A Study on the Effects of Energy Saving on China Economy Using Mudan Model

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China's economy has been developing rapidly since 1980s. However, the high speed of development was accompanied with high energy consumption. The energy consumption per unit GDP in China is much higher than that in developed countries. This situation will not support a sustainable development in the future. In order to solve this problem, Chinese government set a target to reduce 20% energy consumption in the 11th five years plan from 2006 to 2010. In this paper we use Mudan model to do some simulation experiments to study the effects of energy saving on China's economy. The simulations are as follows.

(1) Reducing energy consumption.

(2) Raising vehicle's fuel efficiency.

Simulation Ⅰ : Reducing energy consumption

In China's 11th five years plan, the government plans to reduce 20% energy consumption per unit GDP. Coal, crude oil and natural gas are China's main energy resource, composing 94.2% of China's total energy consumption. So the simulation is to study the effect of reducing consumption coal, crude oil and natural gas.

Mudan is a Multisectoral dynamic model of China economy, which is based on a 59-sector I-O table. The input coefficients of Mudan model reflect the input-output connections of all 59 industrial sectors. Reducing energy consumption means that the input coefficients of coal, crude oil and natural gas sectors to all 59 sectors are reduced. We can simulate the effect of reducing energy consumption by changing the input coefficients of these sectors to 59 sectors.

In base run, we keep the input coefficients of coal, crude oil and natural gas to 59 sectors at current level. In the simulation run, we decrease the input coefficients of coal, crude oil and natural gas to 59 sectors by 4% every year from 2006 to 2010. The results of this simulation are shown in table 1.

Table 1 Effects of Reducing energy consumption

Unit：100 million Yuan

Index (real)		2006	2007	2008	2009	2010	2006 percent change	2007 percent change	2008-2010 percent change
GDP	Base run	95858.9	106595	117574.3	129684.4	143041.9	11.2	11.5	10.2
	Simulation	96981.3	11901.2	12341.5	14521.4	149031.9	11.6	12.0	10.8
Urban Consumption	Base run	26974.8	30400.5	34079.0	38202.5	42825.0	12.7	12.9	12.1
	Simulation	27484.2	31983.1	34991.0	39345.1	43134.1	13.0	13.3	12.6
Rural Consumption	Base run	12744.0	13941.9	15127.0	16412.8	17807.8	9.4	9.1	8.5
	Simulation	13345.2	14293.8	16983.1	17990.2	18489.3	9.7	9.8	9.2
Fixed Investment	Base run	40572.3	44832.4	49539.8	54741.5	60489.3	10.5	10.7	10.6
	Simulation	42234.9	45873.1	50938.3	55903.1	61583.1	10.9	11.3	11.1
Export	Base run	28514.8	31851.0	35290.9	39102.3	43325.4	11.7	11.3	10.8
	Simulation	29342.2	32345.3	36903.3	41239.3	45329.4	12.1	12.3	11.6
Import	Base run	24492.4	27284.5	30380.4	33838.5	37717.2	11.4	11.6	11.9
	Simulation	24313.3	26731.2	28932.1	32328.2	36733.1	11.1	11.2	11.1
Rural CPI	Base run	2.23	2.26	2.30	2.33	2.36	1.3	2.2	2.6
	Simulation	2.20	2.19	2.22	2.30	2.31	1.1	1.9	2.3
Urban CPI	Base run	2.30	2.34	2.38	2.42	2.46	1.5	2.3	2.7
	Simulation	2.28	2.31	2.34	2.38	2.41	1.3	2.0	2.3
Employment	Base run	76391.2	76971.8	77532.4	78091.1	78712.9	0.76	0.74	0.76
	Simulation	76673.3	77231.4	77871.1	78349.2	78989.9	0.78	0.77	0.79
Oil Demand	Base run	2108.9	2345.1	2586.6	2853.1	3146.9	11.4	11.5	11.8
	Simulation	1898.1	2063.7	2198.6	2197.9	2311.2	5.7	10.7	9.6
Oil Import	Base run	695.9	773.9	853.6	941.5	1038.5	11.2	11.5	11.9
	Simulation	612.4	657.8	708.5	620.1	762.6	5.0	9.3	8.7

From the simulation, we can get the following conclusions.

(1) Reducing energy consumption promotes China economy increasing faster. The growth rates of GDP in simulation run are 0.4, 0.5 and 0.6 point higher than those in base run in 2006, 2007 and 2008-2010 respectively.

(2) Another effect of reducing energy consumption is the rate of inflation falling. The rural CPI in the simulation run is 1.1, 1.9 point below base run in 2006 and 2007, and average 2.3 point below base run from 2008 to 2010. The urban CPI in simulation is 1.3, 2.0 point below base run in 2006 and 2007, and average 2.3 point below base run from 2008 to 2010.

(3) Reducing energy consumption could reduce the import and consumption of crude oil. The consumption of crude oil is 3.6 point below base run from 2008 to 2010 on an average. The import of crude oil is 2.2 point below base run from 2008 to 2010.

SimulationⅡ: Raising vehicle's fuel efficiency

The rising price of crude oil is a big problem for the transportation sector. The trend of solving this problem is to raise the vehicle's fuel efficiency.

Raising vehicle's fuel efficiency in the model can be realized by changing the input coefficients of petroleum processing, coking and nuclear fuel processing sector to transportation sectors.

In base run, we keep the input coefficients of petroleum processing, coking and nuclear fuel processing sector to transportation sectors at current level. In the simulation run, we decrease the input coefficients of petroleum processing, coking and nuclear fuel processing sector to transportation sectors by 10% every year from 2006 to 2010. The results of this simulation are shown in Table 2.

Table 2 Raising vehicle's fuel efficiency

Unit：100 million Yuan

Index (real)		2006	2007	2008	2009	2010	2006 percent change	2007 percent change	2008-2010 percent change
GDP	Base run	95858.9	106595	117574.3	129684.4	143041.9	11.2	11.5	10.2
	Simulation	96738.1	112231	119174.3	139385.4	147321.9	11.3	11.7	10.6
Urban Consumption	Base run	26974.8	30400.5	34079.0	38202.5	42825.0	12.7	12.9	12.1
	Simulation	27213.2	31230.3	34892.0	39212.9	43213.0	12.8	13.0	12.3
Rural Consumption	Base run	12744.0	13941.9	15127.0	16412.8	17807.8	9.4	9.1	8.5
	Simulation	13185.1	14361.2	16142.8	17523.8	18276.2	9.5	9.3	8.8
Fixed Investment	Base run	40572.3	44832.4	49539.8	54741.5	60489.3	10.5	10.7	10.6
	Simulation	41972.2	45276.4	50182.2	55627.3	61238.7	10.7	10.9	10.9
Export	Base run	28514.8	31851.0	35290.9	39102.3	43325.4	11.7	11.3	10.8
	Simulation	29172.1	32348.2	36782.3	40982.5	44672.8	11.8	11.4	10.9
Import	Base run	24492.4	27284.5	30380.4	33838.5	37717.2	11.4	11.6	11.9
	Simulation	24382.8	26902.9	29087.1	32677.5	36892.9	11.3	11.4	11.6
Rural CPI	Base run	2.23	2.26	2.30	2.33	2.36	1.3	2.2	2.6
	Simulation	2.21	2.24	2.28	2.31	2.34	1.2	2.1	2.4
Urban CPI	Base run	2.30	2.34	2.38	2.42	2.46	1.5	2.3	2.7
	Simulation	2.29	2.33	2.36	2.39	2.42	1.4	2.2	2.5
Employment	Base run	76391.2	76971.8	77532.4	78091.1	78712.9	0.76	0.74	0.76
	Simulation	76428.3	77081.4	77612.9	78142.1	78934.9	0.77	0.76	0.78
Oil Demand	Base run	2108.9	2345.1	2586.6	2853.1	3146.9	11.4	11.5	11.8
	Simulation	1687.1	1876.3	2043.3	2197.9	2391.2	5.9	10.2	9.8
Oil Import	Base run	695.9	773.9	853.6	941.5	1038.5	11.2	11.5	11.9
	Simulation	450.8	501.4	557.6	620.1	689.5	5.1	9.5	8.9

The conclusions are as following.

(1) Raising vehicle's fuel efficiency promotes China economy increasing faster.

The growth rates of GDP in simulation run are 0.1, 0.2 and 0.4 point higher than those in base run in 2006, 2007 and 2008-2010 respectively.

(2) Another effect of raising vehicle's fuel efficiency is a slight falling in inflation. The rural CPI in the simulation run is 0.1, 0.1 point below base run in 2006 and 2007, and average 0.2 point below base run from 2008 to 2010. The urban CPI in simulation is 0.1, 0.1 point below base run in 2006 and 2007, and average 0.17 point below base run from 2008 to 2010.

(3) Raising vehicle's fuel efficiency could reduce the import and consumption of crude oil. The consumption of crude oil is 2.0 point below base run from 2008 to 2010 on an average. The import of crude oil is 3.0 point below base run from 2008 to 2010 on an average.

References

[1] Chang, Y., Wong J. F. (2006), Oil price fluctuations and economy [J], Energy Policy.

[2] Radchenko S., (2005), Oil price volatility and the asymmetric response of gasoline prices to oil price increases and decreases [J], Energy Economics.

[3] Herce, M. (2006), Using Futures Prices to Filter Short-term Volatility and Recover a Latent, Long-term Price Series for Oil [EB/OL], http://web.mit.edu.

[4] Pindyck, R. S. (2004), Volatility in natural gas and oil market [J], The Journal of Energy and Development.

[5] Meyer, Brend (2007), Oil Price, GDP and International Trade: The Case of Germany，15th INFORUM World Conference

[6] Douglas Nyhus, (2007), Closing China's Trade Surplus，15th INFORUM World Conference

[7] Jeff Werling, (2007), LIFT Model of the U.S. Economy: Long Term Economic Impact of Energy Policies ，15th INFORUM World Conference