



# **Urbanisation, Vulnerability and Sustainability in Asian Cities: A Transport Perspective**

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# Presentation



## Background: UN Habitat Reports

(2009) Planning sustainable cities

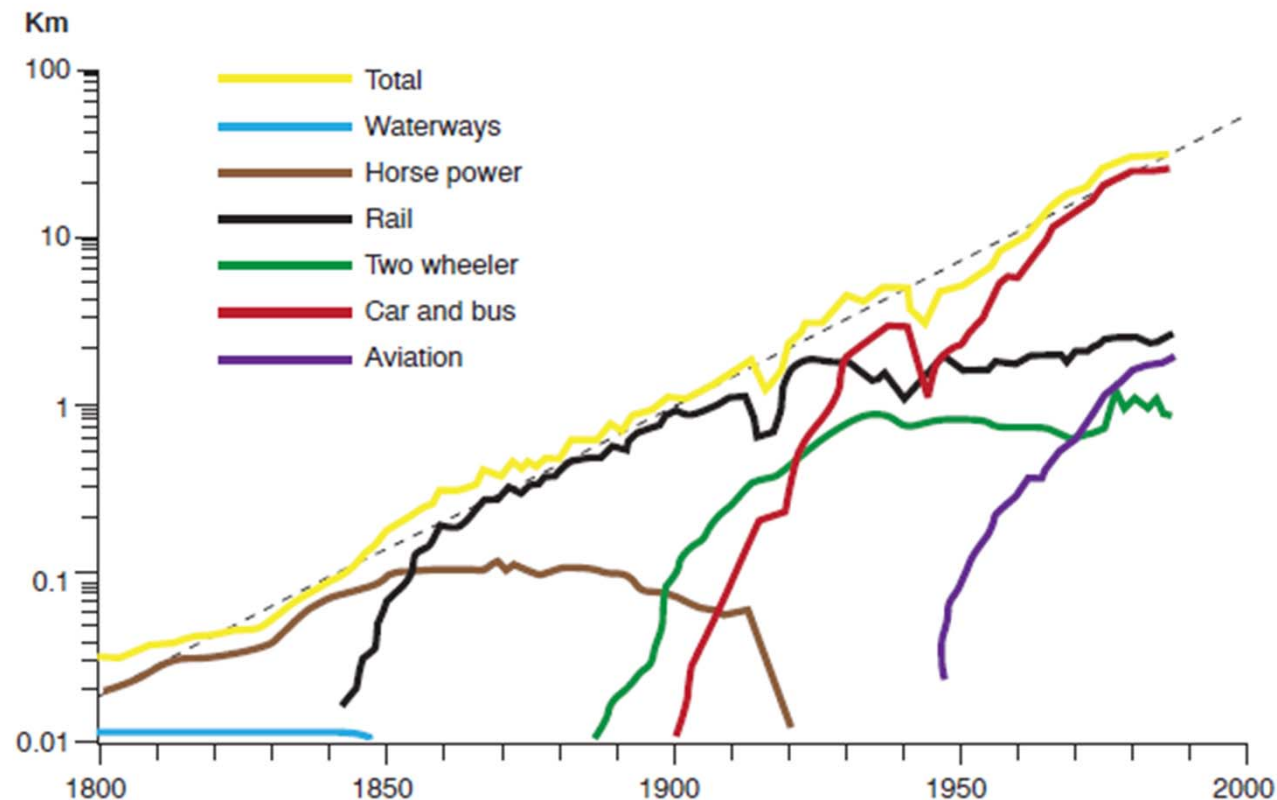
(2011) Cities and climate change

(2013) Sustainable urban mobility

1. Growth in travel distances – more energy use and carbon emissions – taking examples from the developed countries
2. Choices and pathways – inevitability and innovation
3. Comparison of growth and development – the rate and scale of change
4. Urban development patterns in China
5. Vulnerabilities and sustainability
6. Comments and conclusions

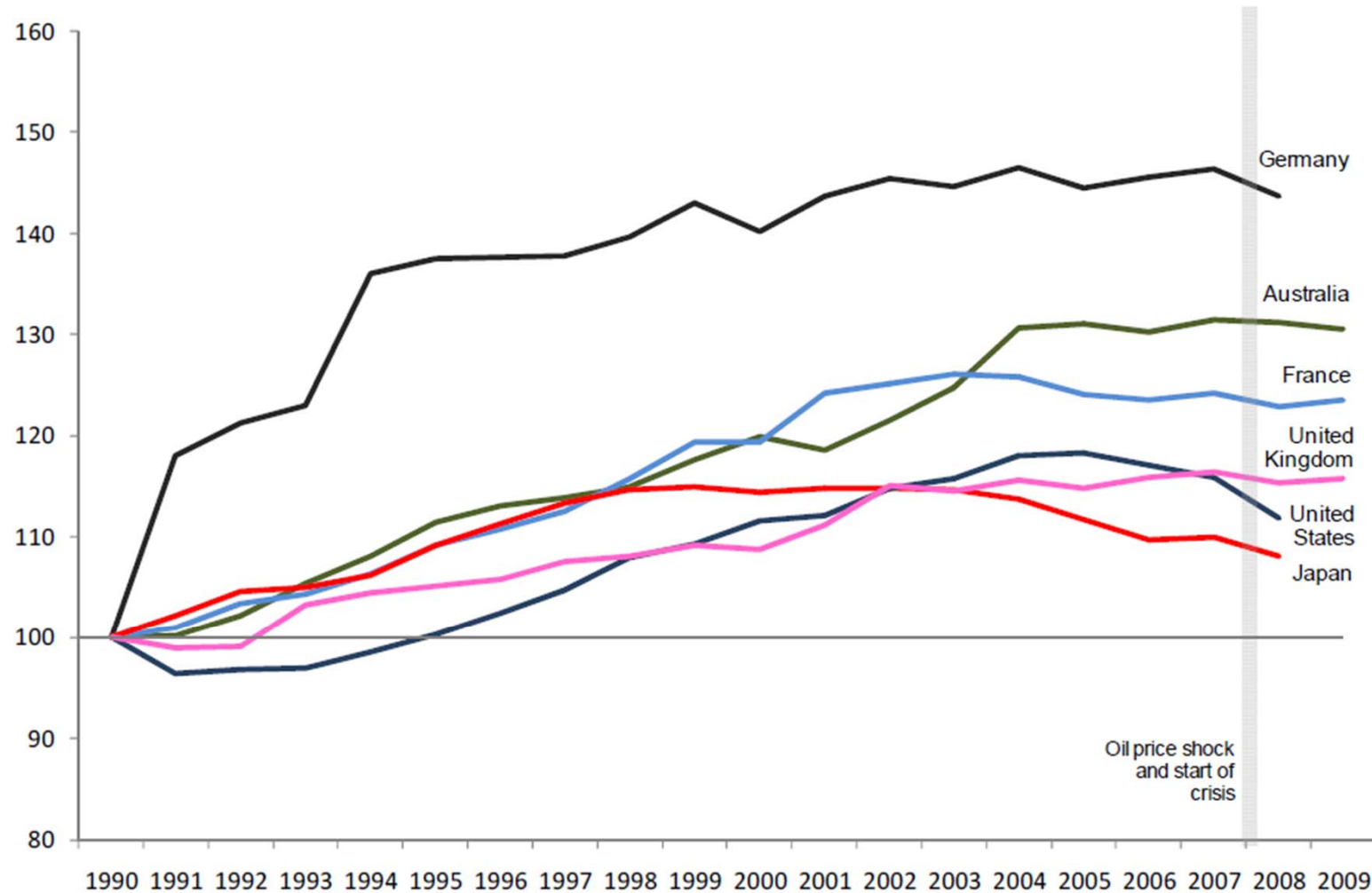
# 1. Growth in travel distances – the experience from the developed countries

**Distance travelled in France during the last two centuries  
(Km/person/day –excluding walking and cycling)**



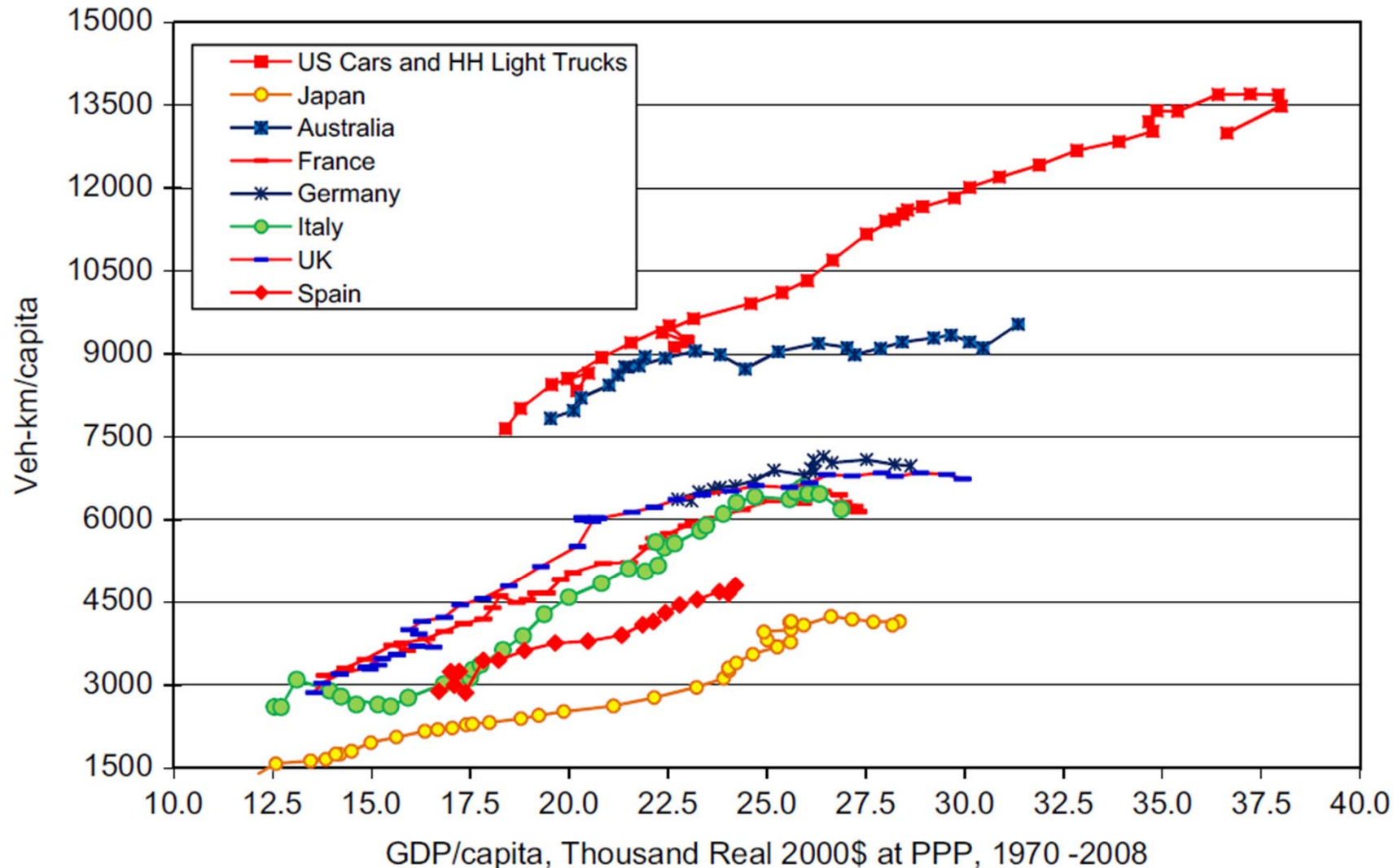
Source: Grübler, A. (2004) *Technology and Global Change*, Cambridge: Cambridge University Press

# Passenger – kilometres by private cars and light trucks in the developed countries: 1970-2009 Indexed to 1990



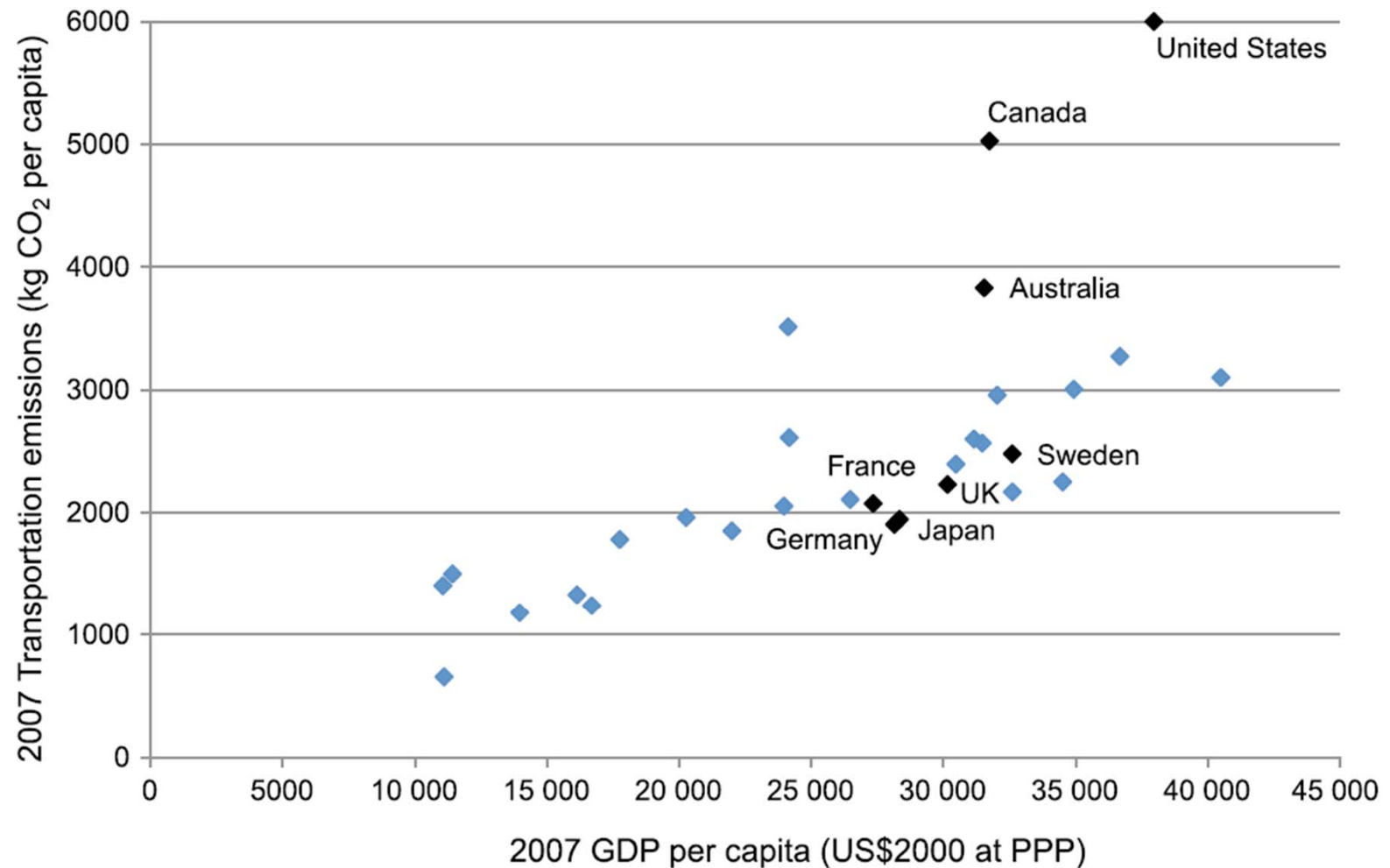
Source: International Transport Forum (2010)

# Vehicle kilometres travelled/capita for cars and household SUV or light trucks vs GDP per capita in 2000 US \$, converted to PPP



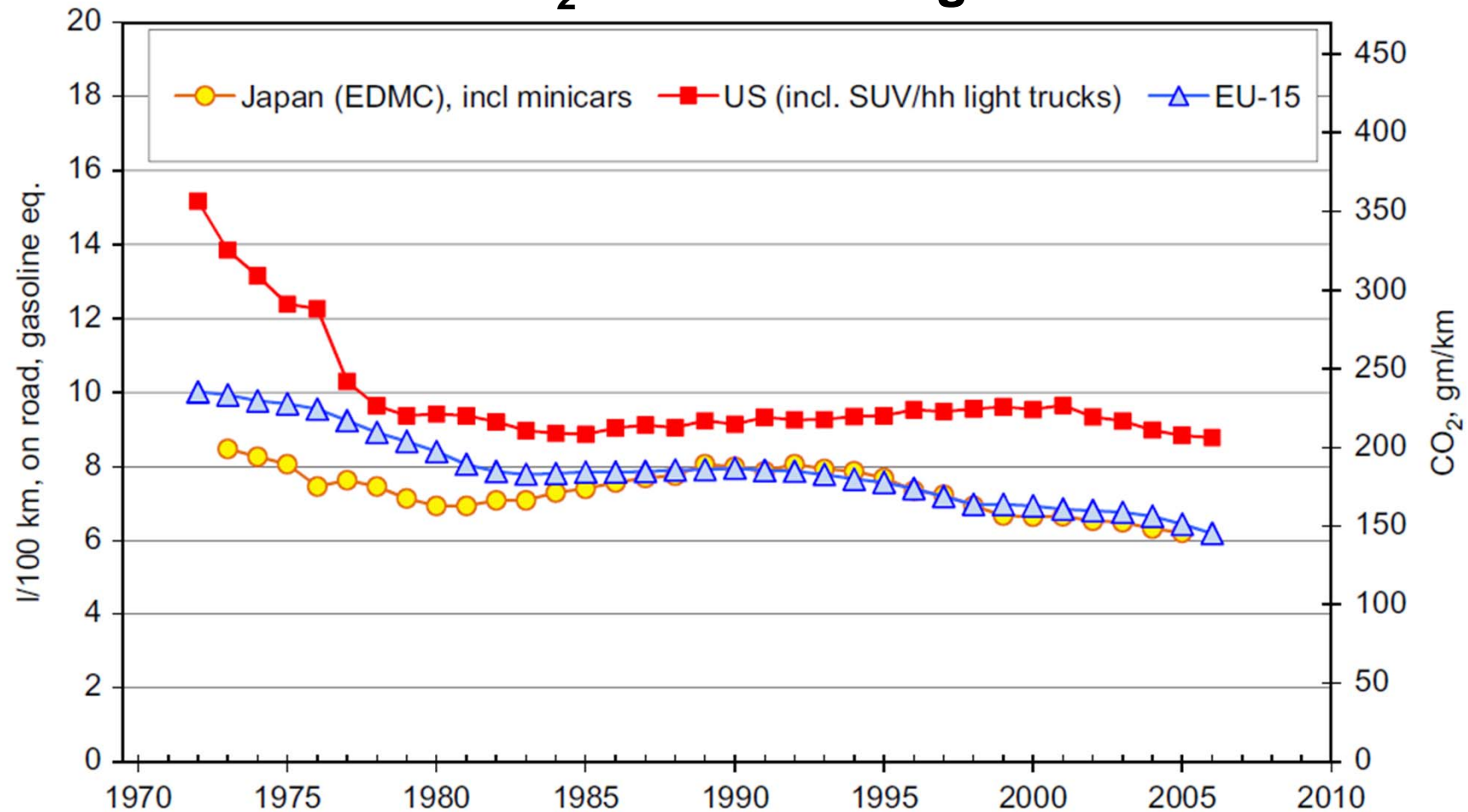
Source: Schipper (2011)

## GDP and transport CO<sub>2</sub> emissions in OECD countries 2007



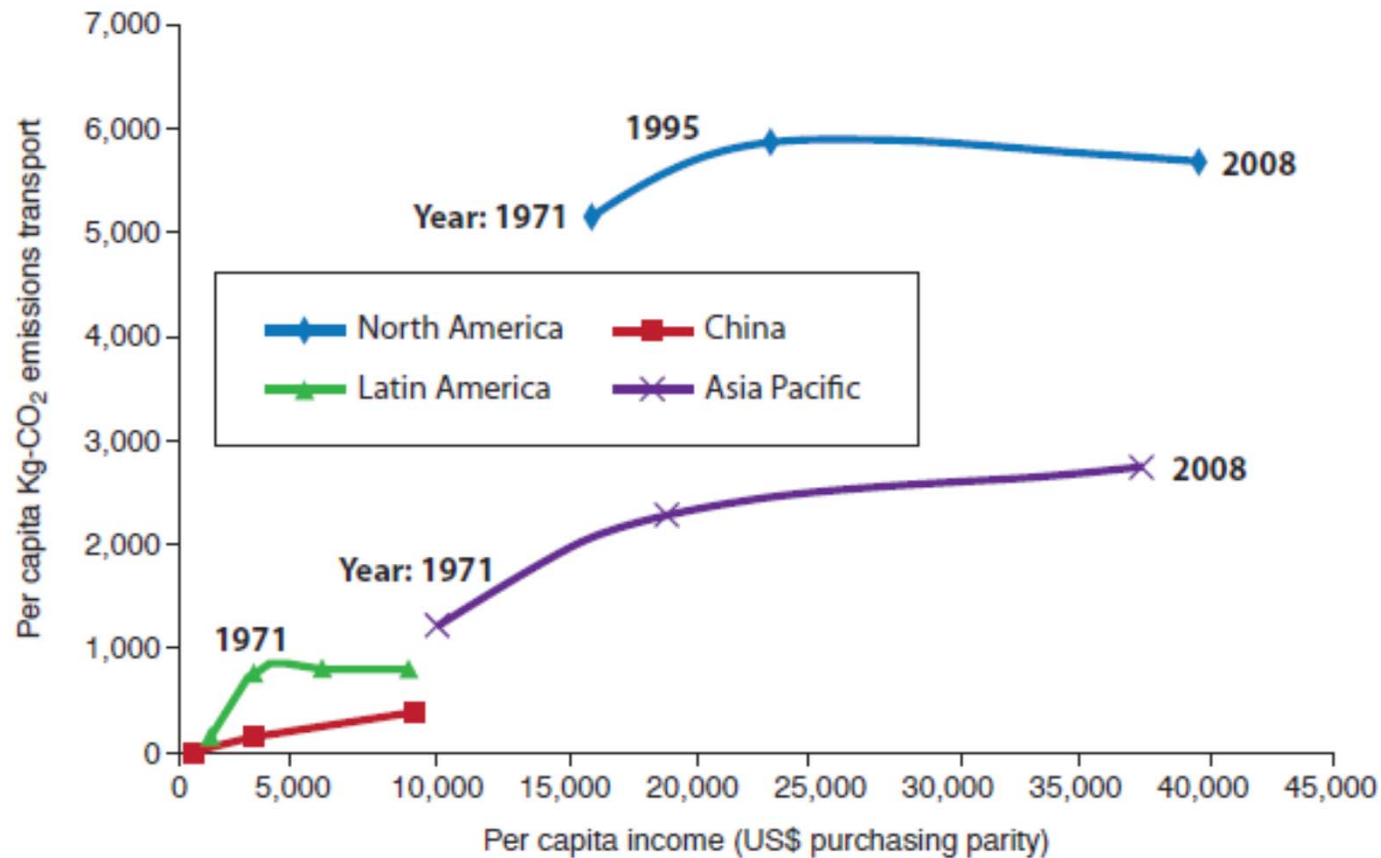


# New vehicle sales-weighted economy petrol equivalents by year – converted to litres of petrol equivalent and approximate CO<sub>2</sub> emissions in g/km



Source: Schipper (2011)

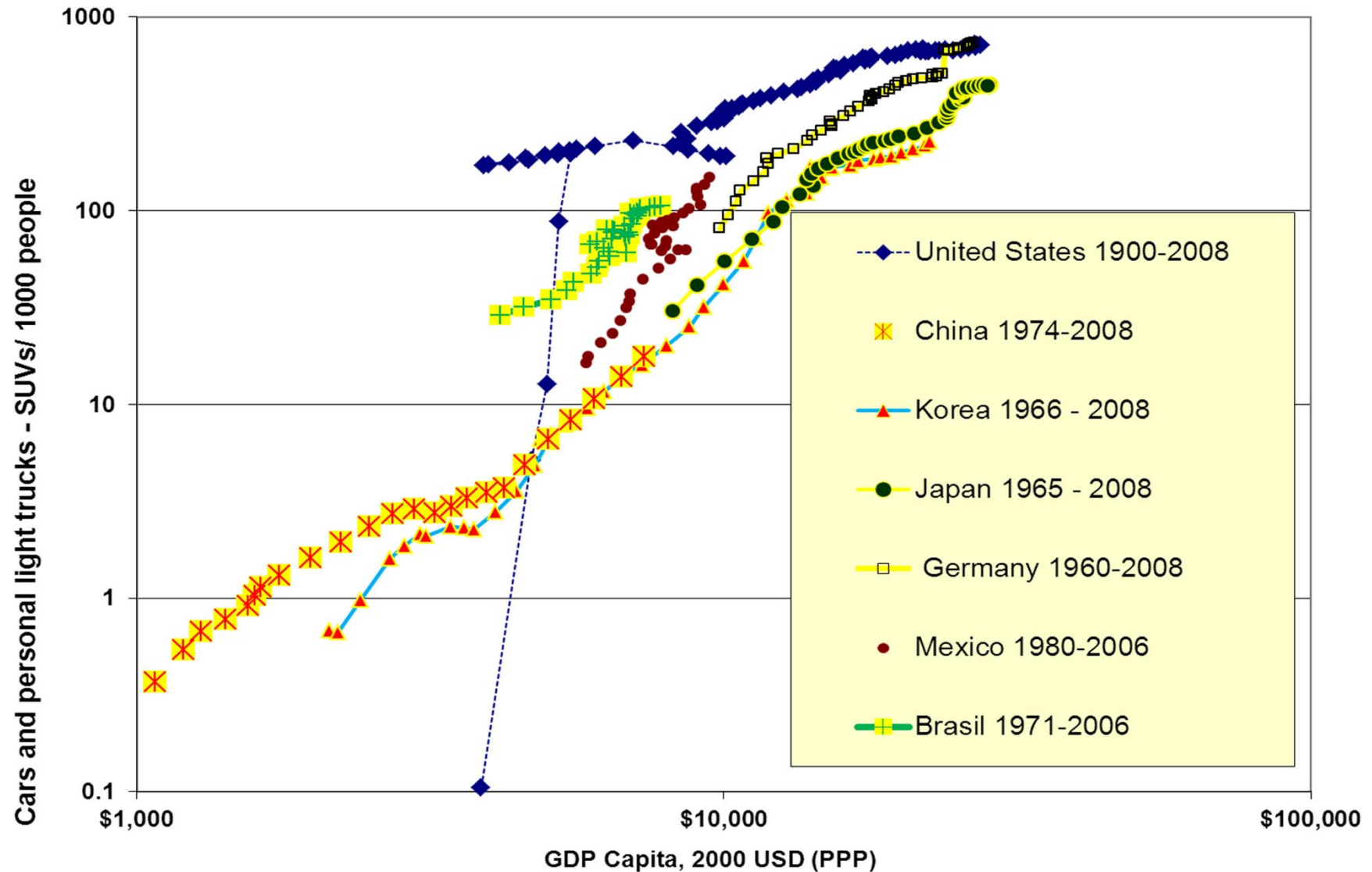
## 2. Choices and pathways



Note: North America covers US and Canada; Asia Pacific covers Japan, S Korea, Australia and NZ



# Motorization and Economic Growth: China Car Ownership 2008 = US 1924!

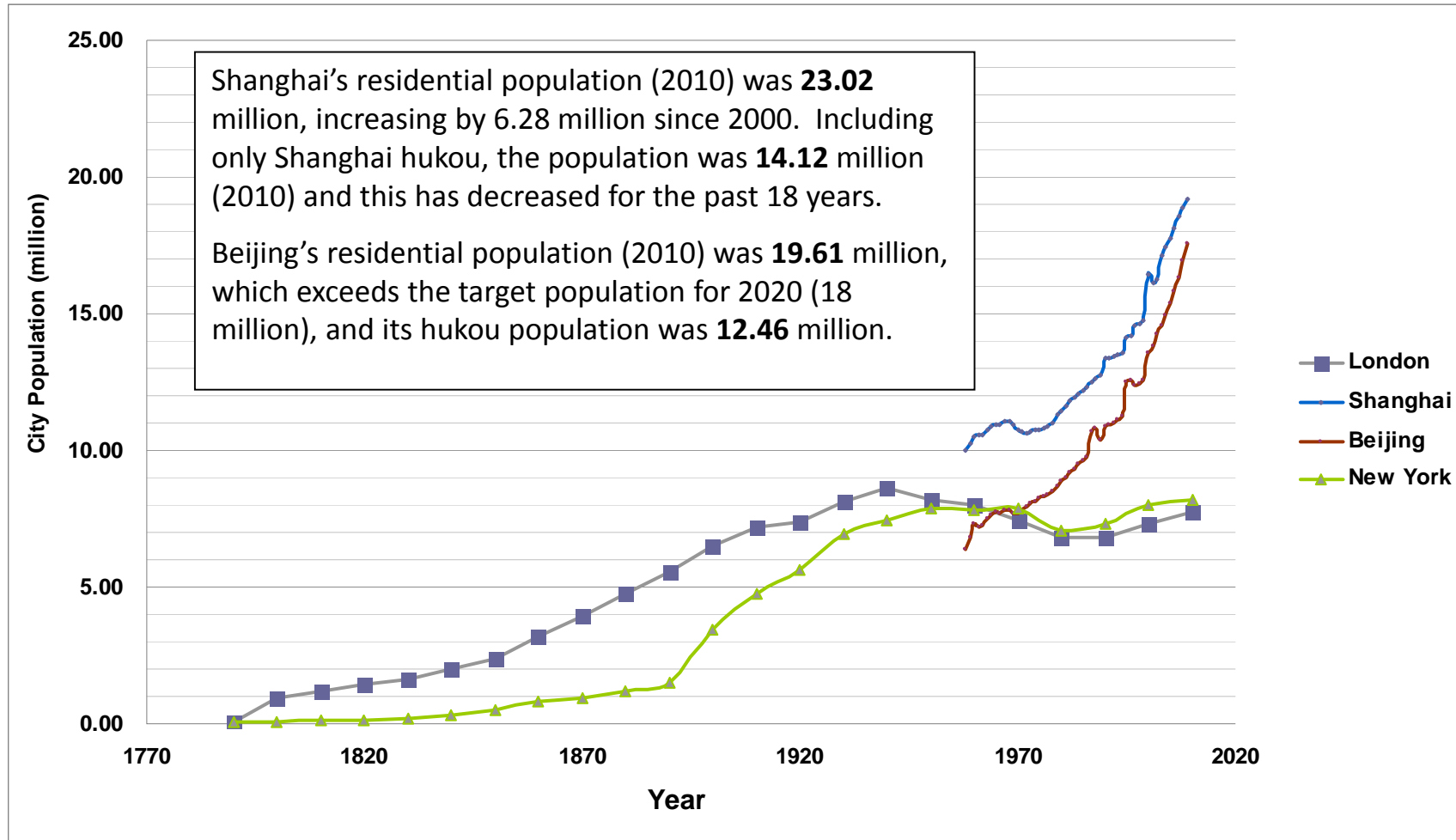


### 3. Comparison of growth and development phases in China and the USA

| Figures are all indicative estimates |   | Industrial based                           | Service based                                  | Knowledge and Information base              |
|--------------------------------------|---|--|--|---|
| China                                | Population<br>Time<br>Per capita<br>GDP | 1-2 million<br>40 years<br>< \$2000        | 2-15 million<br>15 years<br>\$2,000-6,000      | >15 million<br>10 years<br>>\$6,000         |
| USA                                  | Population<br>Time<br>Per capita<br>GDP | 100,000-200,000<br>200 years<br>< \$20,000 | 200,000-500,000<br>75 years<br>\$20,000-40,000 | 500,000-8 million<br>50 years<br>> \$40,000 |

Based on McKinsey (2009, p77, Exhibit 3.2)

# Population Growth in Four World Cities





## 4. Urban Development Patterns in China



### China – Urban population

1990                      254 million (20%)

2005                      572 million (44%)

2025                      926 million (64%)

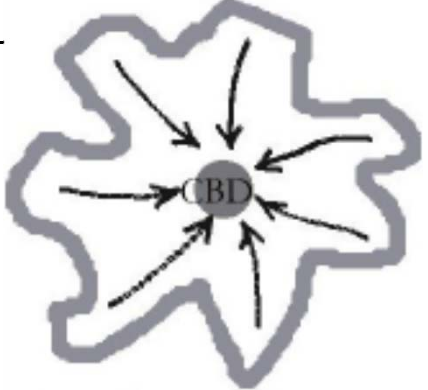
Migration (2005-2025) 243 million (69% of growth)

Currently 145 million migrant workers (11% population)

Income levels in urban areas 3x rural incomes

2025    221 cities in China with populations over 1 million

# Three types of Urban Development in China

| 4.1 Six Radial Cities in China  | Urban Area population   | Metropolitan area population | Average commute time by car |
|---|---|------------------------------|-----------------------------|
| Wuhan   | 5.15 m  | 8.36 m                       | 31 mins                     |
| Xian  | 5.62 m  | 7.82 m                       | 29 mins                     |
| Zhengzhou   | 2.85 m  | 7.31 m                       | 29 mins                     |
| Changsha  | 2.41 m  | 6.52 m                       | 27 mins                     |
| Kunming   | 2.50m   | 5.34m                        | 29 mins                     |
| Lanzhou   | 2.10m   | 3.24m                        | 25 mins                     |
|  | Comment: Potential for future axial growth between Wuhan and Changsha (380km) and from Zhengzhou to Jinan (430km) and Shijiazhuang (440km) both facilitated by new high speed rail links. |                              |                             |

Notes: Population data 2009 from the China Bureau of Statistics (2010) and the commute data is from a Deloitte Survey (2011)



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## 4.2 Three City Clusters in China



**Pearl River Delta** – total population 36 million  
– all cities within 120km of each other

Guangzhou 6.55m (7.95m)

Shenzhen 2.46m (2.46m)

Dongguan 1.79m (1.79m)

Foshan 1.1m (5.4m)

Zhaoqing 0.5m (1.9m)

Zhongshan 1.48m (1.48m)

Jiangmen 1.38m (3.96m)

Huizhou 1.09m (2.59m)

Zhuhai 1.03m (1.03m)

Hong Kong 7.0m

Average commute times 48 minutes

**Yangtze River Delta** – total population 37 million

Shanghai 13.32m (14.01m)

190km to Hangzhou 4.29m (6.83m)

280km to Nanjing 5.46m (6.30m)

Changzhou 2.27m (3.60m)

Suzhou 2.40m (6.33m)

Comment: Possible extension inland to Heifei (2.09m: 4.91m) about 420km from Shanghai. Average commute times are about 47 minutes.

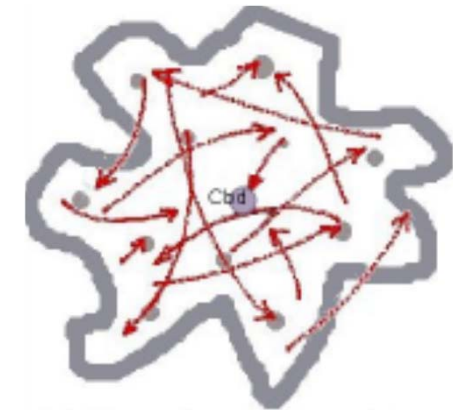
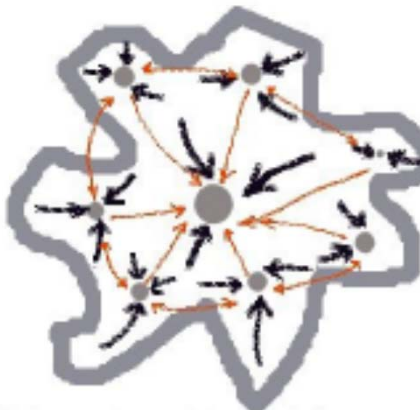
**Beijing – Tangshan – Tianjin** – total population 30 million – all cities about 120-150km apart

Beijing 11.75m (12.46m)

Tangshan 3.07m (7.34m)

Tianjin 8.03m (9.80m)

Average commute time 52 minutes in Beijing and 40 minutes elsewhere



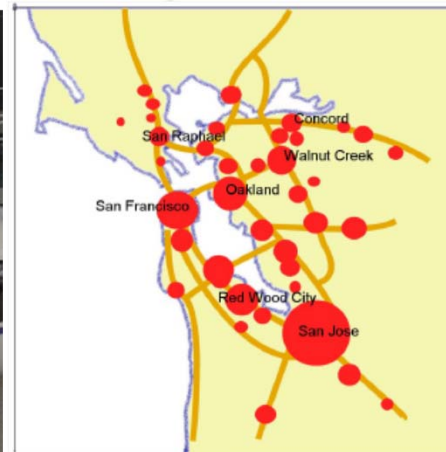
Notes: Population figures (2009) from the China Bureau of Statistics (2010) for the urban area and the for the metropolitan areas in brackets, and the commute time data is from a Deloitte Survey (2011)



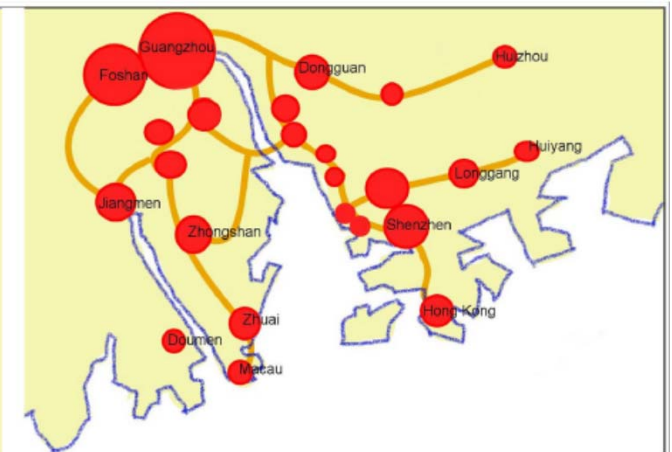


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# The Pearl River Delta



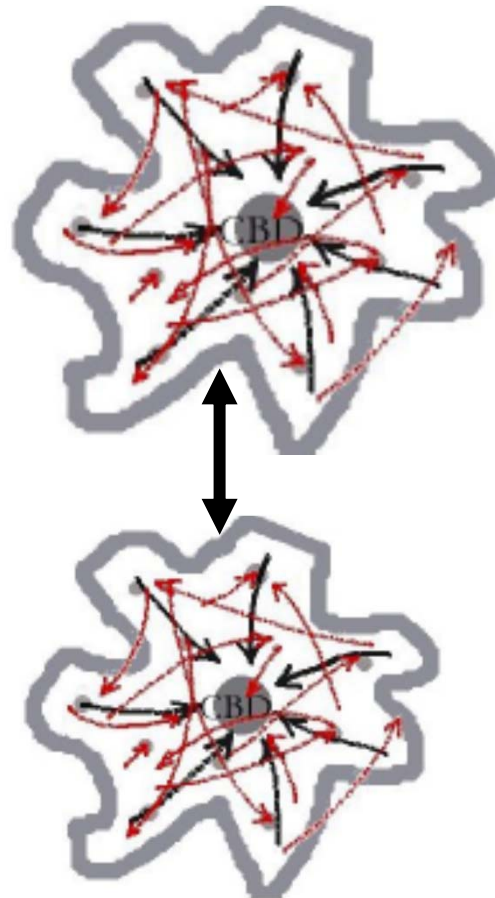
San Francisco Bay Area



The Pearl Delta

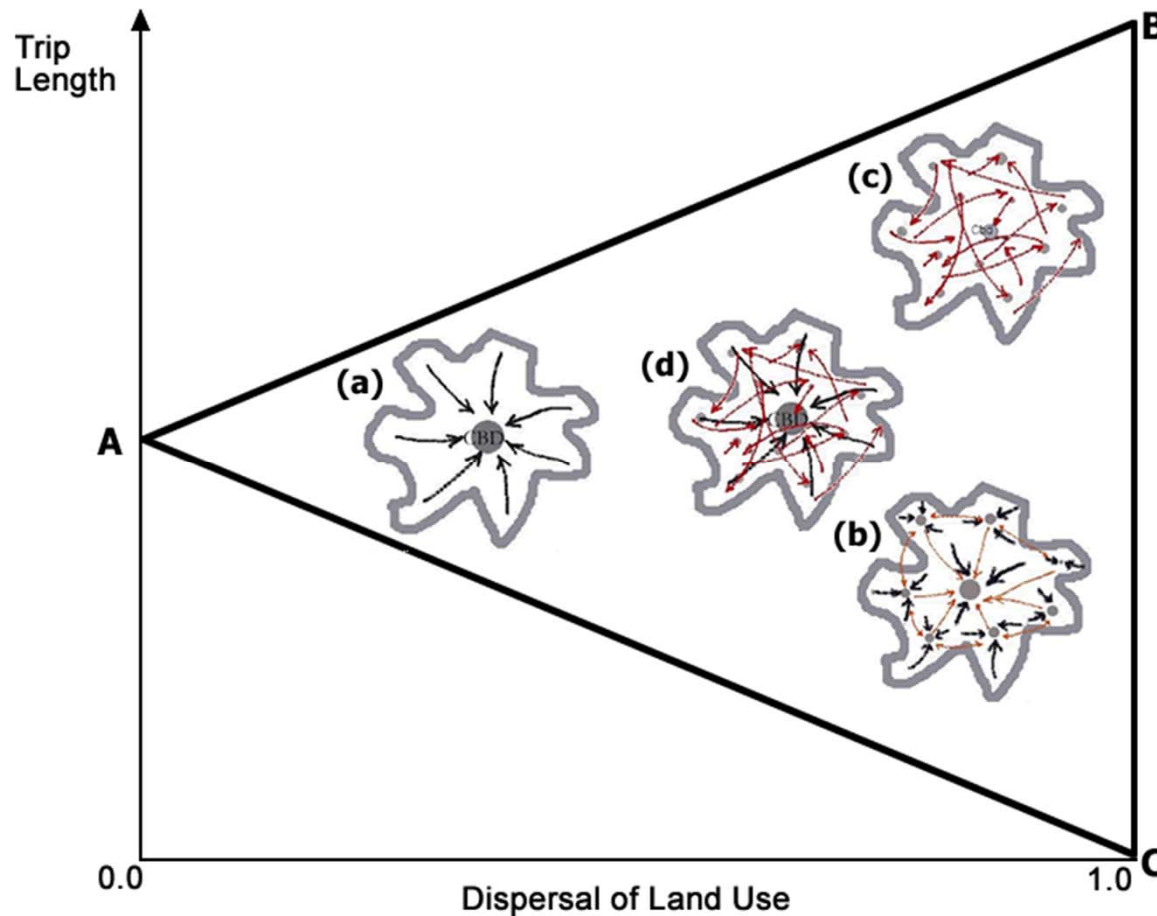


## 4.3 Four Axial Cities in China

|  |  |
|--|--|
| <p>Jinan 3.48m (6.03m) 320km to Qingdao 2.75m (7.63m)<br/>[intermediate cities Zibo 2.79m (4.21m) and Qingzhou 1.35m (3.71m)]. Commute time 29 and 28 minutes.<br/>Total population: 22 million</p>      |  |
| <p>Chengdu 5.21m (11.40m) 340km to Chongqing 15.43m (32.76m)<br/>[intermediate city Neijiang 1.42m (4.26m)]. Commute time 31 and 35 minutes. Total population: 48 million</p>                            |  |
| <p>Shenyang 5.12m (7.17m) 390km to Dalian 3.02m (5.85m)<br/>[possible extension to Changchun 3.62m (7.57m) 330km to north of Shenyang]. Commute time 34 and 29 minutes. Total population: 13 million</p> |  |
| <p>Xiamen 1.77m (1.77m) 280km to Fuzhou 1.87m (6.38m).<br/>Commute time 26 and 25 minutes. Total population: 8 million</p>   |  |

Notes: Population figures (2009) from the China Bureau of Statistics (2010) for the urban area and the for the metropolitan areas in brackets, and the commute time data is from a Deloitte Survey (2011)

# The relationship between trip length, dispersal and urban form



Notes: City (a) is the monocentric model with a strong central city and a radial pattern of travel; City (b), the polycentric model, with a cluster of surrounding cities; City (c), the polycentric model, with random movements, and City (d), the multicentred city with simultaneous radial and random movement. Diagram based on Bertauld (2002).

## 5. Vulnerabilities and Sustainability

| 2005  |  | 2070   |  |
|---|--|--|--|
| Top 10 cities by exposed population   | Top 10 cities by exposed assets  | Top 10 cities by exposed population  | Top 10 cities by exposed assets  |
| Mumbai<br>Guangzhou<br>Shanghai<br>Miami<br>Ho Chi Minh City<br>Kolkata<br>New York-Newark<br>Osaka-Kobe<br>Alexandria<br>New Orleans | Miami<br>New York-Newark<br>New Orleans<br>Osaka-Kobe<br>Tokyo<br>Amsterdam<br>Rotterdam<br>Nagoya<br>Tampa-St<br>Petersburg<br>Virginia Beach | Kolkata<br>Mumbai<br>Dhaka<br>Guangzhou<br>Ho Chi Minh City<br>Shanghai<br>Bangkok<br>Miami<br>Hai Phong (Vietnam)<br>Alexandria | Miami<br>Guangzhou<br>New York-Newark<br>Kolkata<br>Shanghai<br>Mumbai<br>Tianjin (China)<br>Tokyo<br>Bangkok<br>New Orleans |
| These cities are split almost equally between developed and developing countries.   | These 10 cities account for 60% of total exposure, and are based in 3 wealthy countries (USA, Japan, and the Netherlands).                     | The exposed population has increased by 3 times to 150m – almost all the cities are in developing countries.                     | The total exposed assets have increased by 10 times to \$35,000 billion (2005 prices) or 9% of global GDP.                   |

Note: Total exposed assets in 2005 for all 20 cities is \$3000 billion (2005 prices) or 5% global GDP. The main driving forces of the 2070 Scenarios are population growth, economic growth and urbanisation, and these factors are exacerbated by climate change (sea level rises and increased storminess) and subsidence.

Source: Based on Nicholls et al., 2008



## 6. Comments and Conclusions



1. Key differences between the European and US traditions
2. Cities in Asian countries are following the same pathway
3. Critical choices on pathways
4. Challenge is one of leadership and action – supported by institutional and governance structures to accommodate the rapid growth in urban populations and wealth
5. Cities not built for motorised traffic – the high motorised mobility option is costly – implications for social welfare, environmental quality and health – poverty alleviation and sustainable transport must work together
6. Accessibility and demand management controls essential, along with strong land use policy – to shorten trip lengths – this is the sustainable mobility paradigm (Banister, 2008).