Chinese Gasoline and Diesel Demand

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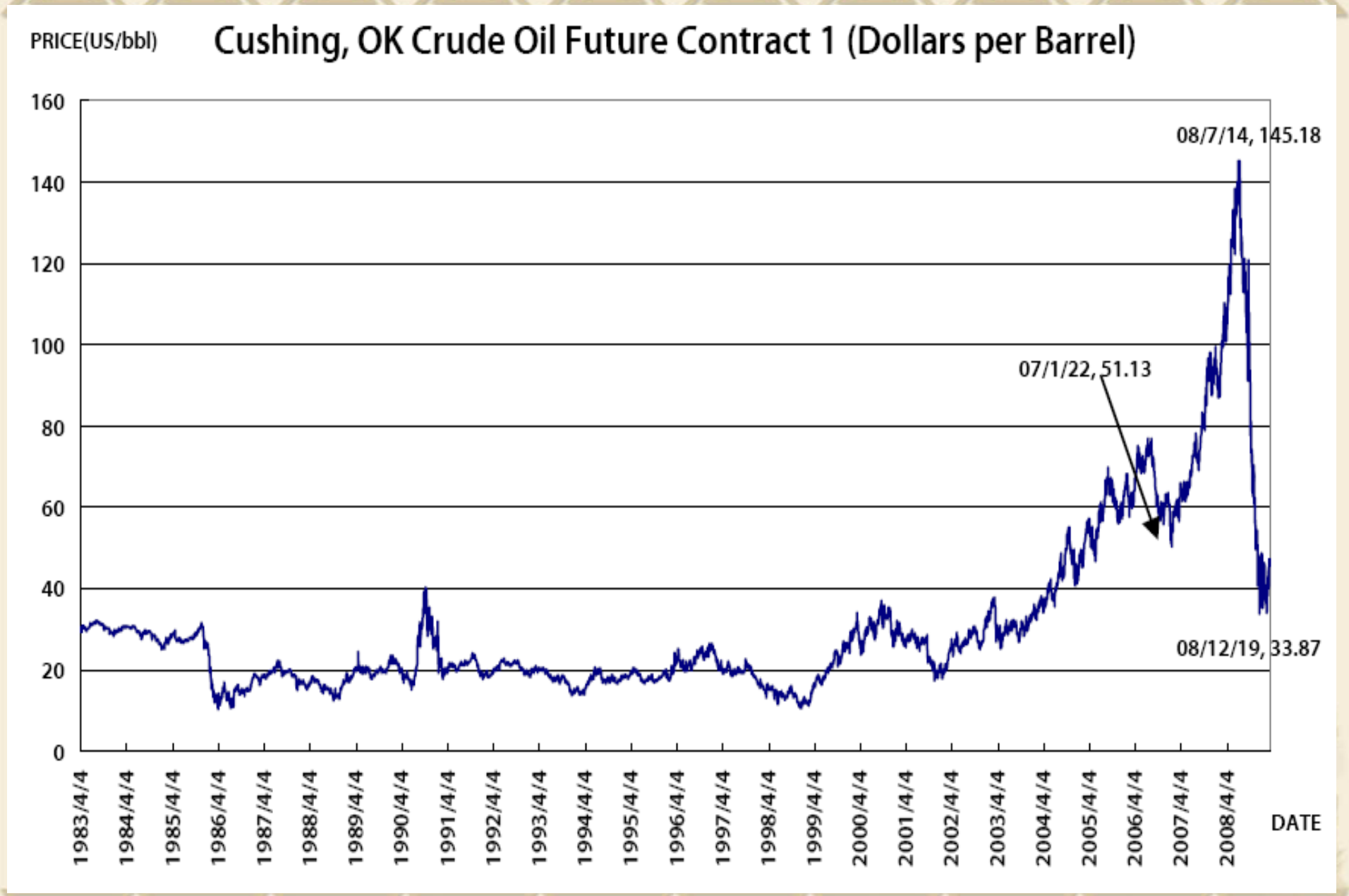
PRICE(US/bbl)
Cushing, OK Crude Oil Future Contract 1 (Dollars per Barrel)
160
140
120
100
80
60
40
20
0
08/7/14, 145.18
07/1/22, 51.13
08/12/19, 33.87
1983/4/4
1984/4/4
1985/4/4
1986/4/4
1987/4/4
1988/4/4
1989/4/4
1990/4/4
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2001/4/4
2002/4/4
2003/4/4
2004/4/4
2005/4/4
2006/4/4
2007/4/4
2008/4/4
DATE

Aim of This Paper

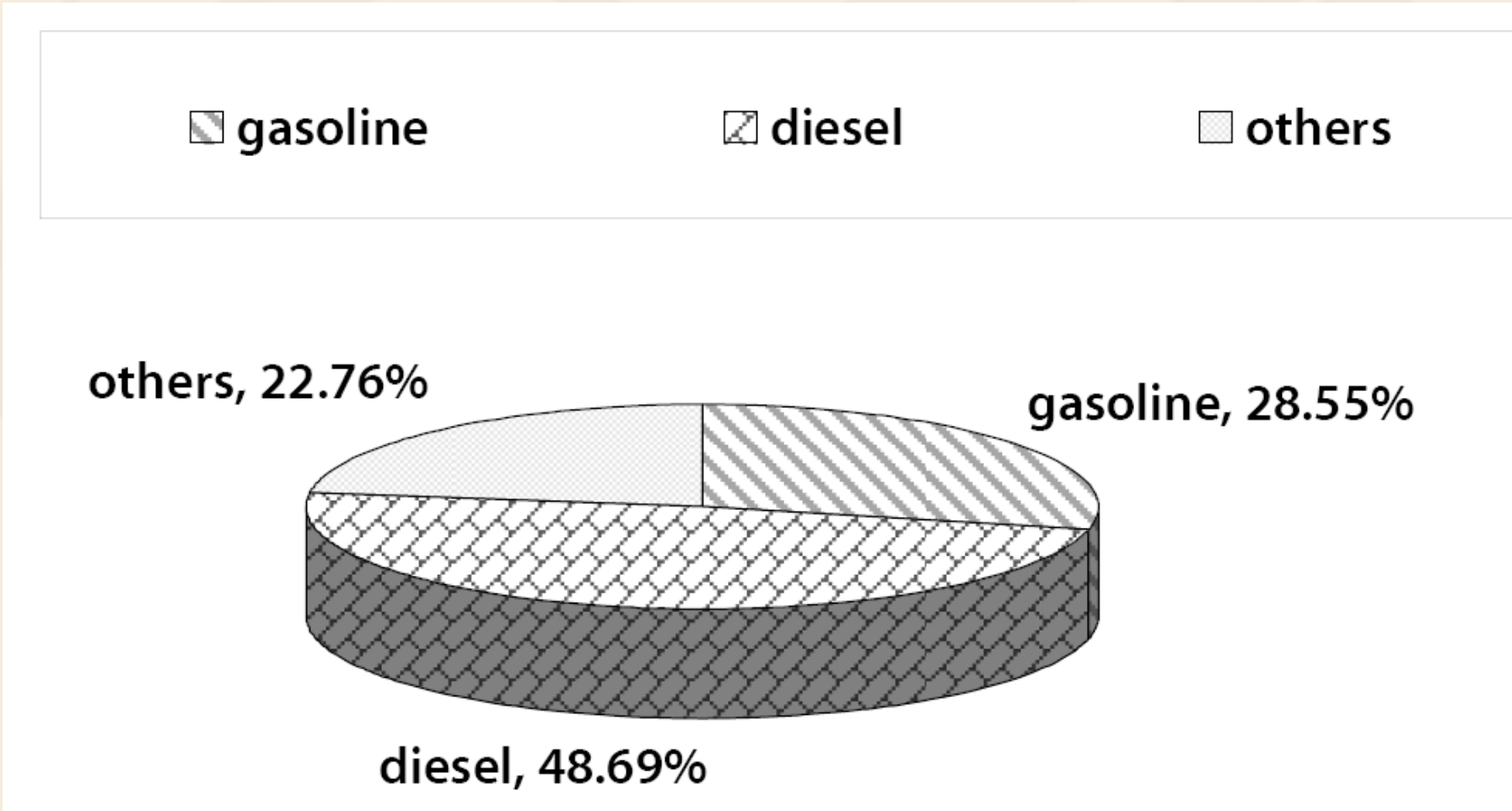
To reveal the possible growth of Chinese petroleum demand.

Why This Paper is Important

1. Oil still play important role in the world.
2. Oil price boom and collapse catch the attention for all world.
3. Currently **China is 2nd petroleum consumers and 3rd oil importer**, only next to USA and Japan.
4. Adams and Shachmurove (2008) pointed out that
   - the ***world oil market has been more influenced by the increase demand from China***.

Why Only Study Chinese Gasoline and Diesel Demand

1. The demand of gasoline and diesel are two petroleum products with much **larger consumption share** in China.
2. These two products have **rapid increasing demand**.
3. Data limitation (fuel oil demand).


gasoline
diesel
others
others, 22.76%
gasoline, 28.55%
diesel, 48.69%

Appendix Table 1: Review for the Literatures of Energy Consumption

Author	Methodology	Type	Main Variables	Conclusions
Dahl and Sterner(1991)	Survey	Gasoline	Real price of gasoline, real income, lagged gasoline consumption, the stock of vehicles, vehicle price, transport price	Summarize the factors that effect the short-run and long-run gasoline demand elasticities.
Bentzen (1994)	1948-1991 Cointegration and ECM	Gasoline	Real price of gasoline, real income, the stock of vehicles	1. The Long-run vehicle elasticity equal to one and short-run value is 0.89. 2. The short-run price elasticity is -0.32 but the long-run value is -0.41 which is lower than other studies on gasoiline demand.
Eltony and Al-Mutairi (1995)	1970-1989 Cointegration and ECM	Gasoline	Real price of gasoline, real income per capita, lagged gasoline consumption per capita	1. The short- and long-run price elasticities are -0.37 and -0.46 indication an inelastic demand. 2. The gasoline consumption's response to changes in income is higher in the long run than short run.
Ramanathan (1999)	1972-1973 1993-1994 Cointegration and ECM	Gasoline	Gasoline price index, real per capita GDP, lagged gasoline consumption per capita	1. Gasoline demand tends to increase significantly for a given increase in GDP. The long-run income elasiticity is 2.682 which is larger than the short-run elasiticity(1.178). 2. Gasoiline demand is relatively inelastic to price changes.
Alves et al. (2003)	1974(1984)-1999 Cointegration and ECM	Gasoline	Real gasoline price, real per capita GDP, real alconol price	1. Price elasticity of gasoline is inelastic in the long-run and completely inelastic in the short-run. 2. Alconol and gasoline are substitutes since the cross elasticity is positive. 3. The shot-run price elasticity amounts to zero and cross-elasticity with value is 0.89.
Cheung and Thomson (2004)	1980-1999 Cointegration and ECM	Gasoline	Real gasoline price, real per capital GDP	1. Gasoline demand is relatively inelastic to price change, both in the short and long run. 2. The long-run income elasticity is 0.97 and the short-run is 1.64.
Polemis (2006)	1978-2003 Cointegration and VAR	Gasoline Diesel	Real gasoline/diesel price, real per capital GDP, per capita diesel-engined fleet	The long-run gasoline demand tends to be price and income inelastic and diesel demand tends to be price inelastic and income elastic.

Gasoline and Diesel Demand Model (per capita)

$$gasoline_{i,t} = \alpha_1 + \alpha_2 gdp_{i,t} + \alpha_3 Pgasoline_{i,t} + \alpha_4 Pdiesel_{i,t} + \alpha_5 car_{i,t} + u_{i,t} \quad (1)$$

$$diesel_{i,t} = \beta_1 + \beta_2 gdp_{i,t} + \beta_3 Pgasoline_{i,t} + \beta_4 Pdiesel_{i,t} + \zeta_{i,t} \quad (2)$$

$$i = 1, 2, \ldots, N \qquad t = 1, 2, \ldots, T$$

where *gasoline* is gasoline consumption per capita; *diesel* is the diesel consumption per capita, i denotes ith region; t denotes tth year; *gdp* is real per capita GDP, *Pgasoline* represents real price of unleaded gasoline #93; *Pdiesel* is the real price of diesel #0; *car* means per capita car; u and ζ are the random errors; α and β are the coefficients to be estimated.

We expect the signs of all coefficients are $\alpha_2 > 0$, $\alpha_3 < 0$, $\alpha_4 > 0$, $\alpha_5 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 < 0$.

Gasoline and Diesel Demand Model (total consumption)

$$GASOLINE_{i,t} = \alpha_1 + \alpha_2 GDP_{i,t} + \alpha_3 Pgasoline_{i,t} + \alpha_4 Pdiesel_{i,t} + \alpha_5 CAR_{i,t} + u_{i,t} \quad (1)$$

$$DIESEL_{i,t} = \beta_1 + \beta_2 GDP_{i,t} + \beta_3 Pgasoline_{i,t} + \beta_4 Pdiesel_{i,t} + \beta_5 PASSENGER_{i,t} + \beta_6 FREIGHT_{i,t} + \beta_7 FARM_{i,t} + \zeta_{i,t} \quad (2)$$

$$i = 1, 2, \ldots, N \qquad t = 1, 2, \ldots, T$$

GASOLINE is gasoline total consumption; i denotes ith region; t denotes tth year; *GDP* is Gross Domestic Product: *Pgasoline* is the real price of unleaded gasoline #93; *Pdiesel* is the real price of diesel #0; *CAR* means numbers of civil vehicles owned; u is the random error; α are the coefficients to be estimated.

DIESEL is the diesel total consumption; *PASSENGER* means the passenger traffic; *FREIGHT* means the freight traffic; *FARM* means the total power of agricultural machinery; ζ is the random error; β are the coefficients to be estimated.

Data Sources

- We collect the detailed data for **30 regions** ranging from **1999 to 2006**.
- The **diesel consumption data here only consists of the diesel for transportation use**.
  - All the diesel uses for the other purposes (e.g. power generation) are excluded.

Table 1: Definition and data source of variables

Variable	Definition (Unit)	Source
Pgasoline	Price of .gasoline 93# (yuan/ton)	Price Yearbook of China
Pdiesel	Price of diesel 0# (yuan/ton)	Price Yearbook of China
GASOLINE	Gasoline oil consumption (10^4 tons)	China Energy Statistical Yearbook
DIESEL	Diesel oil consumption (10^4 tons)	China Energy Statistical Yearbook
GDP	Gross Domestic Production (10^8 yuan)	China Statistical Yearbook
gdp	Per capita GDP (yuan)	China Statistical Yearbook
POP	Year-end population (10^4 persons)	China Statistical Yearbook
CAR	Number of civil vehicles owned (10^4 units)	China Statistical Yearbook
PASSENGER	Passenger traffic (10^4 persons)	China Statistical Yearbook
FREIGHT	Freight traffic (10^4 tons)	China Statistical Yearbook
FARM	Total power of agricultural machinery (10^4 kw)	China Statistical Yearbook

Note：All variables are regional data.

Test and Suitable Empirical Model

1. Panel unit root test => examine “stationary”

2. Hausman Test

- Random effect model (x)
- Fixed effect model (√)

Table 2：Estimation results for gasoline and diesel consumption (per capita).

	gasoline	*diesel*
cons tan *t*	0.147	0.031
	(1.471)	(1.807)
Pgasoline	-0.131	0.839**
	(0.129)	(0.365)
Pdiesel	0.027	-0.639*
	(0.290)	(0.353)
gdp	0.594***	0.987***
	(0.129)	(0.086)
car	0.281**	-
	(0.123)	
LM test	3.04	6.53
P-value	0.081	0.011
Sample	226	226

Note: *** and ** represents 1% and 5% significant level, number in parentheses is standard errors.

Fixed Effect Analysis Results

- **Gasoline price does *not* have significant effect on the gasoline consumption**.
  - Per capita GDP and per capita cars have significant impacts on the gasoline consumption per capita.
- **Gasoline price, diesel price and per capita GDP have significant impacts on the diesel consumption per capita**.
  - Diesel consumption is more sensitive to the price change no matter for the gasoline price or diesel price.
  - The possible reason may be due to the business consideration.

Fixed Effect Analysis Results

- Since diesel is used more by the trucks, businessmen are able to react to the price movement by altering the transportation tools.
  - For example, they can drive more trucks when diesel price is cheaper but drive more gasoline-engine cars for reducing diesel when gasoline price is cheaper.
- It’s hard for households to reduce the gasoline consumption in the short run since car may be the only transportation tools for many households.

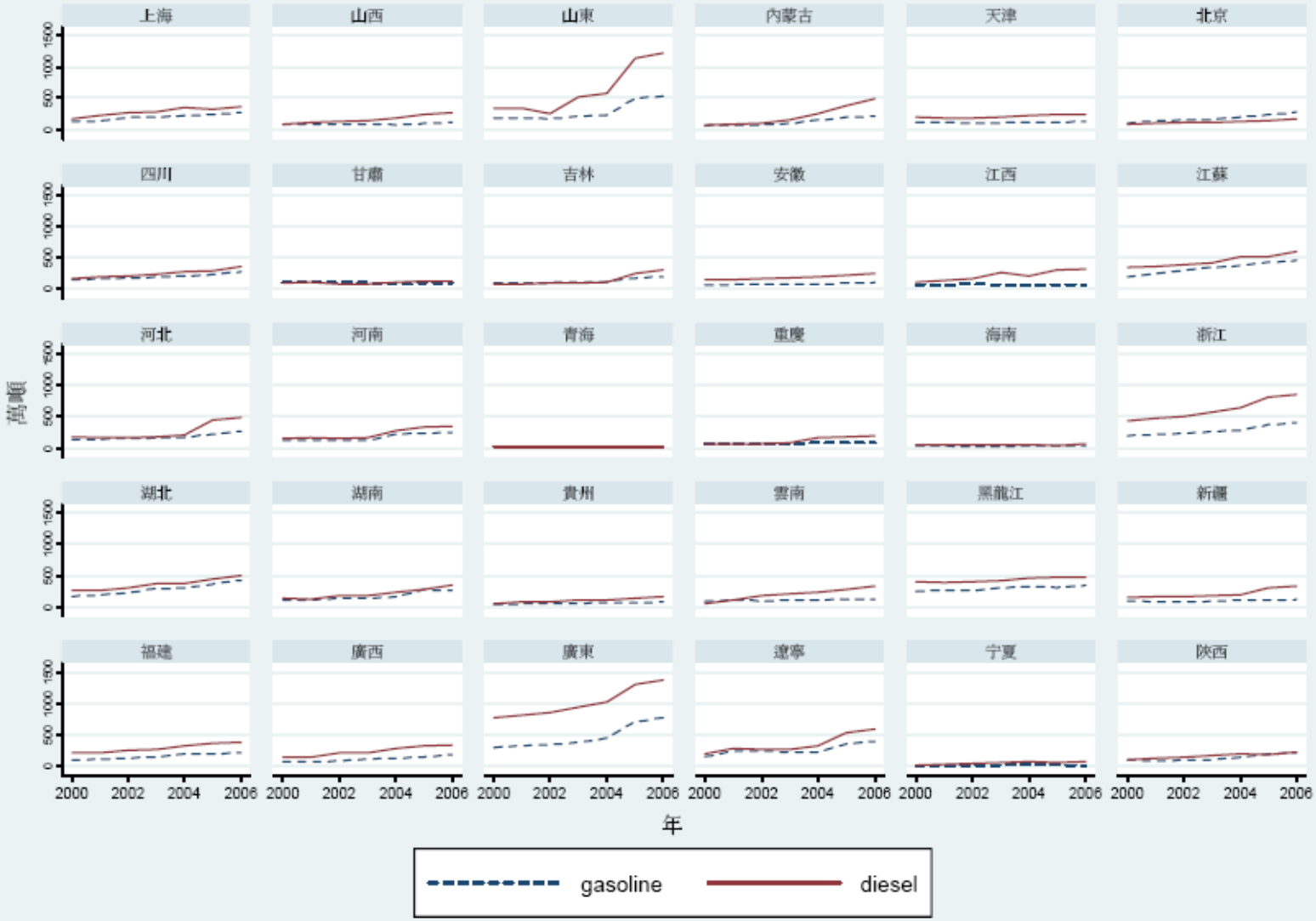
Fixed Effect Analysis Results

- The argument for the insignificant price impacts on gasoline price is due to the **price control by Chinese Government**.
- People lack of incentive to reduce their gasoline consumption if they believe the Government will always keep a lower price level by providing a mount of compensation for all petroleum products.

Conclusion and Remarks

- Comparing to those literature only focusing on the aggregate analysis for Chinese energy demand, this paper uses panel data method for more detailed analysis.
- By examining those regional gasoline and diesel demand from 1999 to 2006, we find some interesting results.
  - Per capita GDP and per capita car have significant impacts on the gasoline consumption.
  - Ggasoline price and diesel price and the per capita GDP have significant impacts on the diesel consumption.

Gasoline and Diesel Total Consumption form 1999 to 2006




HEILONGJIANG
Harbin
JILIN
Changchun
Shenyang
LIAONING
INNER MONGOLIA A. R.
Hohhot
Urumqi
XINJIANG UYGHUR A. R.
GANSU
NINGXIA HUI A. R.
Yin-chuan
BEIJING
HEBEI
Shijiazhuang
TIANJIN
Aksai Chin is claimed by India.
QINGHAI
Xining
Lanzhou
Taiyuan
SHANXI
Jinan
SHAN-DONG
Xi'an
SHAANXI
Zhengzhou
HENAN
JIANG-SU
Nan-jing
SHANGHAI
TIBET A. R.
Lhasa
SICHUAN
Chengdu
CHONGQING
HUBEI
Wuhan
Hefei
ANHUI
Hangzhou
ZHE-JIANG
Most of the area of the Indian state of Arunachal Pradesh is claimed by China.
Changsha
HUNAN
Nanchang
JIANGXI
GUIZHOU
Guiyang
Fuzhou
FUJIAN
Kunming
YUNNAN
GUANGXI ZHUANG A. R.
Nanning
GUANGDONG
Guangzhou
HONG KONG
MACAU
HAINAN
Haikou
Province
Autonomous Region

Conclusion and Remarks

- Since per capita GDP in China is still going up even in this world recession period, we expect that Chinese gasoline and diesel consumption will still gain up.

Conclusion and Remarks

- Our study shows that the petroleum consumption will continue to rise as Chinese GDP keep going up.

Thank you for your attention.

Appendix Table Estimation results for gasoline and diesel consumption (total consumption).

	GASOLINE		*DIESEL*		
	Model 1	Model 2	Model 1	Model 2	Model 3
Cons tan *t*	1.685	2.193	-1.446	-1.148	-4.816
	(3.522)	(3.718)	(3.919)	(3.957)	(4.556)
Pgasoline	0.122	0.112	0.495**	0.505**	0.534**
	(0.22)	(0 .222)	(0.246)	(0.248)	(0.286)
Pdiesel	0.137	0.155	-0.322	-0.314	-0.382
	(0.265)	(0.270)	(0.297)	(0.301)	(0.336)
GDP	0.478**	0.489**	1.117***	1.075***	1.138***
	(0.250)	(0.251)	(0.278)	(0.286)	(0.313)
POP	0.153	0.145	-0.354	-0.346	-0.086
	(0.384)	(.385)	(0.428)	(0.431)	(0.476)
CAR		-0.057			
		(0.140)			
PASSENGER				0.050	0.044
				(0.083)	(0.088)
FREIGHT				-0.020	-0.026
				(0.040)	(0.043)
FARM					0.666**
					(0.298)
LM test	0.27	0.22	0.11	0.08	1.12
P-value	0.6059	0.6361	0.740	0.779	0.290
Sample	200	200	200	200	170

Note: *** and ** represents 1% and 5% significant level, number in parentheses is standard errors.