

# Carbon Dioxide Emissions from Road Transportation in China

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**I**

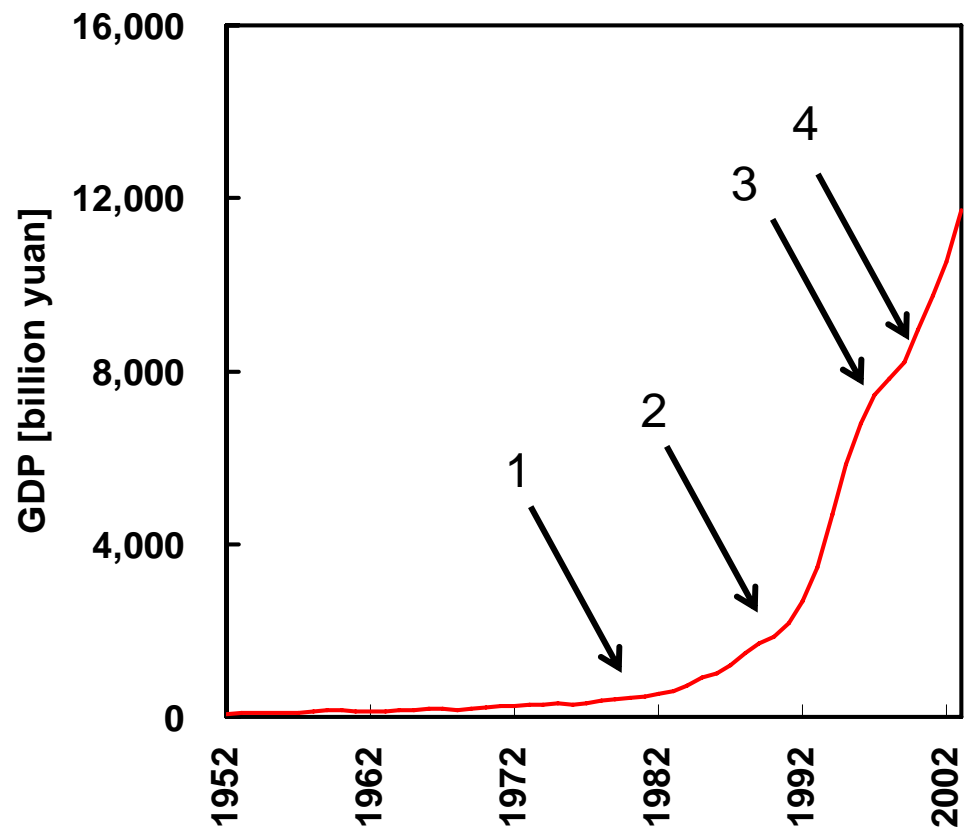
# Chinese Transportation

# Basic Data about China #1

## GDP

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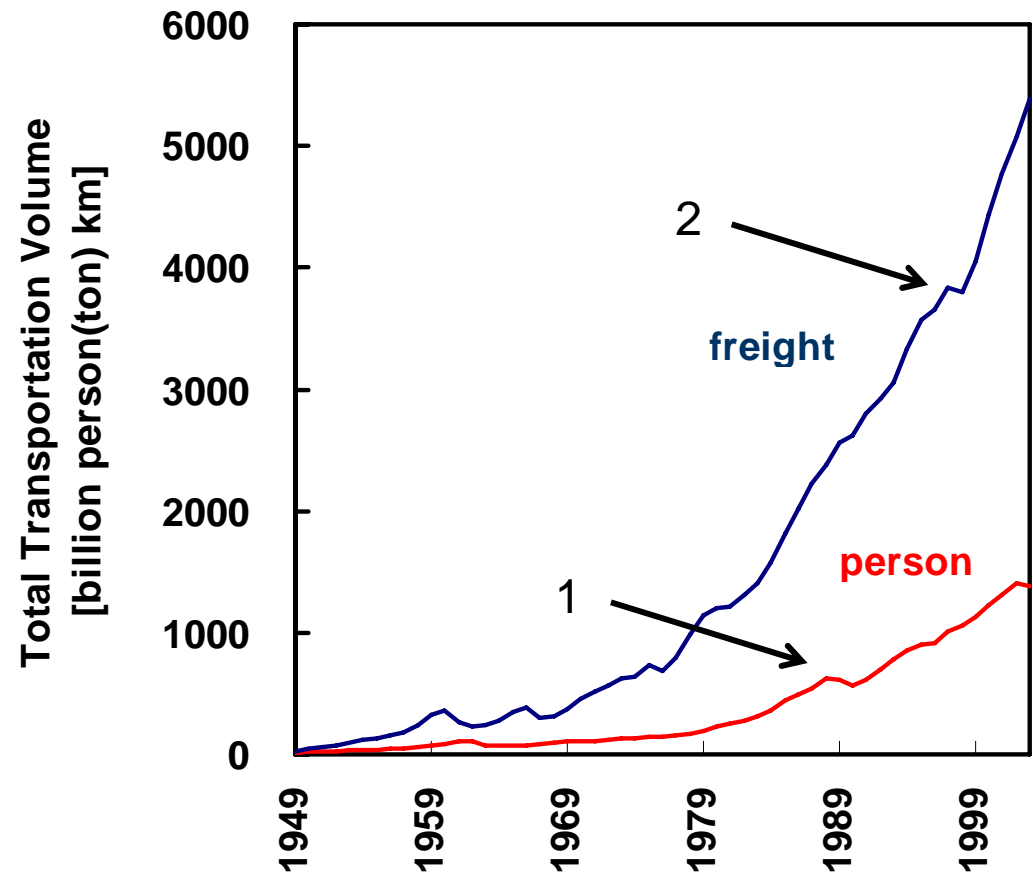
- 1- China entered a high growth era
- 2- Belt-tightening policy  
Tiananmen Square Incident
- 3- Brief economic sluggishness  
from 1995 to 1999
- 4- High growth again from 2000.



# Transportation in China #1

## Total Transportation

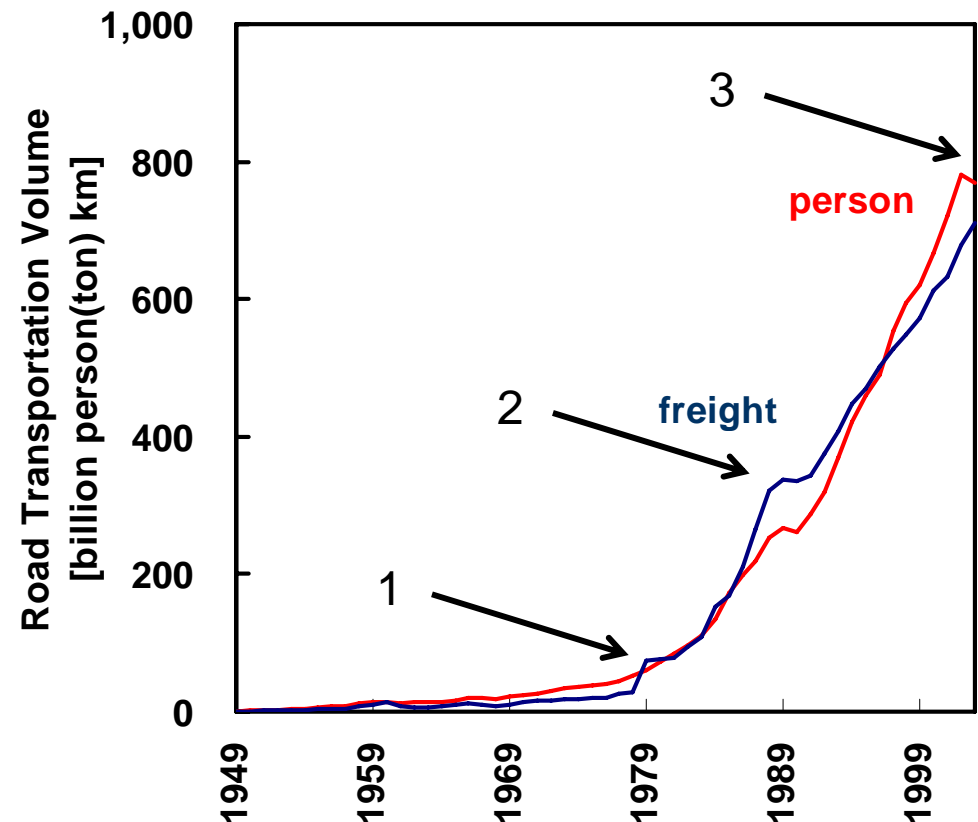
- 1- Belt-tightening policy  
Tiananmen Square Incident
- 2- Brief economic sluggishness  
from 1995 to 1999



# Road Transportation in China

## Road Transportation

- A- More than half of total passenger transportation
  - B- 15% of freight transportation
  - C- A large part of China's fuel supply is transported by train.
- 1- Definition of them were changed
  - 2- Belt-tightening policy  
Tiananmen Square Incident
  - 3- Influence of SARS



# Length of Road in China

## Length of Road

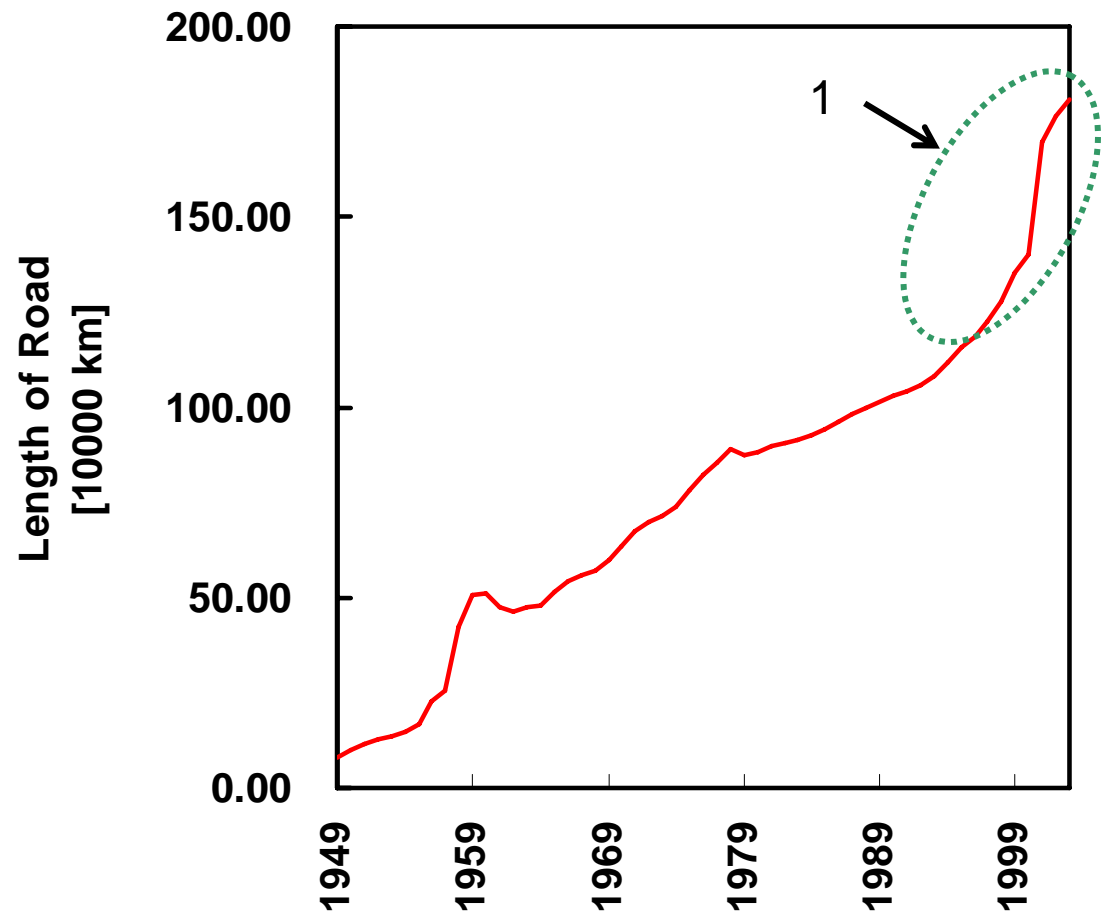
1- Accelerating infrastructure construction

In 2004

highway 1.871 million km  
expressway 34,300km

National Expressway Network Plan

final length 85,000km  
(half are already underway)



# Possession of Civil Vehicles #1

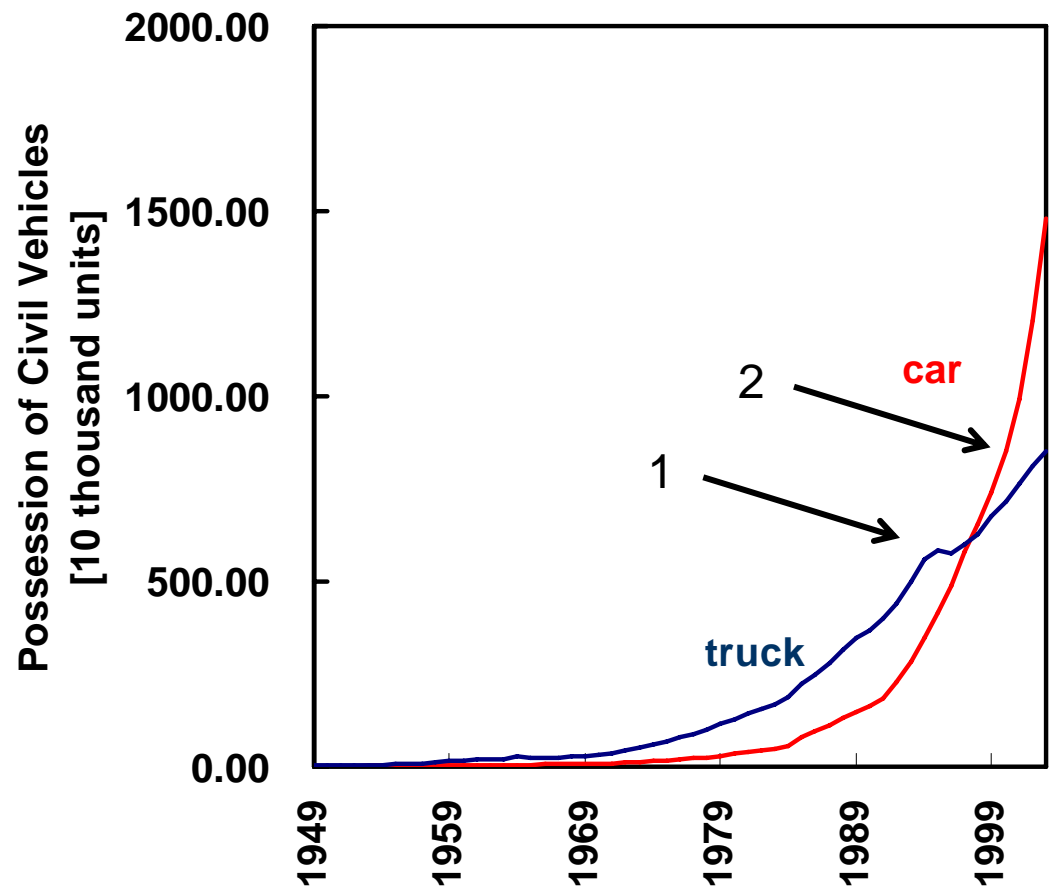
## Total Possession

A- Civil vehicles

= not army vehicles

1- Brief economic sluggishness  
from 1995 to 1999

2- Definition was changed.  
(1998, 1999)



# Possession of Civil Vehicles #2

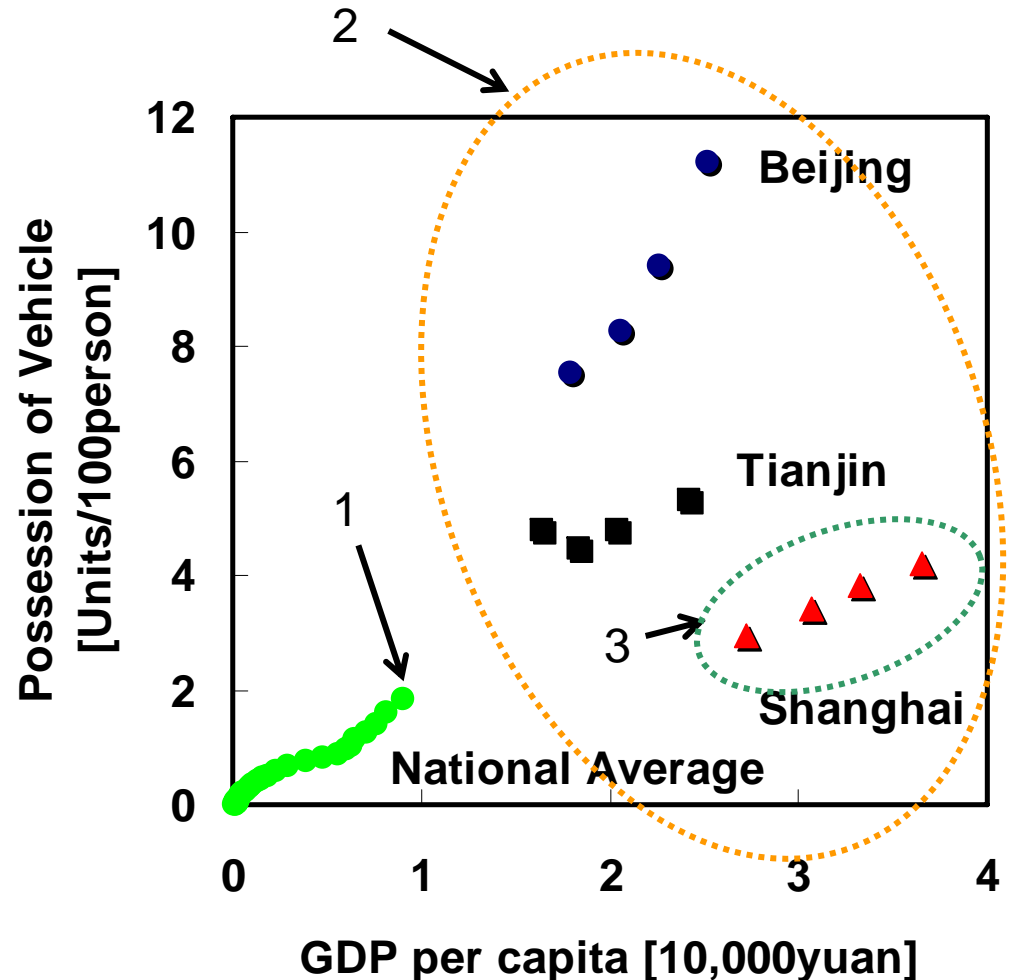
## Region

1- 2.07 units/100 person, 2004  
(58.8 units, Japan, 2003)

2- Difference between large cities  
and the national average

3- Shanghai's car ownership is  
smaller than the average. \*

\* Due to limitations on the number  
of motor vehicle registrations and  
specific policies to restrict vehicle  
ownership



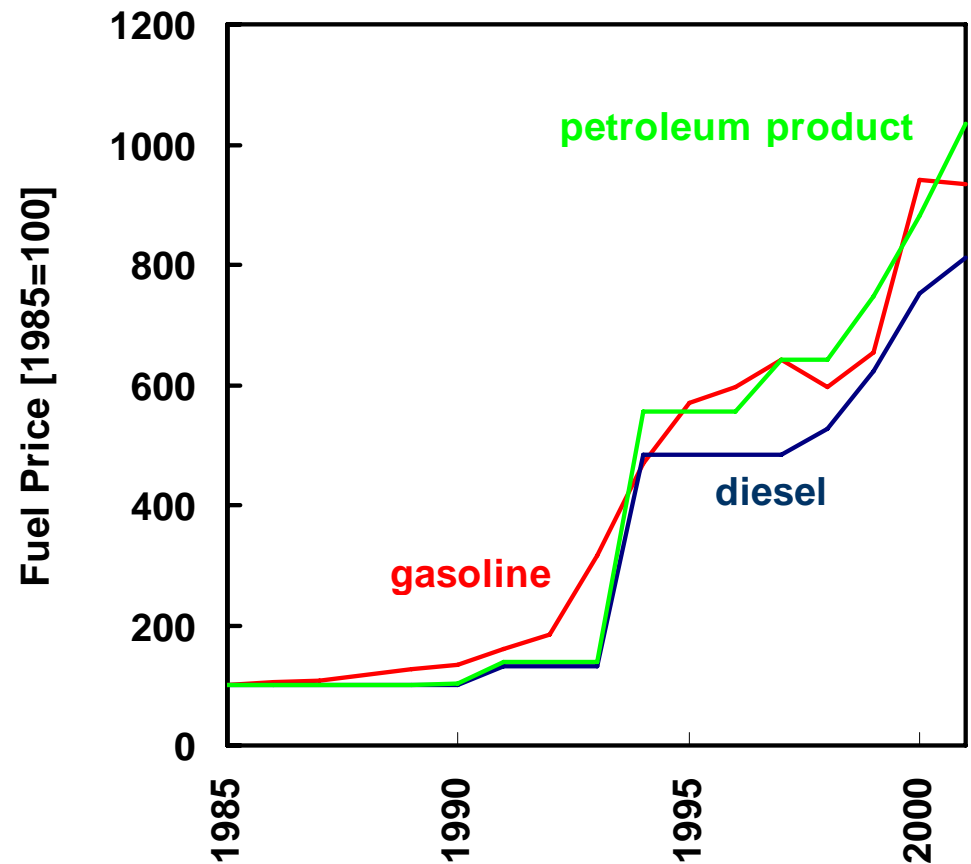
# Prices #2

## Fuel Prices

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- Automotive fuels were subject to price controls in China.

Domestic fuel prices were out of synch with international market prices before last half of 1990's.



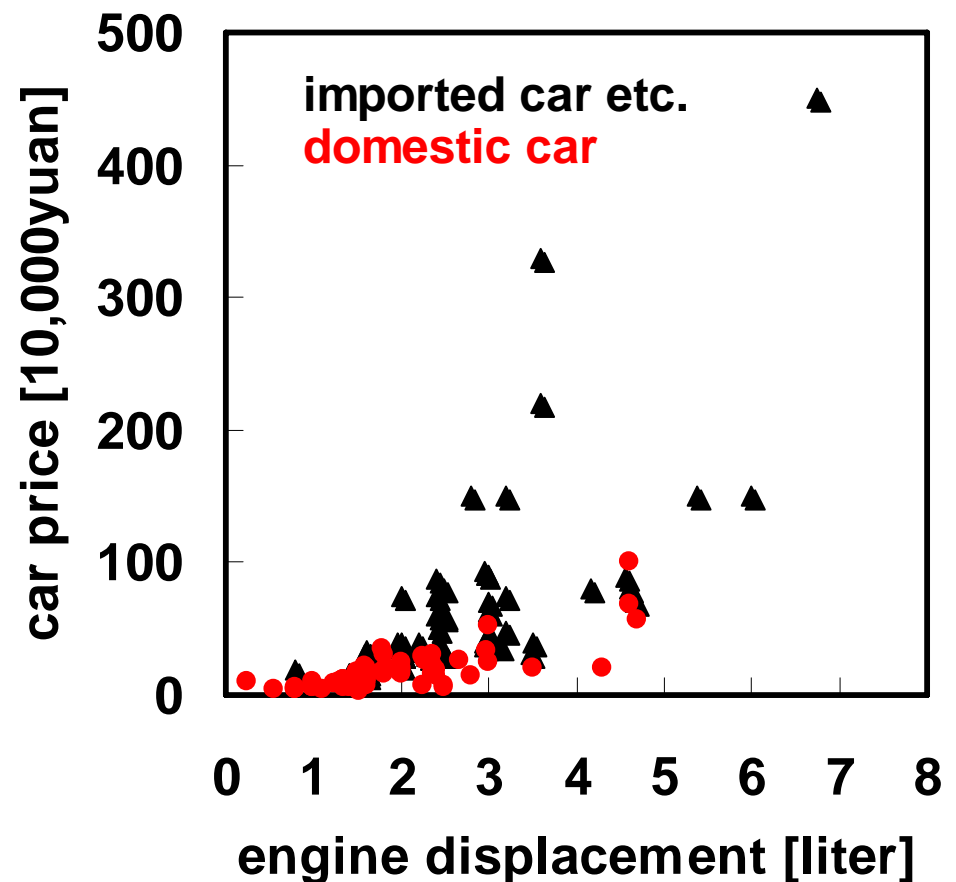
# Prices #1

## Car Price (2003)

A- Market price and engine size  
122 new vehicles in China  
in 2003

B- There are a lot of cars sold at  
prices below 200,000 yuan.

C- Smaller engines cars  
(less than 2000cc) are very  
popular in the market.



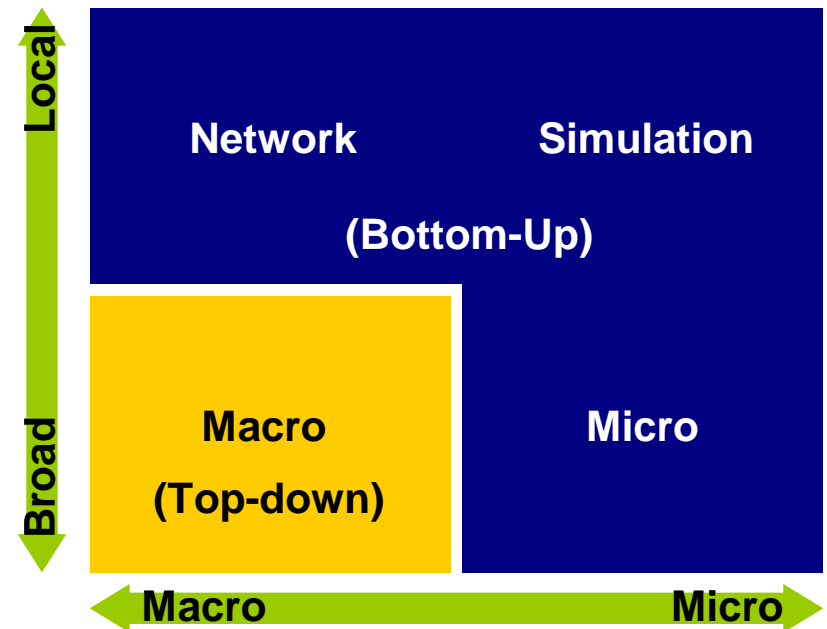
## II

# Projections of Carbon Dioxide Emission from Road Transportation in China

# Forecasting Method #1

## 4 approaches

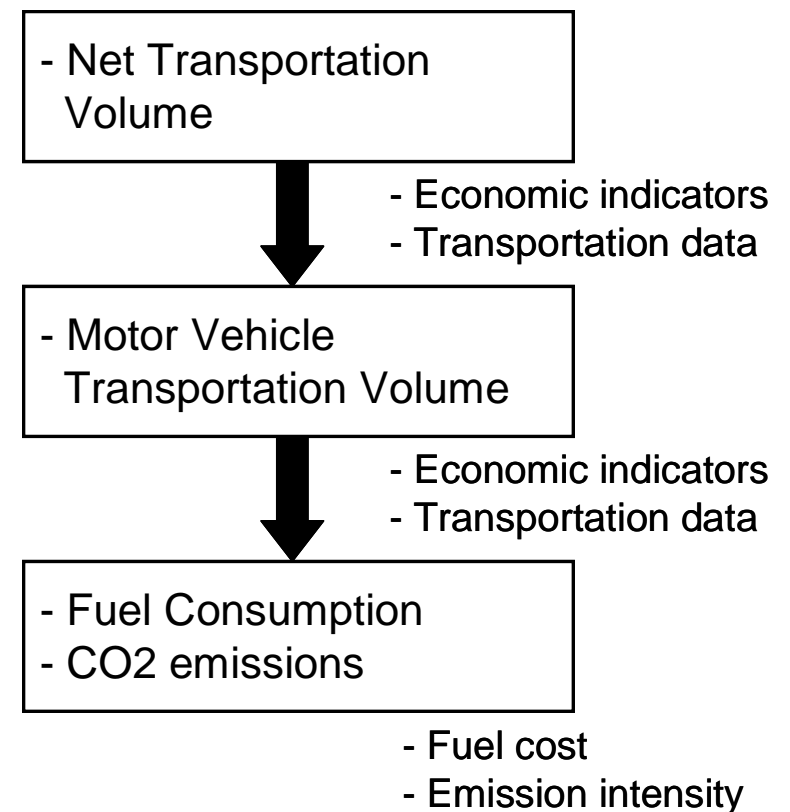
- 1- Network analysis
  - Traffic volume
  - For site to site transportation
- 2- Using macro-data
  - Volume of fuel sales
  - For CO2 emissions
- 3- Simulation
  - Traffic conditions
  - For evaluation of traffic policies
- 4- Micro trip
  - Person trip



# Forecasting Method #2

## Flowchart of model-A

- 1- total transportation volume
  - using a regression model
  - GDP, road length
- 2- road transportation volume
  - using a logit model
  - average price of automobiles
  - disposable income per capita
  - fuel price index
- 3- fuel consumption + CO2 emissions
  - using a conversion factor of CO2 emissions per unit of fuel consumption (from historical data for Chinese Public Roads and Transportation Enterprises)

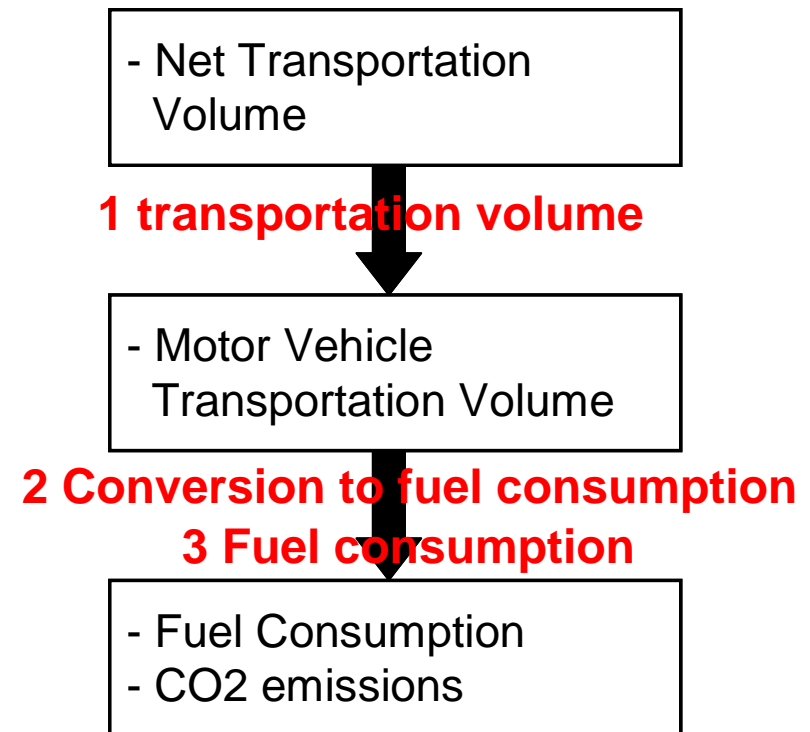


# Forecasting Method #2

## Problems

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- 1- Transportation volume data
  - No time-series data in detail
  - Frequent definition change
- 2- Conversion to fuel consumption
  - Gasoline / Diesel
- 3- Fuel consumption data
  - Transportation sector
  - Gasoline / Diesel



# Result #1

## By model-A

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A- Standard Growth Case  
7% annual growth

B- Low Growth Case  
6% annual growth

Two additional scenarios were also used for forecasting energy consumption including i). holding fuel prices at current levels and ii). a doubling of fuel prices from current levels.

### Energy Consumption by Vehicles

#### [A] Standard Growth Case

Gasoline Price	Constant	Double
2000	75	75
2030	187	153

[Mtoe]

#### [B] Low Growth Case

Gasoline Price	Constant	Double
2000	75	75
2030	182	150

[Mtoe]

# Result #2

## Comparison

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### Reasons

- 1- Not including the possession of vehicles
- 2- Coefficient of fuel consumption
- 3- Formula of fuel consumption  
- large margin of error

### Energy Consumption by Vehicles

#### Our Standard Growth Case

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2000	75
2030	187

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[Mtoe]

#### IEA's Projection

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2000	50
2030	220

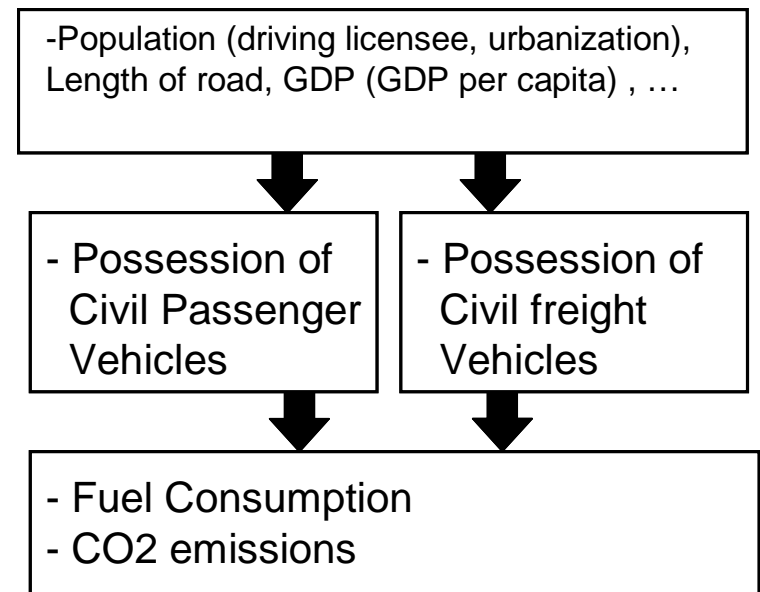
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[Mtoe]

# Result #3

## Flowchart of model-B

- 1- Possession of passenger vehicles
  - using a regression model
  - GDP, Population, Urbanization rate
- 2- Possession of freight vehicles
  - using a regression model
  - GDP, Length of road and railway
- 3- fuel consumption + CO2 emissions
  - using a conversion factor of CO2



# Result #4

## By model-B

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- Standard Growth Case  
7% annual growth  
(from 2002 to 2030)
- Total vehicle stock : 122 million units

### Energy Consumption by Vehicles

#### Our Standard Growth Case

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2000	45
2030	195

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[Mtoe]

#### IEA's Projection

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2000	46
2030	220

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World Energy Outlook2004 [Mtoe]

# Conclusions

## Today

2 simple models and 2 results

- in consideration of the possession of vehicles, we estimated the results closer to IEA's projection.
- many problems (rough using of statistics, rough estimation)

## Next Step

Fusion of the top-down model and the bottom-up model

- for evaluating the traffic policies

Fusion of the macroeconomic model and these models

- transportation volume  $\leftrightarrow$  GDP ?

Refining Chinese statistics we used

- cooperation with the Chinese Information Center
- possession of vehicles (car, bus, L-truck, and so on)
- estimating the volume of each fuel (gasoline / diesel)