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Effects of the Prices of Imported Crude Oil on China's Economy

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China's well-established energy policy, which prescribes that the optimization of the energy portfolio should be based on home and relies mainly on coal, has made the country's energy consumption structure much inferior to the world advanced level, though the total production has, in the main, satisfied the demand for domestic economic growth. Since the 1990s, the rapid development of China's economy has been accompanied by the rising energy consumption and an accelerated incremental increase in energy import, especially the import of petroleum. The linking of China's oil prices with the price system of the world in 1998 has tied the country's economic development to the fluctuation of crude oil prices in the international energy market that has, since the year 2000, especially 2004, become continuously unstable, with the constant appearance of new peaks of the already high oil prices. In 2007, the price of oil has continued to rise, breaking the highest historical record of US\$74 per barrel. The soaring price has given rise to a considerable increase in the energy cost of China's economic growth, making energy safety one of the problems over which the society has expressed grave concern.

The paper first examines the relationship between economic development and energy consumption, which is followed by an industrial-related analysis of the effects of the fluctuating crude oil prices on the international market upon China's economy. The exploration of China's energy strategy from the economic perspective is also conducted.

I. China's Economic Development and the Increase of Energy Consumption

Since the reform and opening-up, China's economy has been growing very fast. Its GDP, which was RMB 364.5 billion in 1978, had reached 18.3098 trillion in 2005, a hike of 51 times. The GDP growth rate exceeded 10% in the first half of the 1990s, maintained 7-8% in the second half and went up to 9.9% in 2005. The rapid economic development has

caused high-speed growth of demand for energy, and consequently China has become the world's second largest consumer of energy after the U.S.. China's energy consumption rose at an annual rate of 5.2% from 571.44 million tons in 1978 to 2233.79 million tons in 2005, an increase of about 4.9 times.

In order to clearly define the relationship between China's GDP and energy consumption, the regression equation is used to calculate the elasticity coefficients of energy consumption from 1990 to 2005. The result is, every one percent of GDP growth in China contributes to 0.295% of energy consumption increase. (Fig 1)

$\ln E = 8.553 + 0.295 \ln Y$ $(20.79) \quad (7.95)$ $R^2 = 0.819$ <p style="font-size: small;">The digit in () is standard error</p>
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From this result, China's energy consumption in 2020 can be predicted. By taking 2005 as the base year and on the premise of IEA estimation of China's GDP growth rate in 2010 and 2020, which is 6% and 5% respectively, the paper forecasts that the country's energy consumption growth rate could reach 1.78% in 2010 and 1.48% in 2020, with the total energy consumption 2437.95 million tons in 2010 and 2781.71 million tons in 2020.

II. Changes of China's Import of Crude Oil

As the volume of energy consumption increases, significant changes have also taken place in the structure of energy consumption. Since 1990, new energy sources like petroleum, natural gas, hydropower and atomic energy have become more and more widely used whereas the consumption of coal has been dwindling. The proportion of coal consumption had fallen from 76.2% in 1990 to 68.9% in 2005; that of petroleum, on the contrary, had risen from 16.6% in 1990 to 21.0% in 2005. From this it can be concluded that the coal consumption, which still dominates China's energy portfolio, is now in decline whereas the petroleum consumption, the volume of which was 100 million tons in 1988, topped 200 million tons in 1999 and reached 320 million tons in 2005, is on the increase.

The secondary industry, the principle cause of these changes, contributes to 70% or so of China's energy consumption. With the popularization of cars, residential energy consumption is also bound to increase in the near future.

Since the 1990s, the major oilfields in eastern China such as Daqing and Shengli has entered their later development period and their oil production has been diminishing. A notable example is that the production of Daqing Oilfield in 2003 fell below 50 million tons. Petroleum development in the western area like Xinjiang has yet achieved expected effects

despite the breakthroughs in the development of natural gas. Offshore oilfields are also not able to become major oilfields due to technological and environmental constraints. Overall, the cutbacks in the eastern oilfields and the production increase in the western and offshore oilfields have resulted in a mild increase in crude oil production.

In order to fill the supply/demand gap, crude oil and petroleum products have been imported from other countries. The increase of import and the reduction of export have made China become a net importer of petroleum products in 1993 and of crude oil in 1996. The imported crude oil in 2005 made up one third of the total amount of domestic consumption. From 1990 to 2005, the growth rate of petroleum consumption (6.7%) has considerably exceeded that of domestic petroleum production (1.6%).

In 2006, China's crude oil import went up to 145 million tons, an increase of 15% above that of the same period of the year before. This expansion has been accompanied by the changes in the geographical distribution of the origins of import.

III. Economic Effects of the Prices of Imported Crude Oil

With the increase of the world petroleum consumption, the crude oil price on the international market has begun to go upward since 1999. The pace accelerated in the second half of 2004, the price of WTI crude oil soaring to US\$41 per barrel. It broke the US\$70 per barrel mark and hit an all-time high in August 2005, subsequent to the hurricane that stroke the U.S. The average price of WTI crude oil was US\$56 per barrel during that year. On 16th April, 2006, the closing price reached US\$70 per barrel.

The soaring crude oil prices have had a profound impact on the energy, economy and political status of the world, thus becoming a major concern of the international community. In recent years, with a deepening understanding of this problem, some international institutions have set about correcting the predictive values of long-term crude oil prices. For instance, according to the data published by IEA in November 2005, the crude oil price is going to reach US\$39 per barrel in 2030 (based on the real price of 2004), US\$10 above the value predicted a year before (2004). Another forecast made by IEA is that if the investment on oilfields is insufficient, the crude oil price will grow even higher and get at US\$52 per barrel in 2030, which indicates the ongoing structural change on the international petroleum market. On the other hand, the rise of crude oil prices has also caused significant changes in business operation and people's lifestyle.

The mathematical model below is used in the paper to analyze the effects of the rising prices of imported crude oil on China's economy.

$$(1 + \Delta)\mathbf{p}^d = [\mathbf{I} - (\mathbf{I} - \hat{\mathbf{M}})\mathbf{A}]^{-1T} [(\hat{\mathbf{M}}\mathbf{A})^T (1 + \alpha)\mathbf{p}^m]$$

(\mathbf{p}^m : the price vector of import crude oil in RMB. \mathbf{p}^d : the price vector of domestically

produced wealth. V : the price vector of added value. A : the determinant of input coefficients. \hat{M} : variety. M_i/X_i : diagonal determinant. $\alpha \times 100\%$: the change of price and its effects)

Fig 2 is an input-output table (17 sectors) designed on the basis of China's CIF crude oil prices from 2002 to 2006. The paper also introduces how to develop an input-output table of China. Considering that the crude oil price is settled in RMB instead of U.S. dollars in China, the fluctuation of exchange rates also affects the import price. For example, when RMB appreciates, the increased amount of crude oil prices can be counter-balanced to some extent. The central parity of the RMB against the U.S. dollar is 8.2770 yuan to one U.S. dollar in 2002 and decreased to 8.0093 yuan to one U.S. dollar in 2006.

The result of the analysis is that the petroleum processing industry and the coke production industry, the cost expenditures of which rose by 159.3%, are most subject to the crude oil prices on the international market. The manufacturing industry is also affected by the prices (Fig 2). The seven sectors where the costs rose by over 50% make up 41.2% of all included in this table. Come first are the petroleum processing industry, coke production industry and gas industry, successively followed by metal products industry (82.9%), chemical industry (74.1%), food manufacturing industry (70.8%) and construction industry (67.9%). From this we can see that the sectors affected by crude oil prices are heavily concentrated in the manufacturing industry. The costs of the service industry that is relatively immune to the changing prices also went up by 15% plus.

Overall, it is the secondary industry, whose development determines China's economic structure, that is most influenced by the prices of imported crude oil. Since the price has been going up and that the changes of industrial structure will not take place for now, China's economy is subject to the crude oil prices.

In consequence of the expensive petroleum, the production cost of the society as well as the life expenditures of the people has been increased.

IV. Conclusion

1. The sharp increase of energy consumption in China is determined by the current industrial structure. The country's shift from a coal-dependent to a petroleum-dependent nation has made the development of the secondary industry rely on multiple energy sources. Such an industrial structure can be easily influenced by the prices of crude oil on the international market. In fact, in a country with abundant coal resource like China, more attention should be paid to the comprehensive use of different sources of energy.

2. The insufficient energy supply in China has much to do with the low efficiency of energy utilization. Therefore great efforts should be made to develop and popularize

energy-saving machines.

3. China's petroleum import that has been going up year by year has had a great impact on the national economy. A potential solution is that we increase the development and investment of overseas petroleum while developing domestic petroleum so that we can gain initiative in energy issues.

4. Another factor that has made China's economy subject to the fluctuation of crude oil prices on the international market is the small amount of oil reserves. Thus strategic oil reserves can be a good way out.

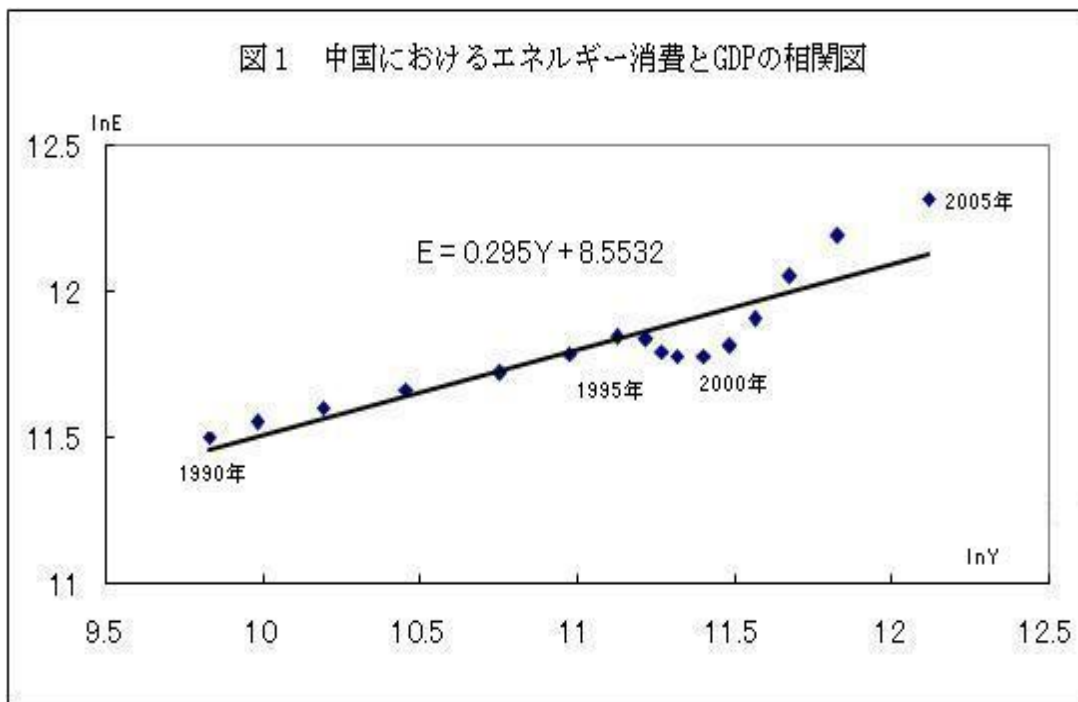
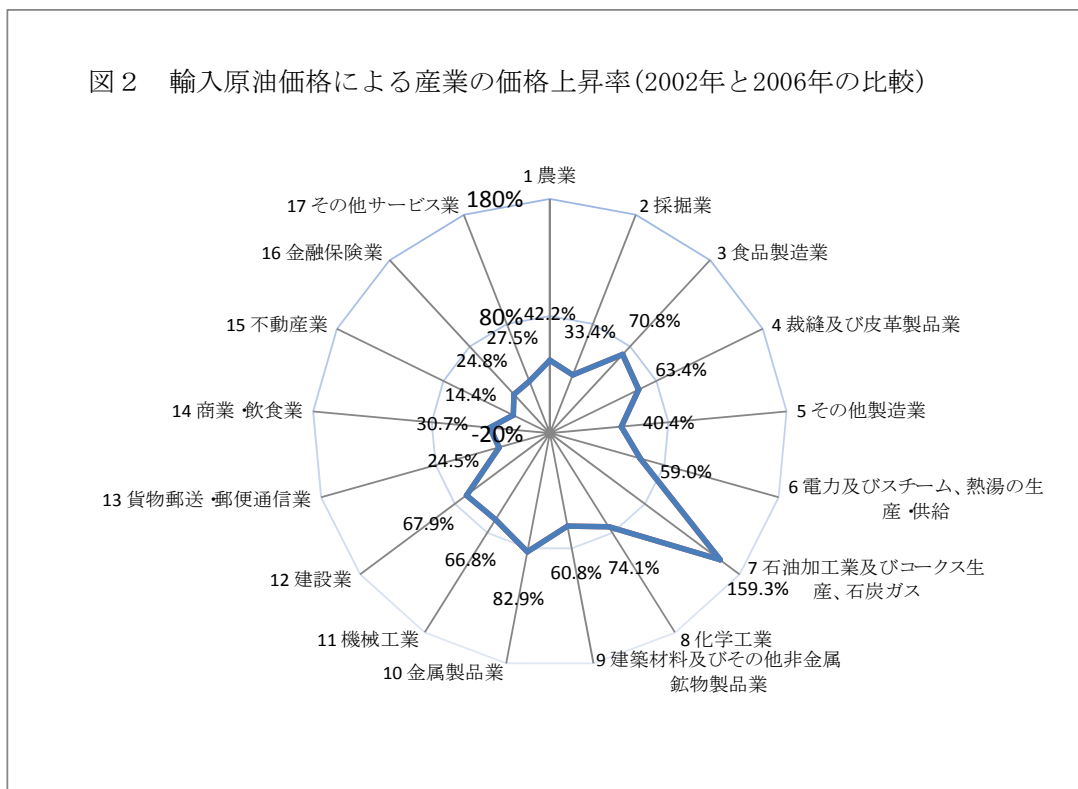


図2 輸入原油価格による産業の価格上昇率(2002年と2006年の比較)



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