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jul 02, 1999	16.28	14.54	11.69	1.89	0.28	1.06	0.89	0.72	0.17	2.69	0.63
Aug 06, 1999	18.74	31.84	25.60	4.14	0.61	2.31	1.96	1.57	0.38	6.17	1.38
Aug 27, 1999	19.78	39.16	33.11	5.28	0.79	2.84	2.35	2.01	0.47	7.59	3.38
Sep 03, 1999	20.09	41.38	33.27	5.38	1.15	3.00	2.54	2.04	0.50	8.02	1.79
Oct 01, 1999	22.68	59.54	47.87	7.74	0.99	4.33	3.66	2.92	0.71	11.04	2.57
Nov 05, 1999	21.49	51.18	41.15	6.65	1.37	3.72	3.14	2.51	0.61	9.49	2.21
Dec 03, 1999	24.33	71.21	57.25	9.26	1.39	5.18	4.37	3.50	0.85	13.20	3.07
Dec 31, 1999	24.42	71.84	57.76	9.34	1.22	5.22	4.41	3.53	0.85	13.32	3.10
Jan 07, 2000	23.17	62.99	50.65	8.19	1.59	4.58	3.87	3.09	0.75	11.68	2.71
Feb 04, 2000	25.95	82.61	66.42	10.74	1.76	6.01	5.07	4.06	0.98	15.32	3.56
Mar 03, 2000	27.15	91.03	73.19	11.83	1.25	6.62	5.59	4.47	1.08	16.88	3.92
Apr 07, 2000	23.39	64.55	51.90	8.39	1.37	4.69	3.96	3.17	0.77	11.97	2.78
May 05, 2000	24.29	70.91	57.01	9.22	1.83	5.16	4.35	3.48	0.84	13.15	3.06
Jun 02, 2000	27.72	95.00	76.38	12.35	1.96	6.91	5.83	4.66	1.13	17.61	4.09
Jul 07, 2000	28.70	101.91	81.95	13.25	1.49	7.41	6.26	5.01	1.22	18.89	4.40
Aug 04, 2000	25.21	77.35	62.19	10.06	2.22	5.62	4.75	3.80	0.61	14.34	3.33
Sep 01, 2000	30.59	115.20	92.63	14.98	1.92	8.37	7.07	5.66	1.37	21.35	4.97
Oct 06, 2000	28.33	99.29	79.83	12.91	2.05	7.22	6.10	4.88	1.18	18.41	4.28
Nov 03, 2000	29.37	106.62	85.73	13.86	2.09	7.75	6.55	5.24	1.27	19.76	4.60
Dec 01, 2000	29.66	108.70	87.40	14.13	1.07	7.90	6.67	5.34	1.30	20.15	4.69
Jan 05, 2001	22.10	55.48	44.61	7.21	1.43	4.03	3.41	2.72	0.66	10.29	2.39
Feb 02, 2001	24.76	74.23	59.68	9.65	1.25	5.40	4.56	3.64	0.88	13.76	3.20
Mar 02, 2001	23.44	64.90	52.18	8.44	1.16	4.72	3.98	3.19	0.77	12.03	2.80
Apr 06, 2001	22.76	60.12	48.34	7.82	1.52	4.37	3.69	2.95	0.72	11.15	2.59
May 04, 2001	25.38	78.60	63.19	10.22	1.68	5.71	4.83	3.86	0.94	14.57	3.39
May 25, 2001	26.61	87.24	70.14	11.34	1.68	6.34	5.36	4.28	1.04	16.18	3.76
Jun 01, 2001	26.55	86.83	69.81	11.29	1.28	6.31	5.33	4.26	1.03	16.10	3.74
Aug 03, 2001	23.61	66.14	53.18	8.60	1.45	4.81	4.06	3.25	0.79	12.26	2.85
Sep 07, 2001	24.90	75.21	60.47	9.78	0.80	5.47	4.62	3.69	0.89	13.94	3.24
Oct 05, 2001	20.09	41.37	33.26	5.38	0.56	3.01	2.54	2.03	0.49	7.67	1.78
Nov 02, 2001	18.31	28.84	23.19	3.75	0.43	2.10	1.77	1.42	0.34	5.35	1.24
Dec 07, 2001	17.35	22.06	17.74	2.87	0.61	1.60	1.35	1.08	0.26	4.09	0.95

14 Jing He

Jan 04, 2002	18.68	31.39	25.24	4.08	0.48	2.28	1.93	1.54	0.37	5.82	1.35
Feb 01, 2002	17.77	25.01	20.11	3.25	0.67	1.82	1.54	1.23	0.30	4.64	1.08
Mar 01, 2002	19.16	34.83	28.00	4.53	1.44	2.53	2.14	1.71	0.41	6.46	1.50
Apr 05, 2002	24.83	74.71	60.07	9.71	1.40	5.43	4.59	3.67	0.89	13.85	3.22
May 03, 2002	24.50	72.38	58.19	9.41	1.10	5.26	4.44	3.55	0.86	13.42	3.12
Jun 07, 2002	22.31	56.97	45.80	7.41	1.35	4.14	3.50	2.80	0.68	10.56	2.46
Jul 05, 2002	24.14	69.84	56.15	9.08	1.40	5.08	4.29	3.43	0.83	12.95	3.01
Aug 02, 2002	24.51	72.45	58.25	9.42	1.61	5.27	4.45	3.56	0.86	13.43	3.12
Sep 06, 2002	26.07	83.42	67.07	10.85	1.80	6.06	5.12	4.10	0.99	15.47	3.60
Oct 04, 2002	27.44	93.06	74.82	12.10	1.40	6.77	5.71	4.57	1.11	17.25	4.01
Nov 01, 2002	24.53	72.59	58.36	9.44	1.37	5.28	4.46	3.56	0.86	13.46	3.13
Dec 06, 2002	24.27	70.76	56.89	9.20	2.01	5.14	4.34	3.47	0.84	13.12	3.05
Jan 03, 2003	29.03	104.25	83.82	13.55	2.14	7.58	6.40	5.12	1.24	19.32	4.50
Feb 07, 2003	30.00	111.07	89.31	14.44	2.37	8.07	6.82	5.46	1.33	20.59	4.79
Mar 07, 2003	31.71	123.11	98.99	16.00	1.47	8.95	7.56	6.05	1.47	22.82	5.31
Apr 04, 2003	25.01	75.97	61.08	9.88	1.06	5.52	4.66	3.73	0.90	14.08	3.27
May 02, 2003	22.04	55.07	44.28	7.16	1.56	4.00	3.38	2.70	0.66	10.21	2.37
Jun 06, 2003	25.72	80.96	65.09	10.52	1.67	5.89	4.97	3.98	0.96	15.01	3.49
Jul 04, 2003	26.52	86.59	69.62	11.26	1.69	6.30	5.32	4.25	1.03	16.05	3.73
Aug 01, 2003	26.66	87.57	70.41	11.38	1.74	6.37	5.38	4.30	1.04	16.24	3.77
Sep 05, 2003	27.05	90.32	72.62	11.74	1.64	6.57	5.55	4.43	1.07	16.75	3.89
Oct 03, 2003	26.29	84.97	68.32	11.05	1.64	6.18	5.22	4.17	1.01	15.75	3.66
Nov 07, 2003	26.28	84.90	68.26	11.04	1.77	6.17	5.21	4.17	1.01	15.74	3.66
Dec 05, 2003	27.23	91.59	73.63	11.91	1.87	6.66	5.62	4.50	1.09	16.98	3.95
Jan 02, 2004	28.00	97.00	77.99	12.61	1.81	7.05	5.96	4.76	1.15	17.98	4.18
Feb 06, 2004	27.56	93.93	75.52	12.21	2.26	6.83	5.77	4.61	1.12	17.41	4.05
Mar 05, 2004	30.88	117.27	94.29	15.24	2.15	8.52	7.20	5.76	1.40	21.73	5.06
Apr 02, 2004	30.07	111.56	89.70	14.50	2.63	8.11	6.85	5.48	1.33	20.68	4.81
May 07, 2004	33.63	136.63	109.86	17.76	2.86	9.93	8.39	6.71	1.63	25.32	5.89
Jun 04, 2004	35.29	148.32	119.26	19.28	2.97	10.78	9.11	7.29	1.77	27.49	6.40

Appendix

Data Sources:

OECD international sectoral database

OECD Structural analysis database

Energy Balances

And own calculations

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