



Innovation of Chinese Automobile Market: A Consequence of China's Urbanization Process

Yang Yu

Department of Civil and Environmental Engineering
Department of Economics
Stanford University
(Working with Yang Shu and Yueming Lucy Qiu)



Research Topic

□

- Describe the technological progress of China's automobile sectors during 2005-2011
- Describe the change of consumers' preference



Background: Urbanization and Automobile Market





Automobile: connecting urbanization and energy consumption and pollution

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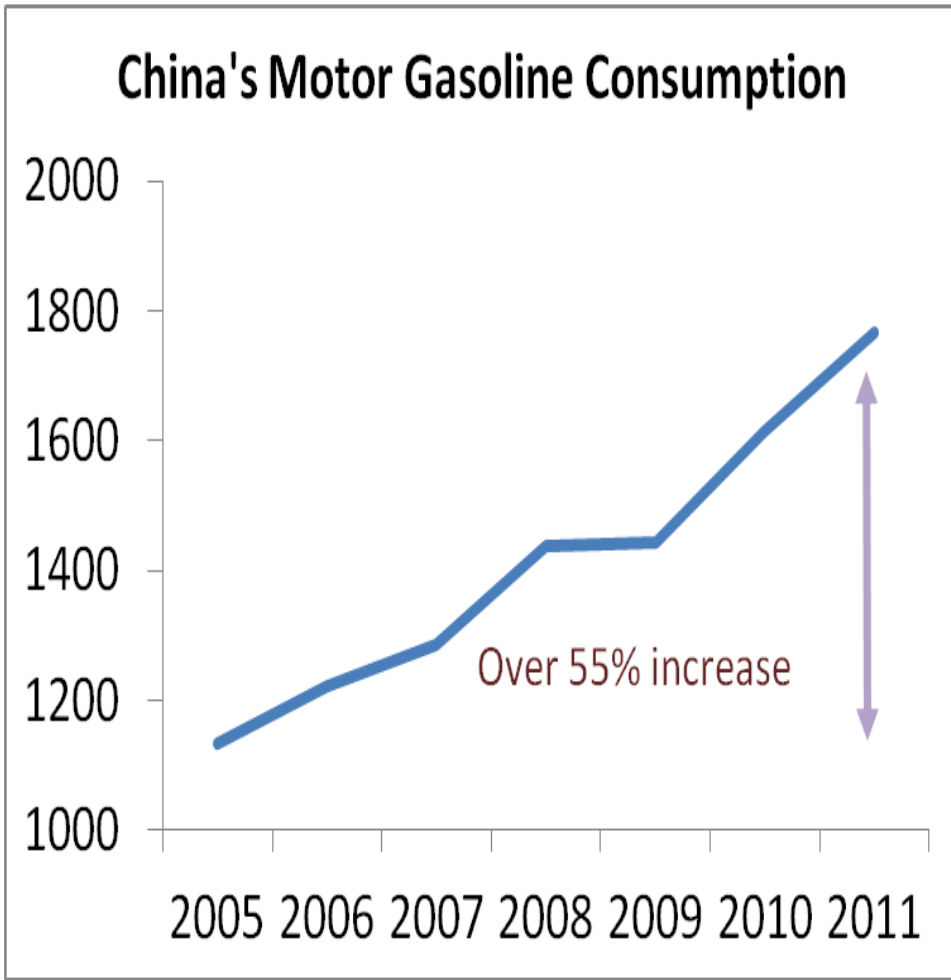
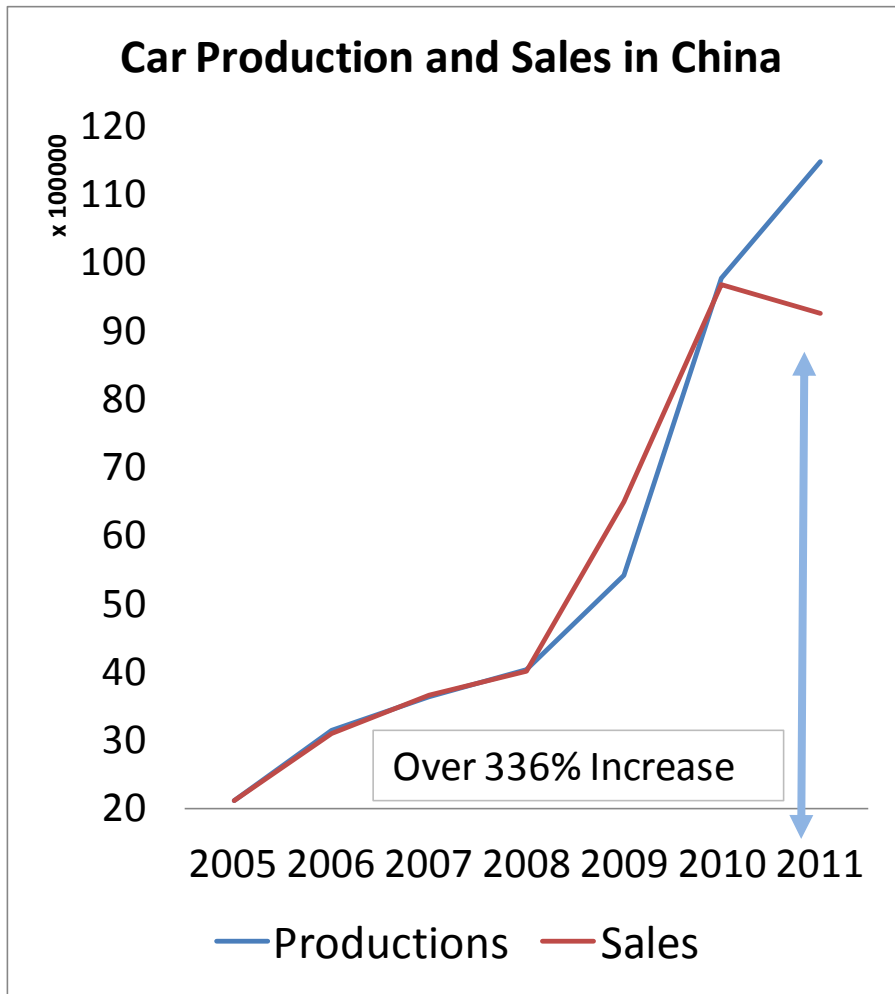
consequence of China's urbanization process



- The booming caused by the urbanization will exhaust the global oil!.....or ?



Dramatic Market Growing During Last Decades

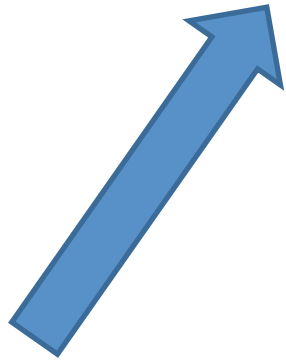


Data Source: CAAM Statistical yearbook of China automobile industry &EIA

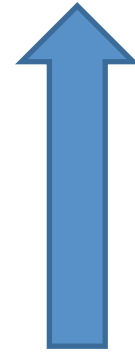


Decompose the Fuel Consumption

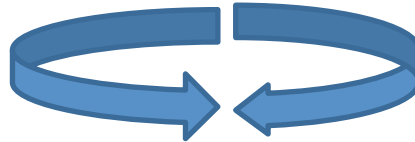
$$\text{Fuel Consumption} = \sum VMT_i \times \text{Fuel Efficiency} \times \text{Sales of Model } i$$



• Progress of Available Technology



• Travel behavior



• Consumer Preference



Had technologies of cars' fuel efficiency been improving





Unit for Energy Efficiency Measurement

- Miles per Gallon (MPG)
- Fuel consumption per 100 Km (inverse to MPG)
 - Definition of improvement rate of fuel efficiency technology of a car model



How can we measure the technological progress

- Could we use average fuel efficiency of car models to represent the technological progress?
 - No
- The change in fuel efficiency performances of cars with same weight, power, transmission technologies and other related attributes.



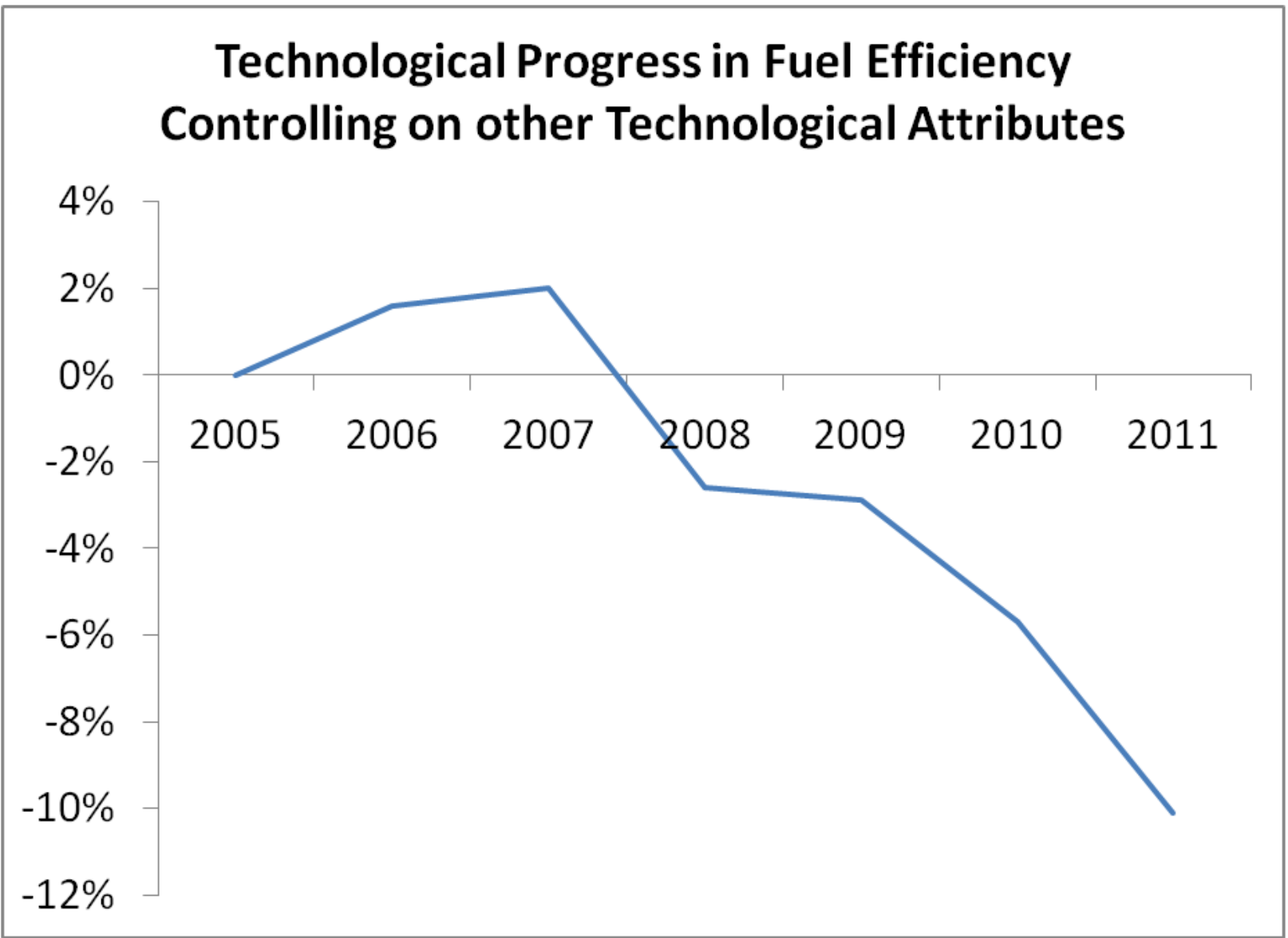
Comparing to the car sold in 2005, how more energy the car sold in other years would use for 100 km

Less Efficient



More Efficient

Technological Progress in Fuel Efficiency Controlling on other Technological Attributes

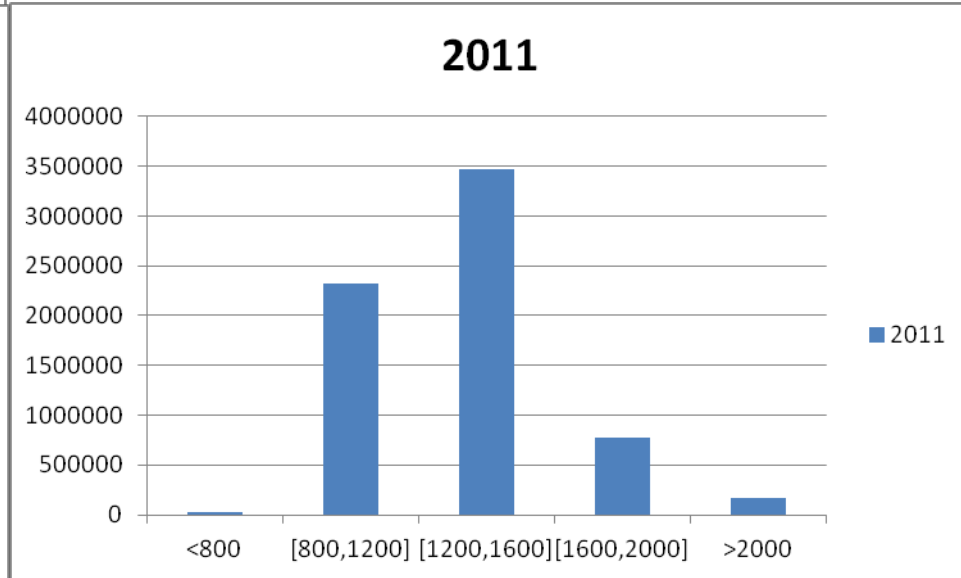
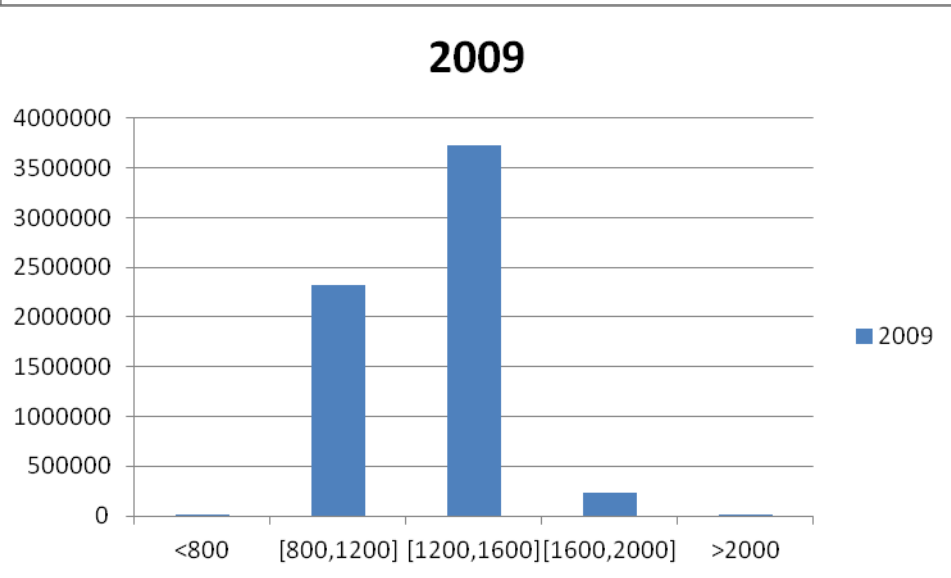
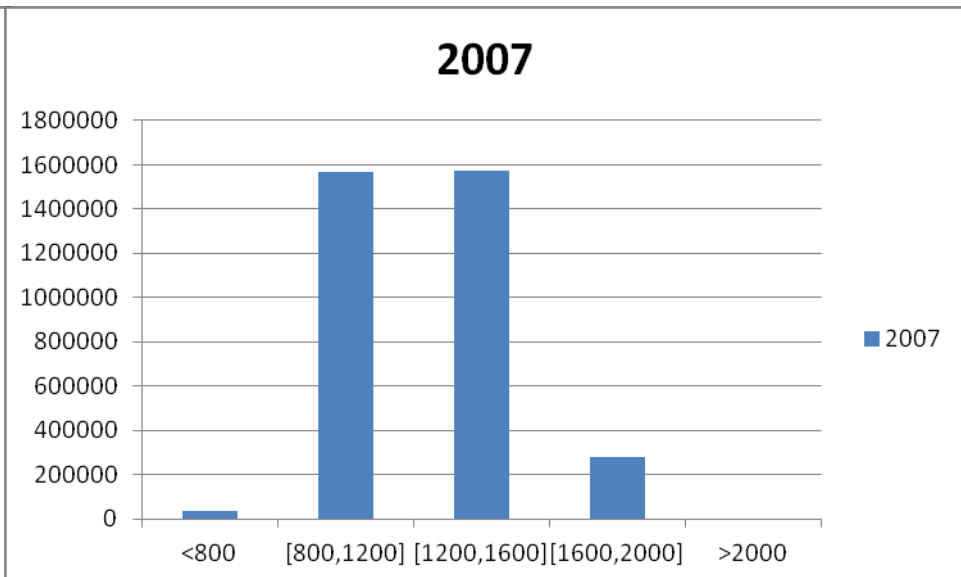
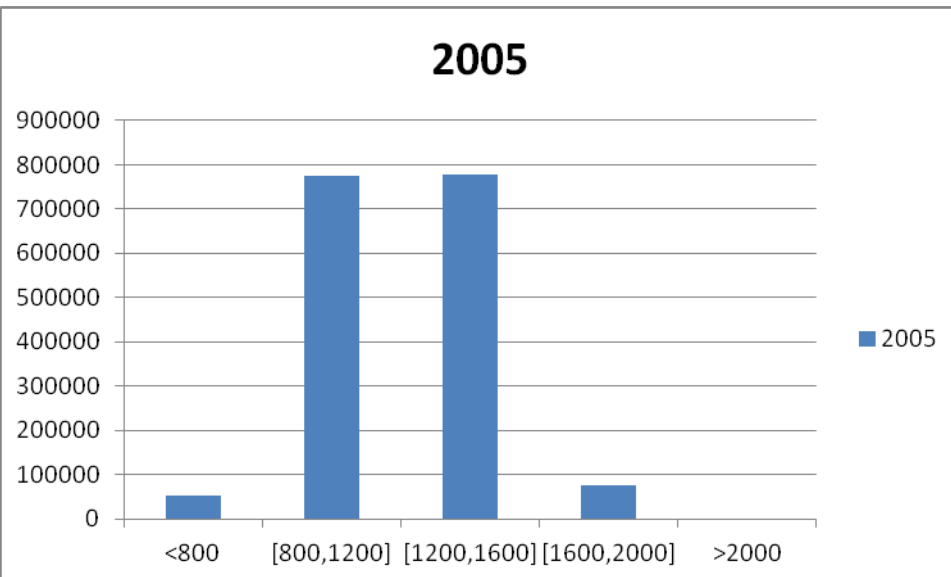




- That's not enough, we should considering
 - The impact of consumers' preference
 - Attributes
 - Technology sources
 - Policies



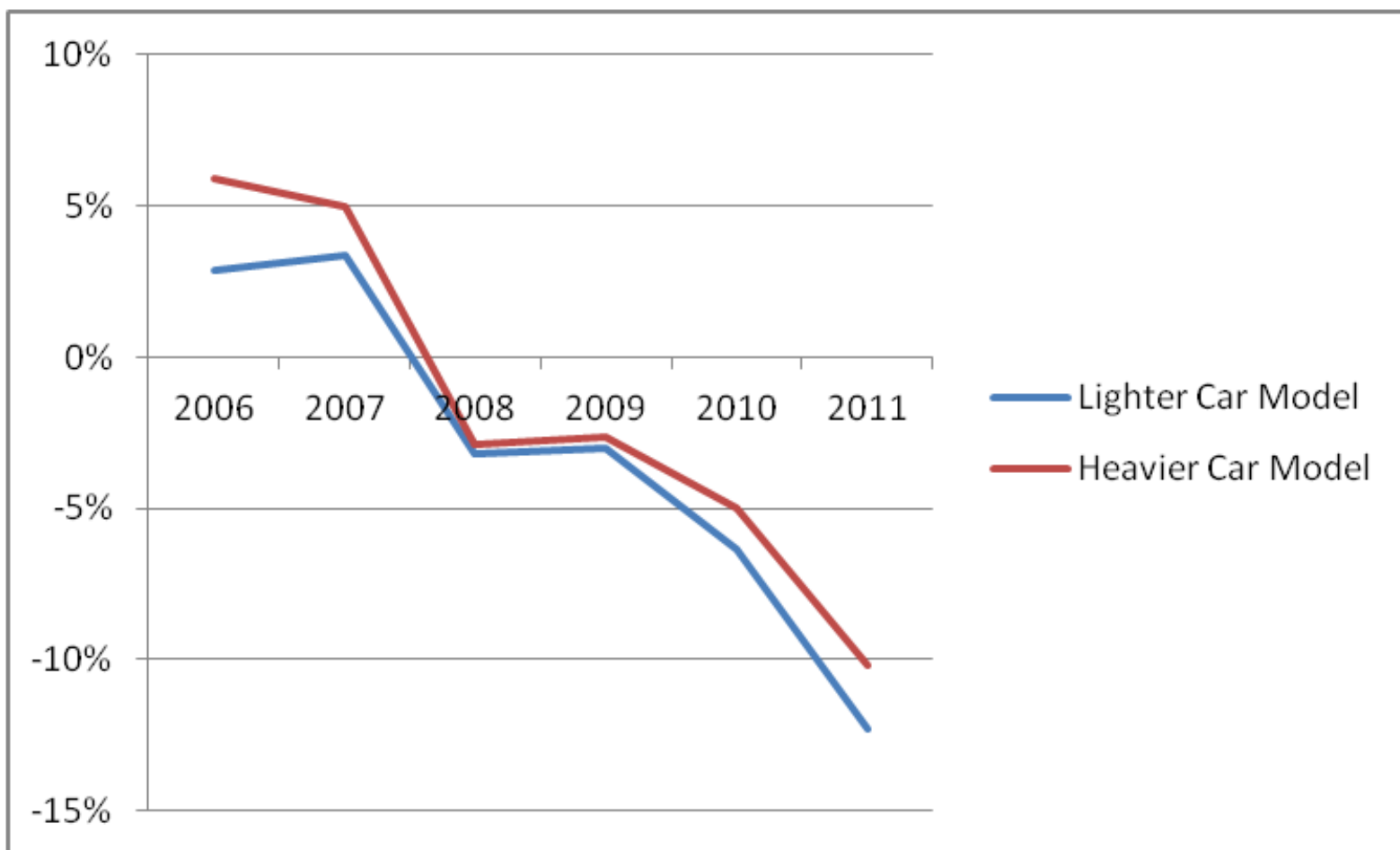
Distributions of car sales over different Cars' weights





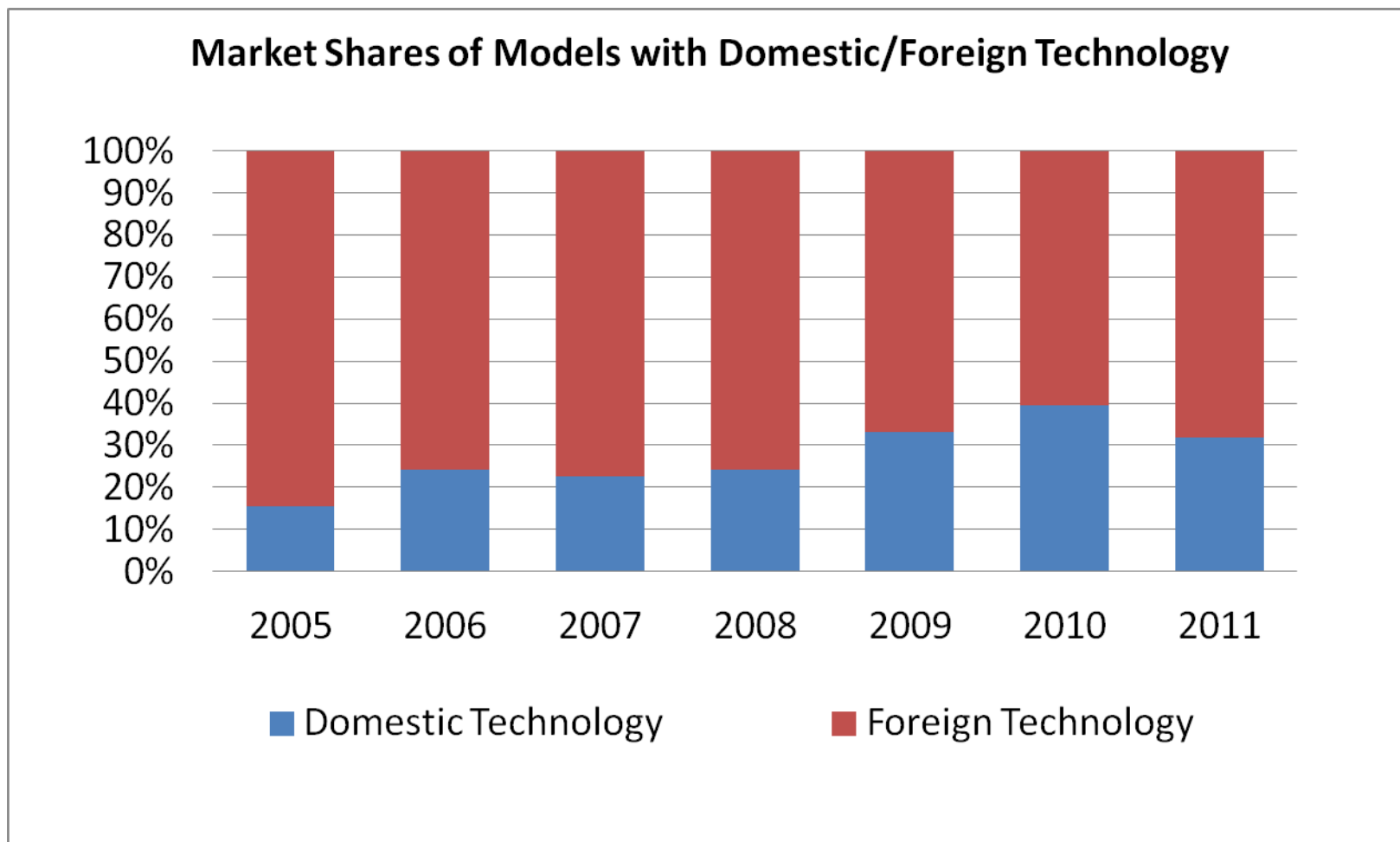
Heavier cars improve slower than smaller cars

- Blue Line: improvement rate of fuel efficiency technology of car model with 1350 kg
- Red Line: the improvement rate of fuel efficiency technology of car model with 1350*120% kg





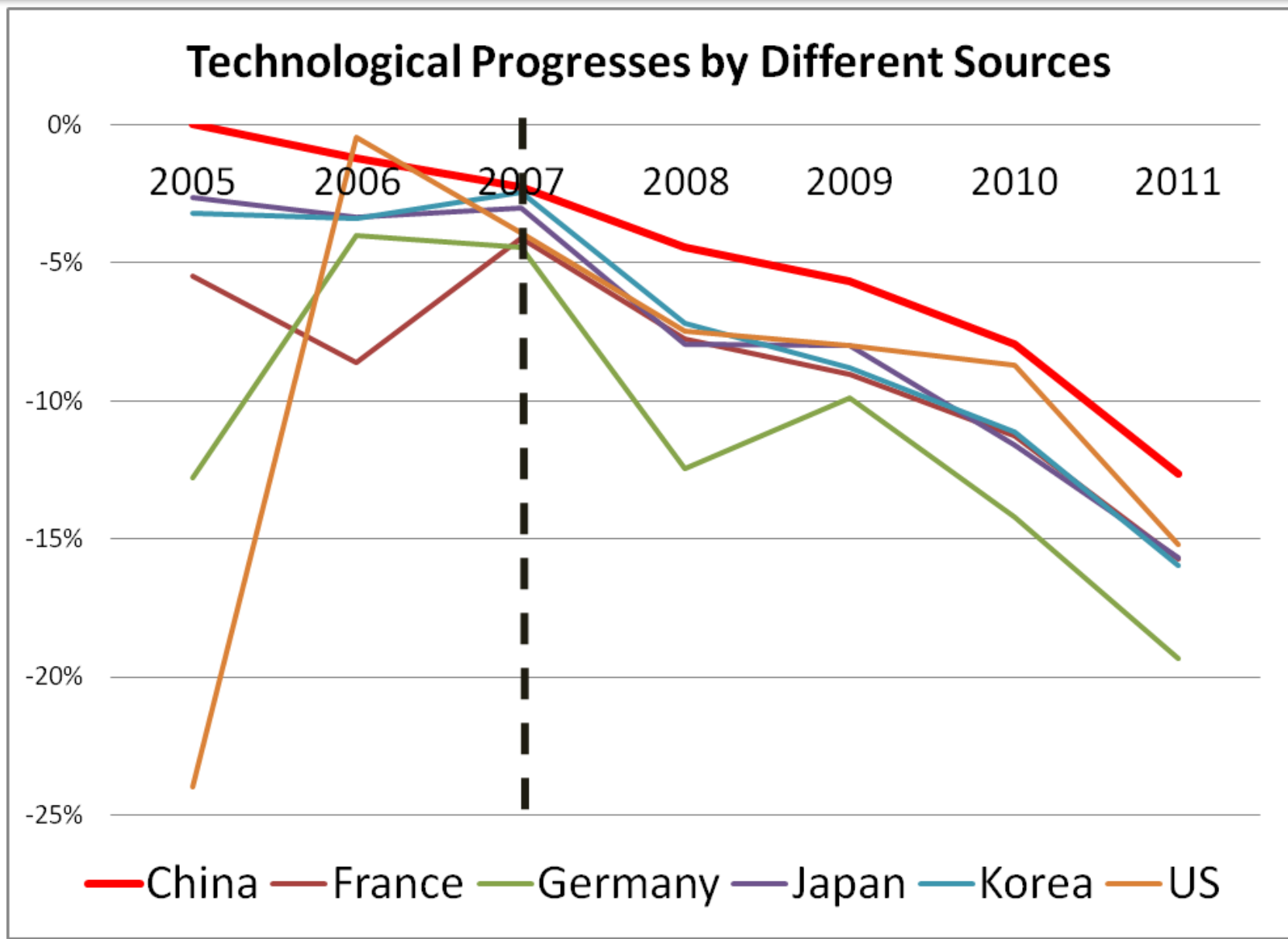
China's Car Market Are Dominated by Foreign Technologies



Data Source: CAAM Statistical yearbook of China automobile industry



Domestic Car Models versus Foreign Car Models





China's Fuel Efficiency Standard

- Announced in 2004
- Phase I is implemented in 2005 and 2006
- Phase II is implemented in 2008 and 2009 (Wagner et al. 2009)

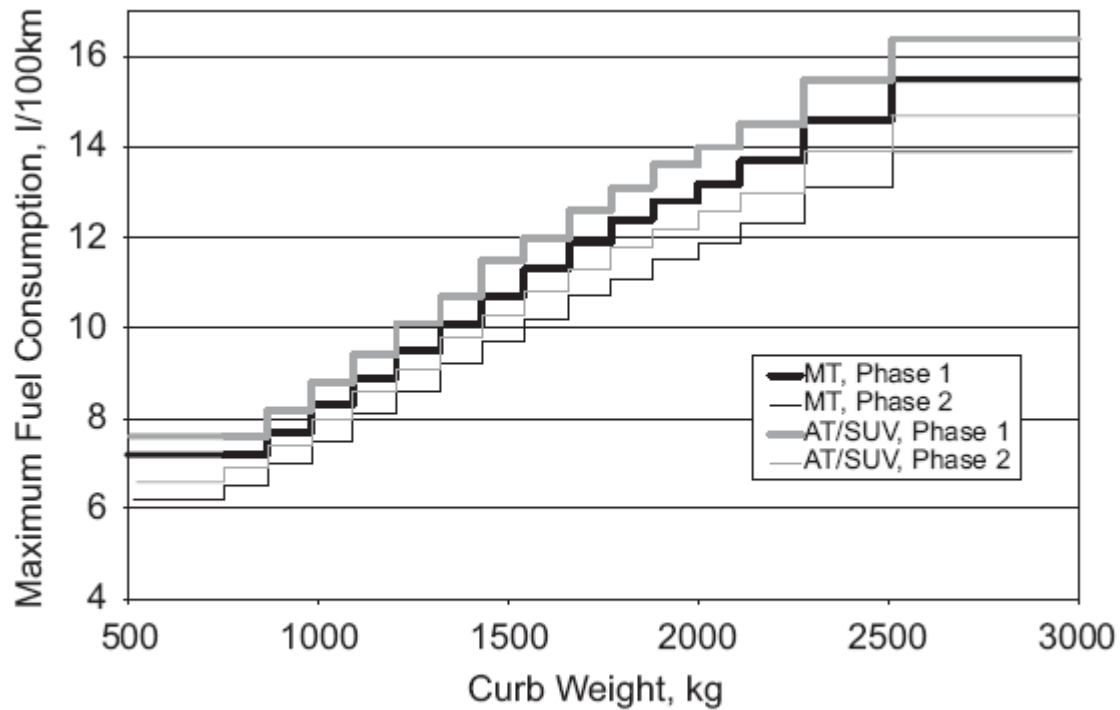


Fig. 7. Chinese passenger car fuel consumption limits.

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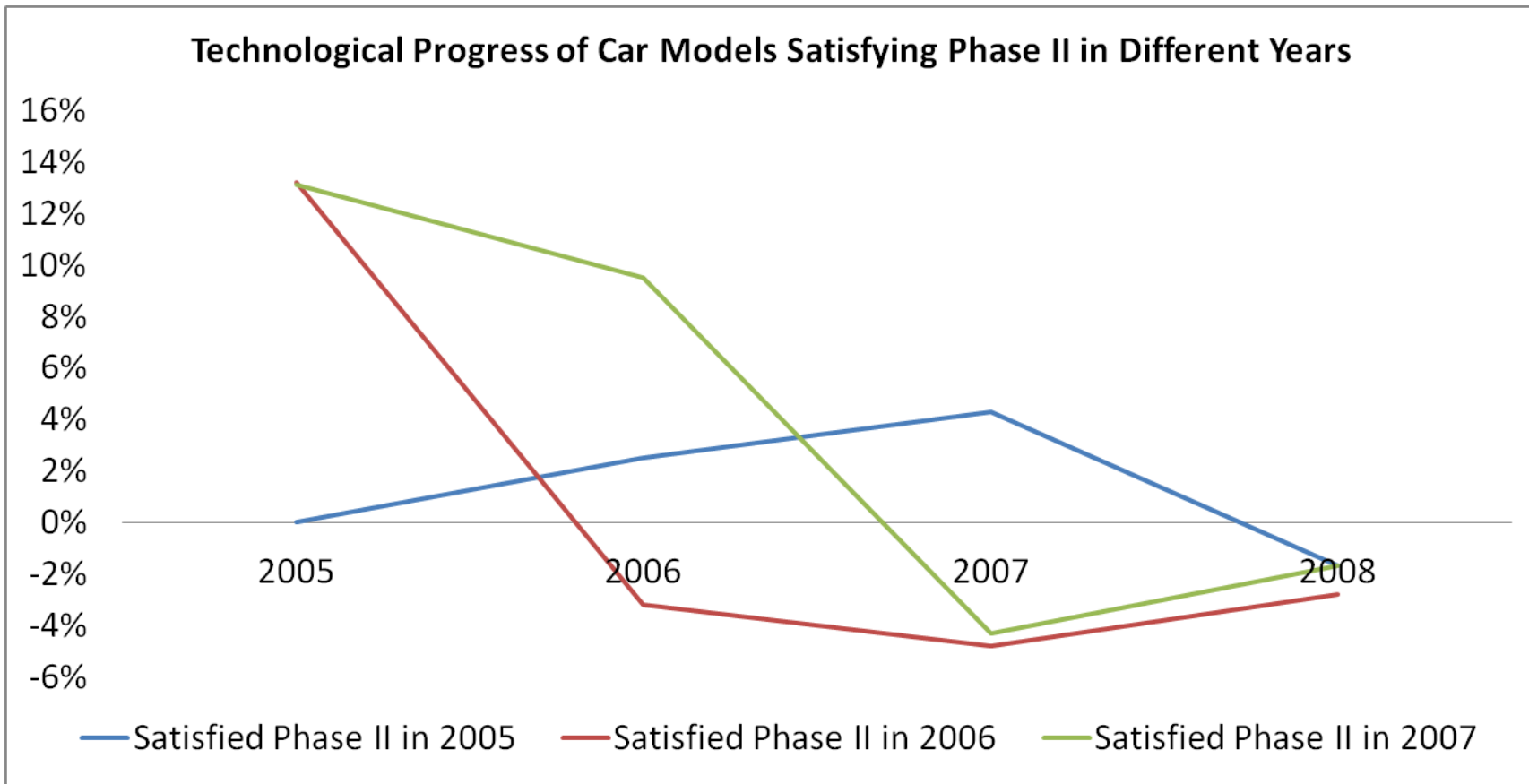
- Three types of models:
 - nearly 50% models had already satisfied the Phase II standard in 2005 (group A);
 - Some satisfied the standard in 2006 (group B)
 - Some satisfied the standard in 2007 (group C)
- The classification can be represent by vector:

$$\Phi = (\phi_{2005}, \phi_{2006}, \phi_{2006})$$

$$\phi_t = \begin{cases} 1, & \text{if model } i \text{ satisfied Phase 2 standard in year } t \\ 0, & x \geq 0 \end{cases}$$



Technological Progresses of Car Models under Different Policy Pressures





- Technologies of fuel efficiency in China's automobile sector improved
- However, the improvement can not explain why the increase rate of motor fuel consumption is far slower than that of car sales
 - Averagely, the improve is only around 10%
 - Cars favorite by consumers perform worse
 - The market share of domestic car model increase, but their fuel efficiency technologies were worst



- Why the year of 2007 is a tipping point?
- Why with more and more serious congestion, people still trended to choose heavier cars?
- Why foreign car models did not improve faster than domestic car models?



Thank You!
Questions?



Backup Slides for Discussion Part





Had consumers' preference been changing during the urbanization process?

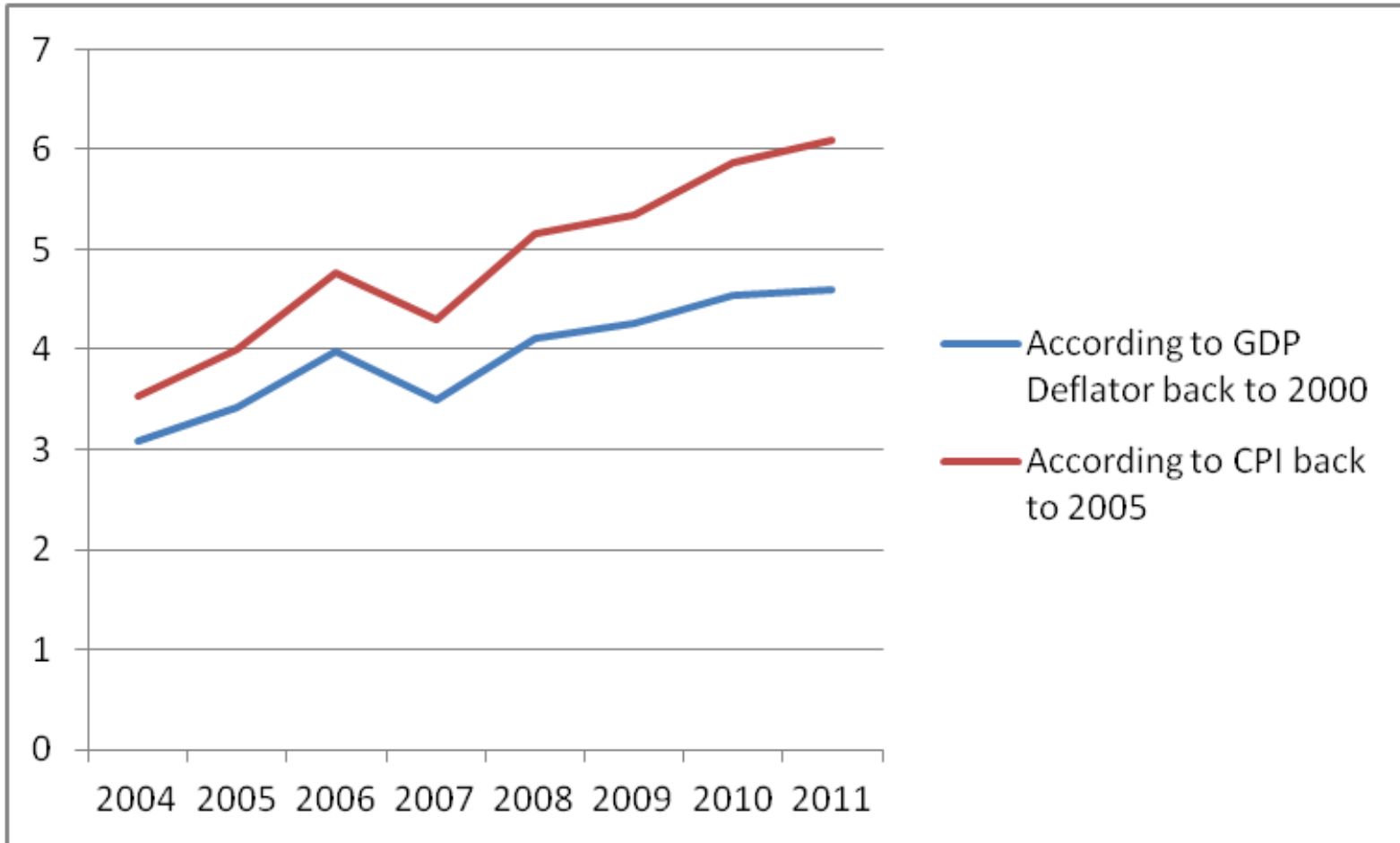




- During the urbanization process
 - Fuel cost increased
 - Congestions become more and more serious
 - Parking price increased
 - More and more people can afford a car (later consumers may have lower income or willingness to pay than earlier consumers)
- Will consumers trend to buy
 - More fuel efficient cars?
 - Smaller cars?

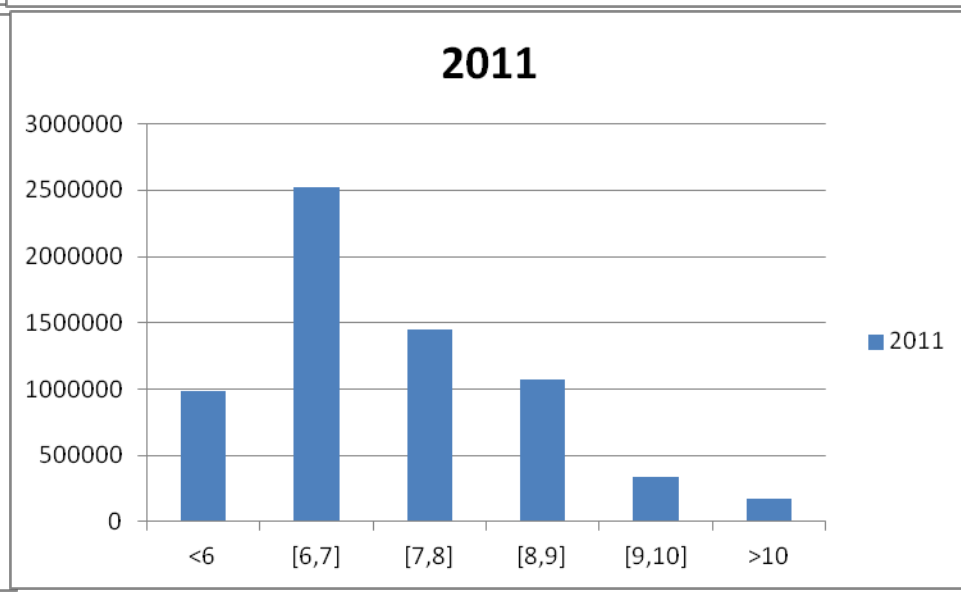
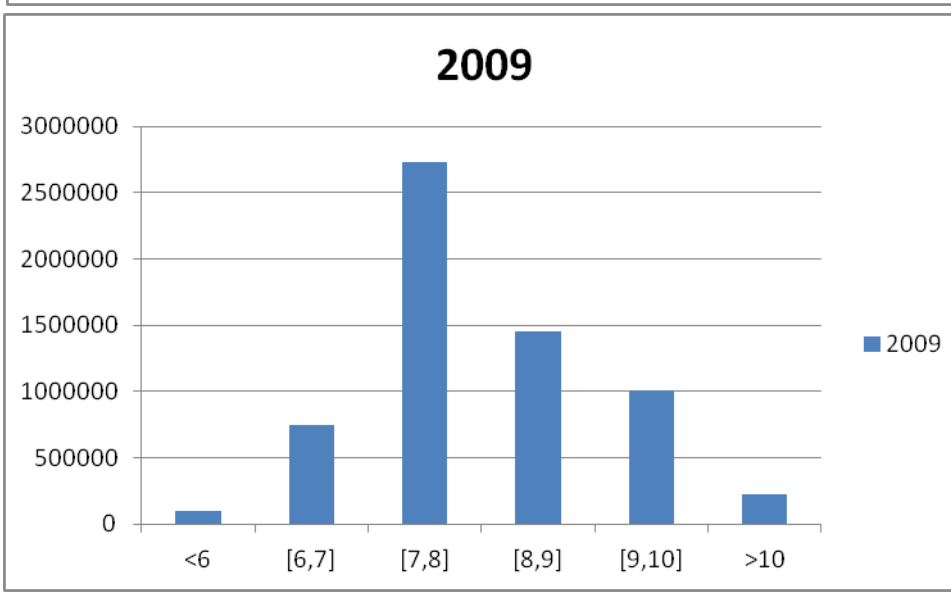
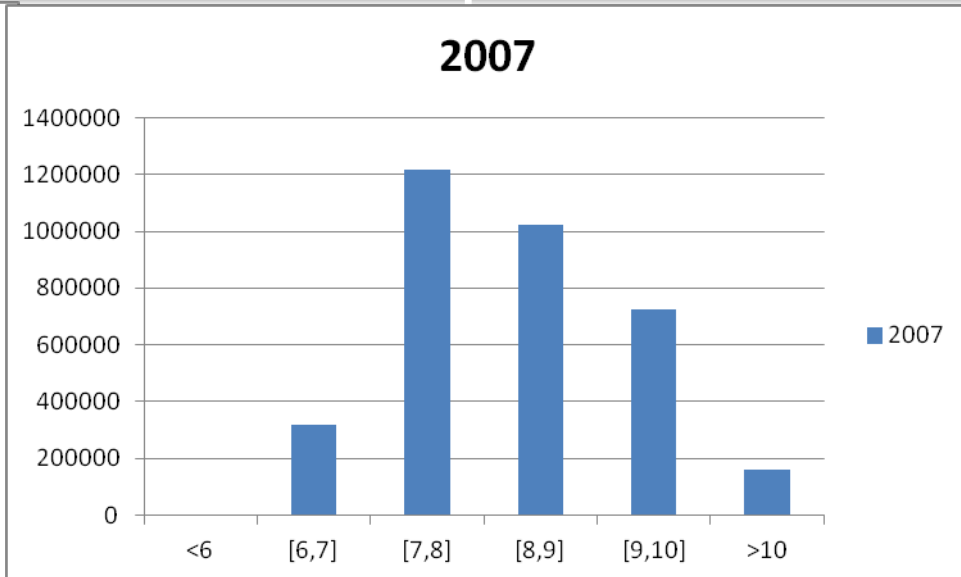
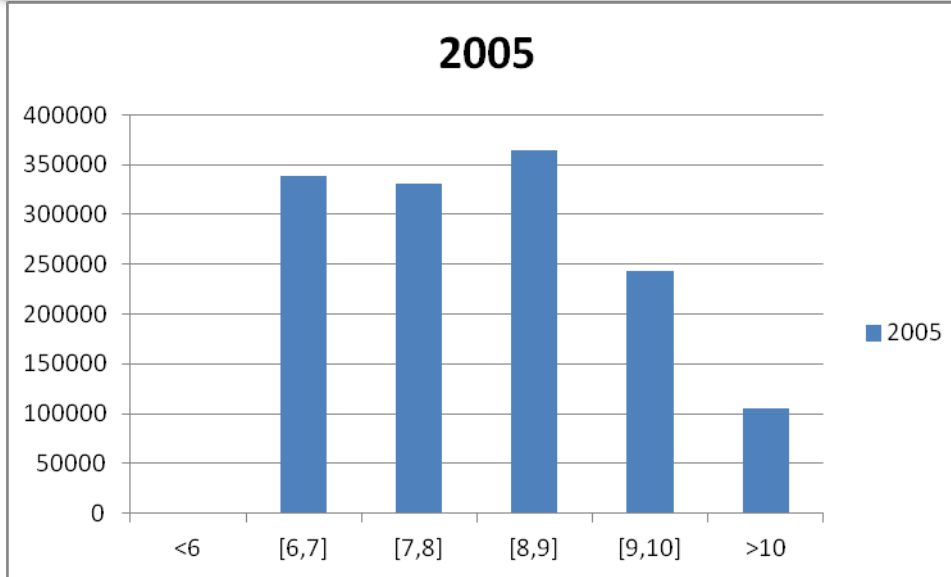


Back up slide: Fuel Price





Distributions of car sales over different Fuel consumption levels





Had consumers' preference been changing during the urbanization process?

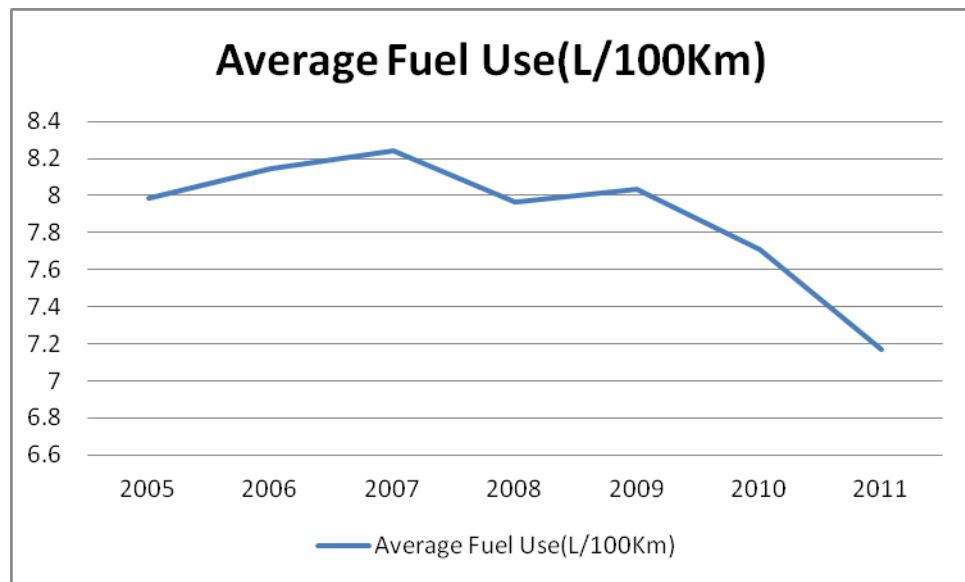
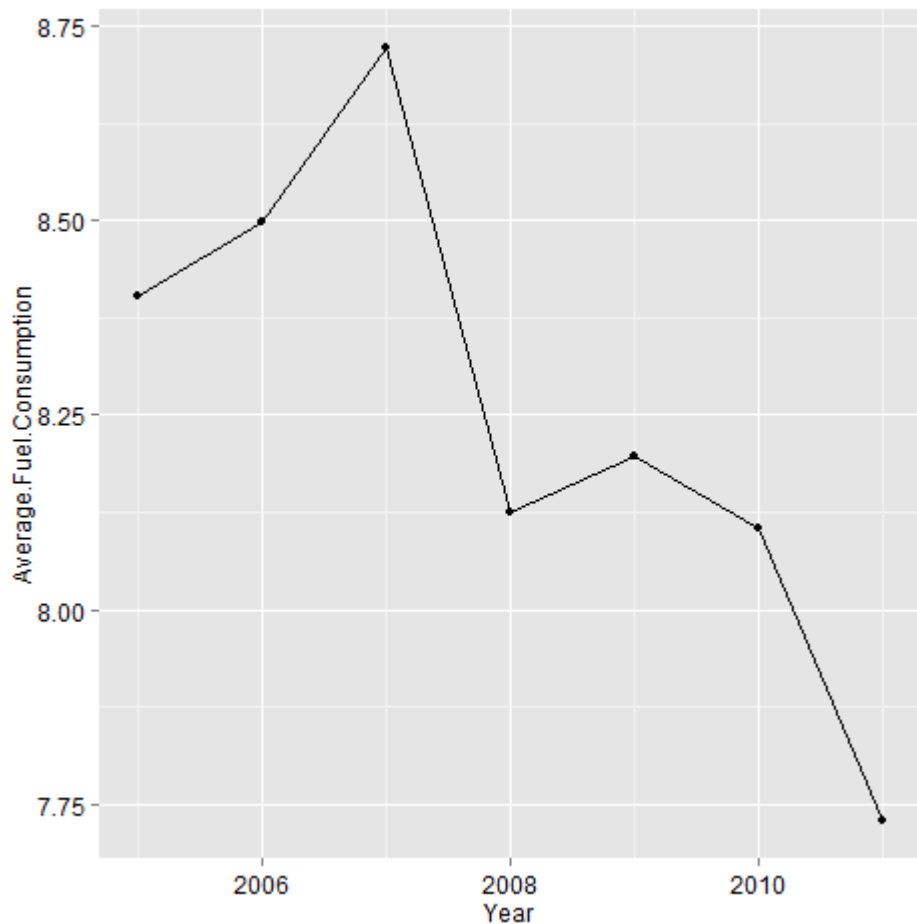




Trend of Available Technology in the Market

Fuel Efficiency and Displacement

Average Fuel Use (Liter/100Km)



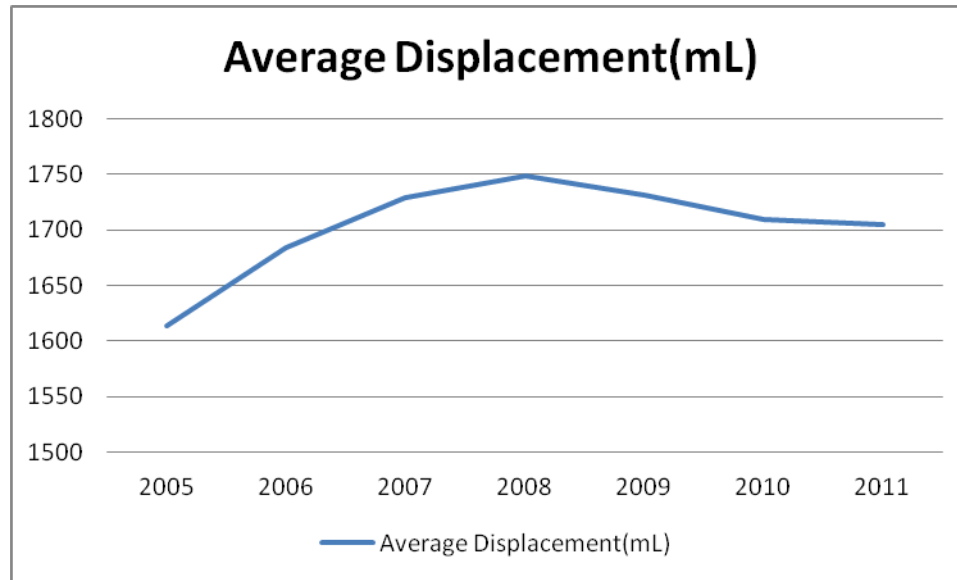
Sales weighted average
and average have same
trend



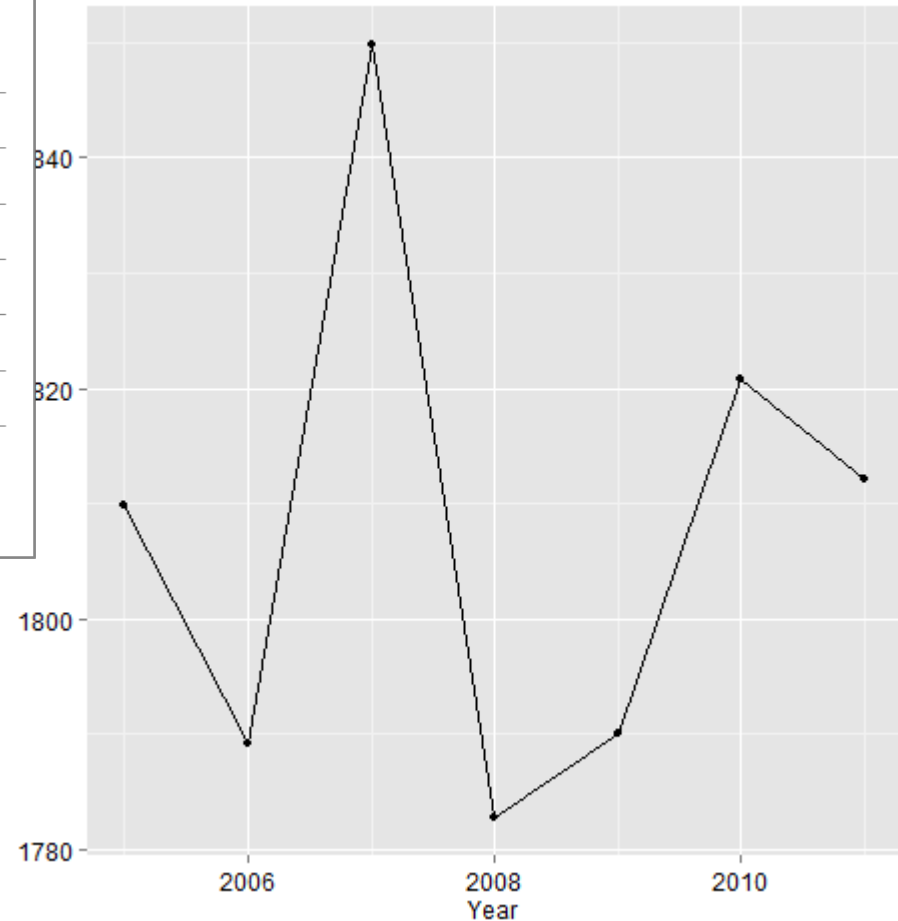
Trend of Available Technology in the Market

Fuel Efficiency and Displacement

Displacement(Liter)



- Change of the main part of consumers are smooth
- Extreme consumers' preference was fluctuating

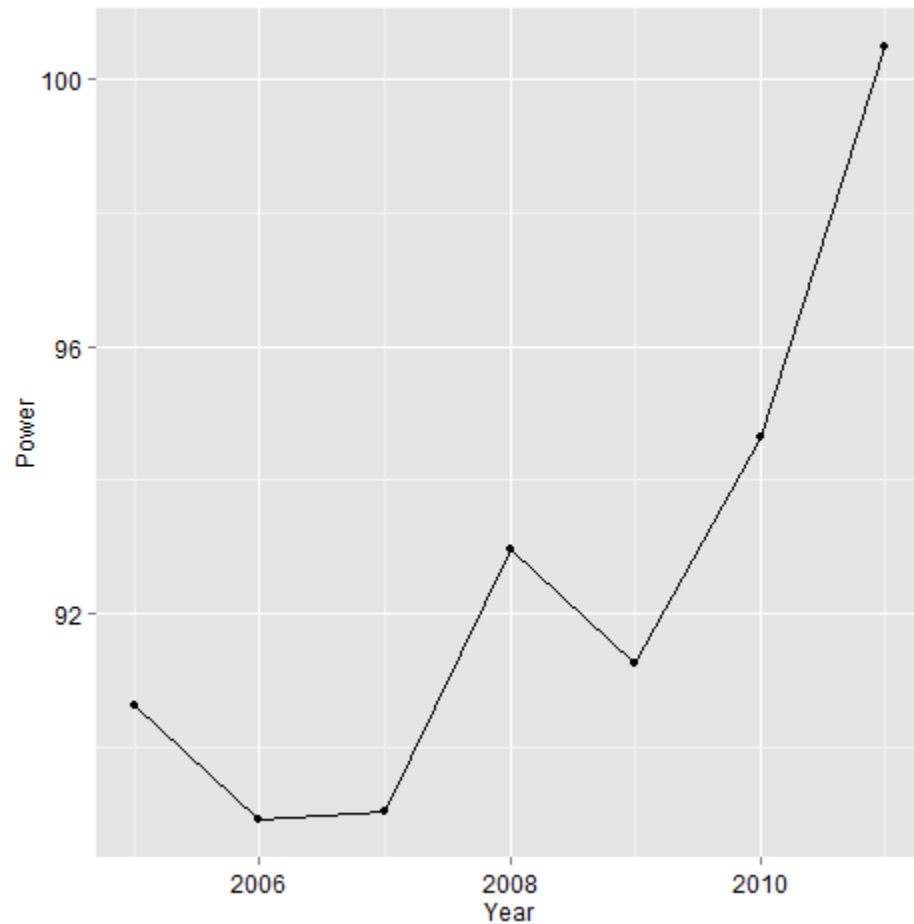


Data Source: MIT Fuel Consumption Report of Light Vehicle

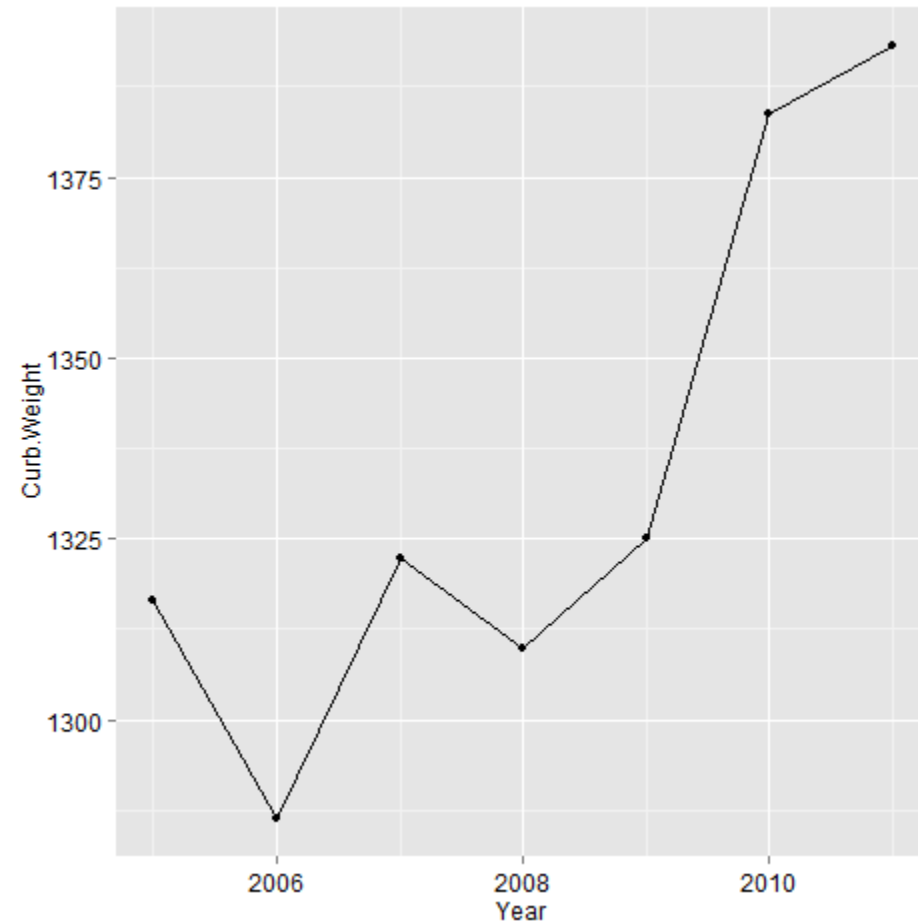


Trend of Available Technology in the Market: Bigger Cars with Larger Power

Average Horsepower(kW)



Average Curb Weight(kg)

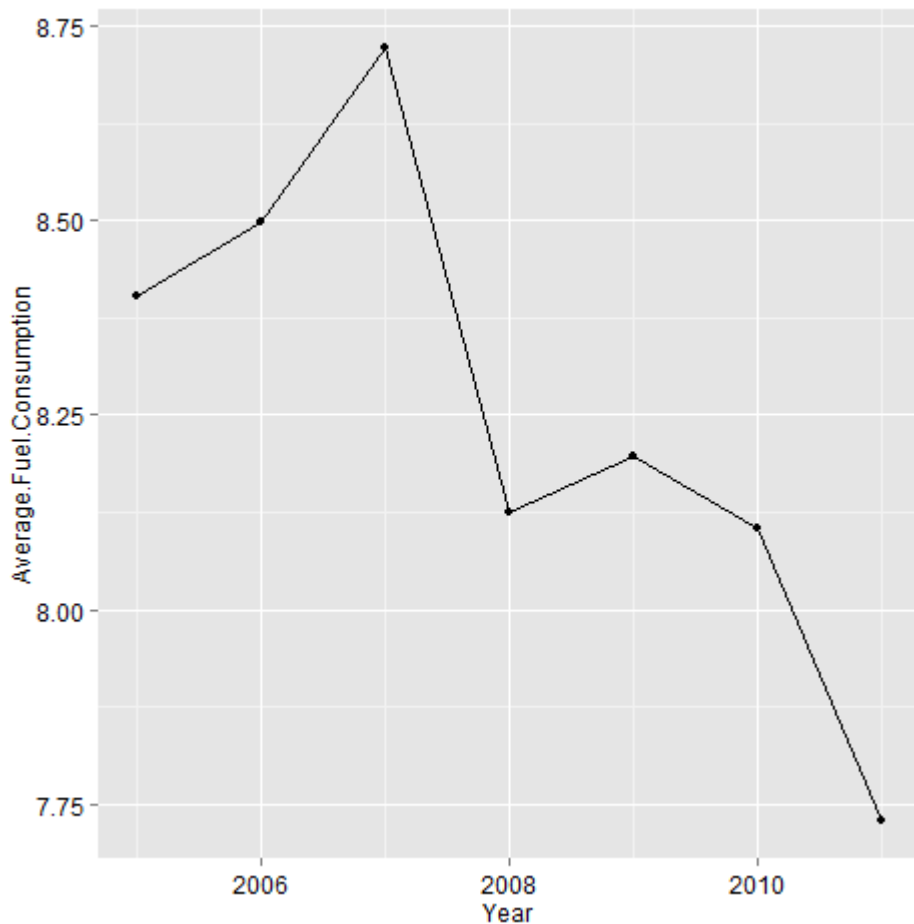


Data Source: MIT Fuel Consumption Report of Light Vehicle

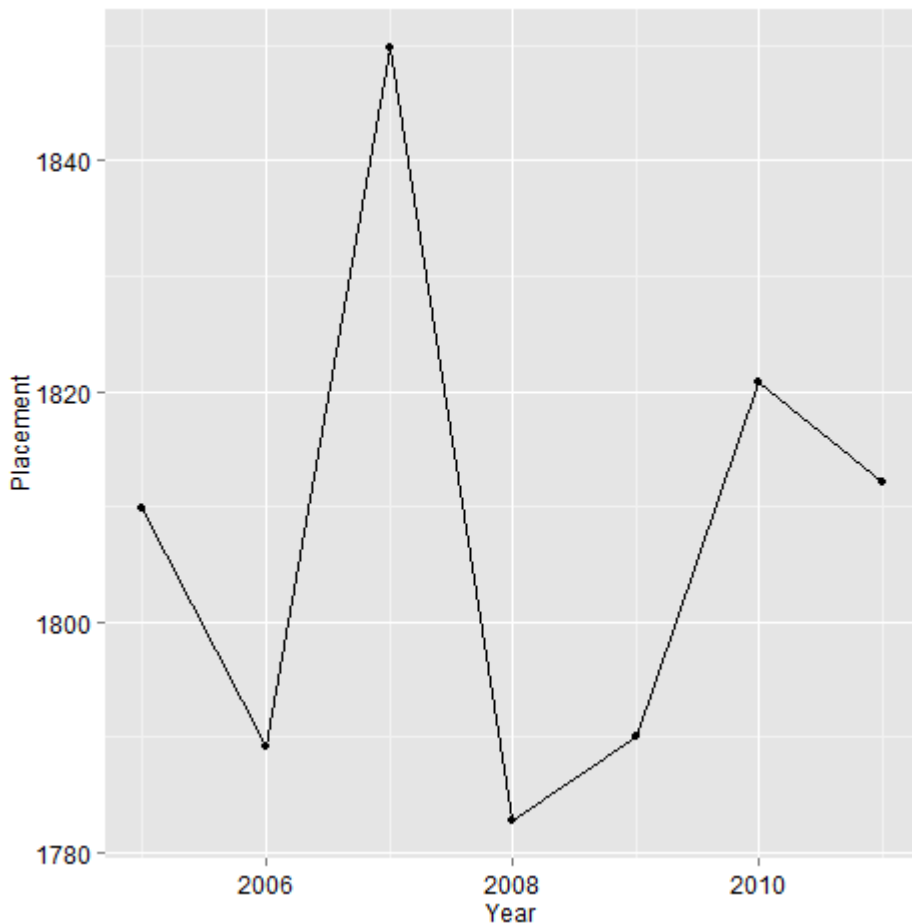


Trend of Available Technology in the Market Fuel Efficiency and Displacement

Average Fuel Use (Liter/100Km)



Displacement(Liter)



Data Source: MIT Fuel Consumption Report of Light Vehicle



Did Fuel Efficiency Tech Improve?

- Fixed Effects Panel Regression Model

$$\text{fuel efficiency} = \beta_1 \text{Year}_t + (\ln X) \Gamma + \varepsilon_{it}$$

- Controlling all the related attributes, the coefficient of year dummy β_1 is defined as the fuel efficiency technological change of Year t to Year 2005



Image removed due to copyright restrictions. Fuel Efficiency graph.
Source: unknown.



Images removed due to copyright restrictions. Fuel Efficiency graphs comparing Korean and Japanese Car Models.
Source: unknown.



Conclusion Part: Interaction among policy makers, car companies and car consumers, Phenomena and Stories





Policy makers' concerns change during the urbanization process

- At beginning
 - No standard regulating cars' fuel efficiency performance
 - Discourage the car models with small engine size
- Then
 - More and more stringent standard to regulate cars' fuel efficiency performance
 - Strongly encourage the car models with small engine size

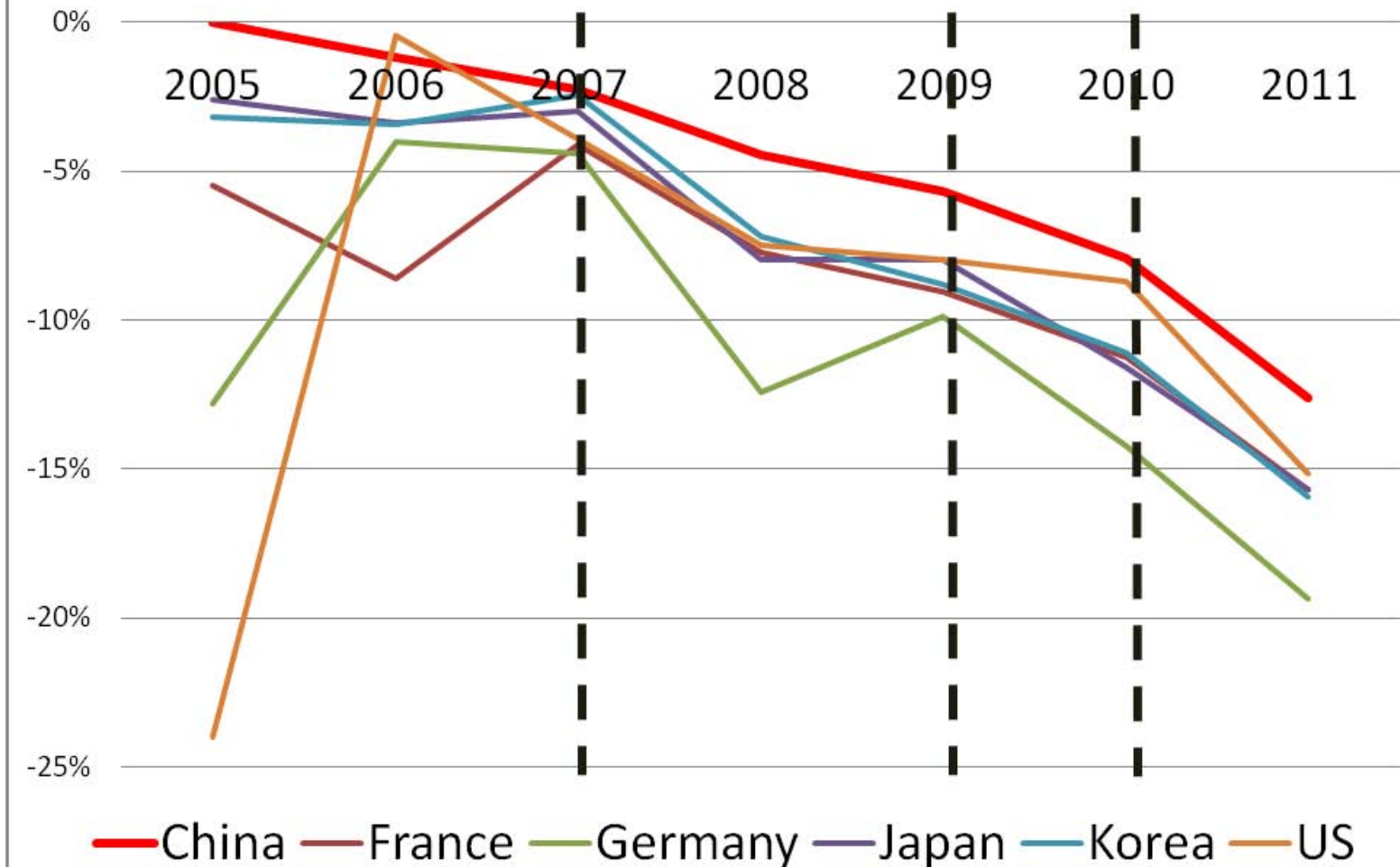


Are policies driven by concerns about the urbanization?

- Fuel Efficiency Standard (Announced in 2004)
- Purchasing Tax Credit for small displacement cars (2009 and 2010)
- Consumption Tax Increase for large displacement cars (From 2009)
- 3000 Yuan subsidy to energy efficient small displacement cars (From 2010)

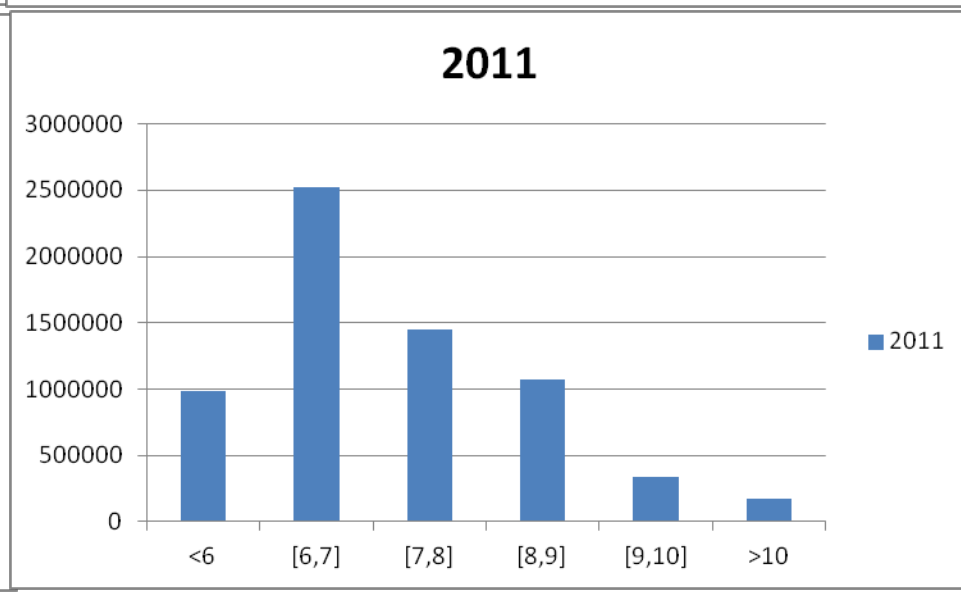
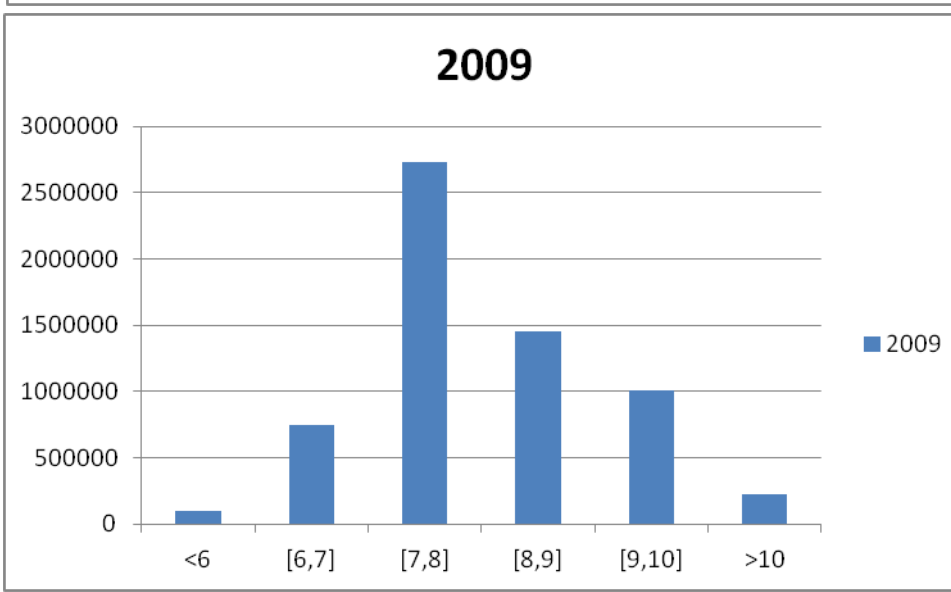
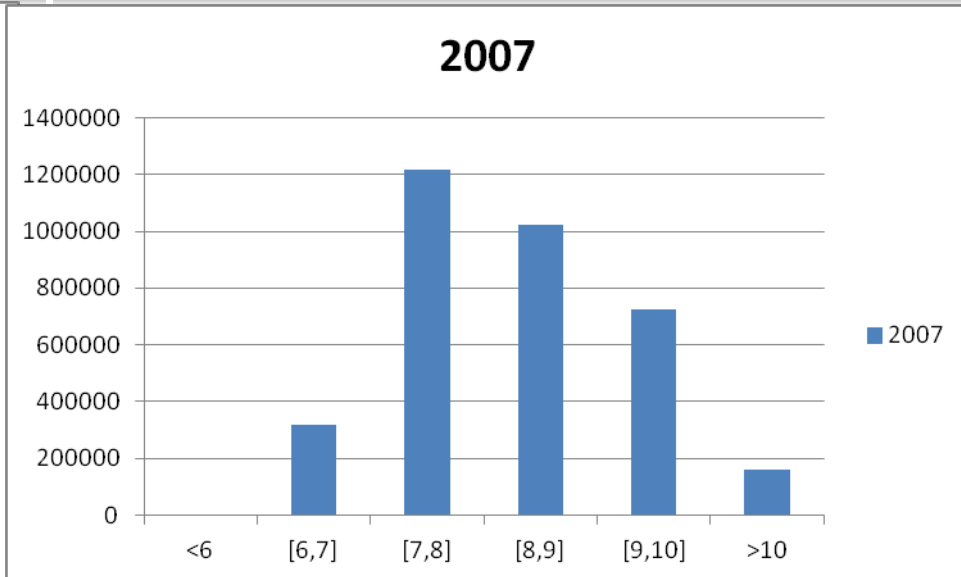
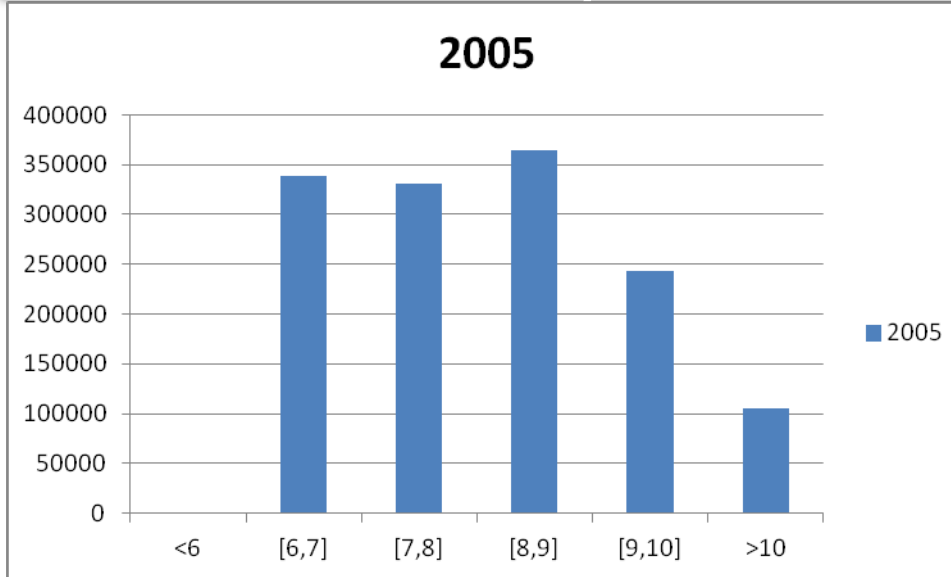


Technological Progresses by Different Sources





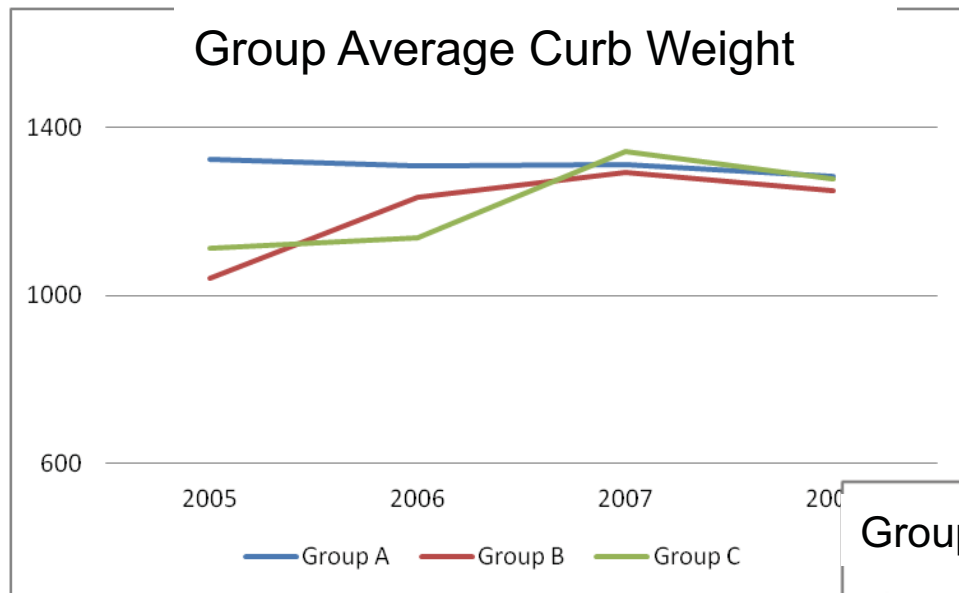
Were consumers' preferences impacted by the consequence of urbanization?





How do car models satisfy the standard?

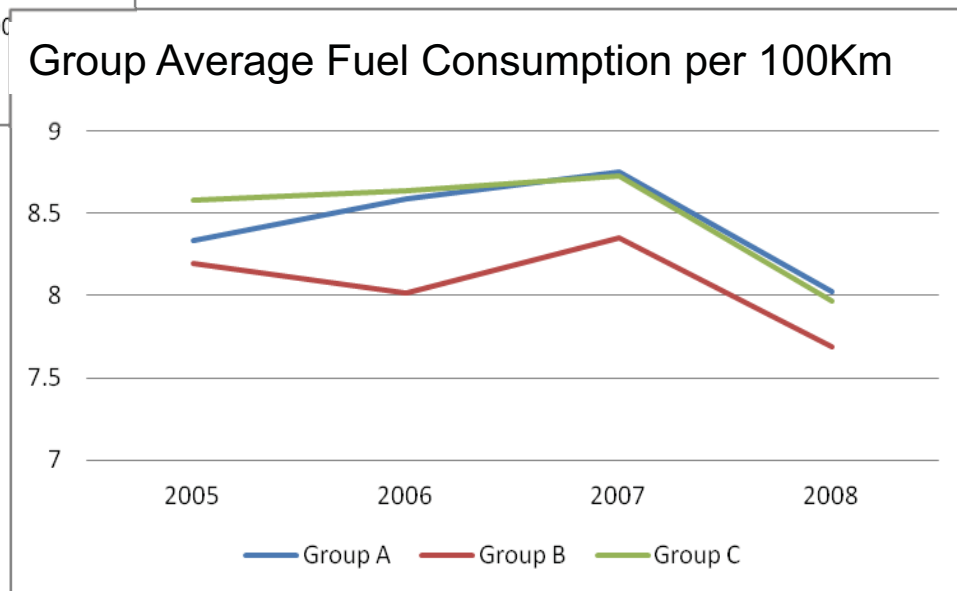
Group Average Curb Weight



- Group A: meeting Phase II standard by 2005
- Group B: meeting Phase II standard by 2006
- Group C: meeting Phase II standard by 2007

- Heaviest car meet the standard first
- Progress of meeting standard include increase weight and decrease fuel consumption

Group Average Fuel Consumption per 100Km





Model 1: considering the demand effects

	<i>OLS</i>	<i>instrumental variable</i>
	(1)	(2)
log(Placement)	0.336*** (0.019)	0.345*** (0.028)
log(Curb.Weight)	0.463*** (0.019)	0.404*** (0.059)
log(Power)	-0.117*** (0.013)	-0.133*** (0.025)
alterf	-0.065*** (0.008)	-0.026 (0.036)
d2007	-0.041* (0.022)	0.008 (0.054)
d2008	-0.047** (0.021)	-0.040 (0.032)
d2009	-0.034* (0.021)	0.013 (0.058)
Germany:d2008	0.056** (0.028)	0.067 (0.043)
Germany:d2009	0.080*** (0.027)	0.176** (0.089)
Germany:d2010	0.066** (0.027)	0.233 (0.149)
Germany:d2011	0.079*** (0.028)	0.141** (0.068)

- no significant change in trade off
- Domestic and German technological progress change significantly

	p-value
Weak instruments	0.3148
Wu-Hausman	0.0844



My intuition

- Why the motor gasoline consumption increased far slower than the car sales?
- Because the consequence of urbanization changed the car owners' traveling behavior



Thank You!
Questions?

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