

# Back to the Future? Land Use, Mobility & Accessibility in Metropolitan China

11.953  
Day 23  
C. Zengras

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- Remember the Developing World.....?
- Motorization!
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## Motorization

- Income and per capita motor vehicle fleets
  - At national level, 90%
  - At the urban level, 80%
- Still considerable variation, due to
  - Population densities, urbanization levels, vehicle production (national industrial policy), vehicle prices, etc.
  - Particularly at urban level...

## China

- Average travel rate: 1000 kilometers/year
  - Europe: 15,000
  - US: 24,000
- Motorization
  - Approximately 9 cars per 1000 persons
  - National car sales growing by ~70% per year in 2000s
  - National car manufacturing growing by ~80 percent per year.

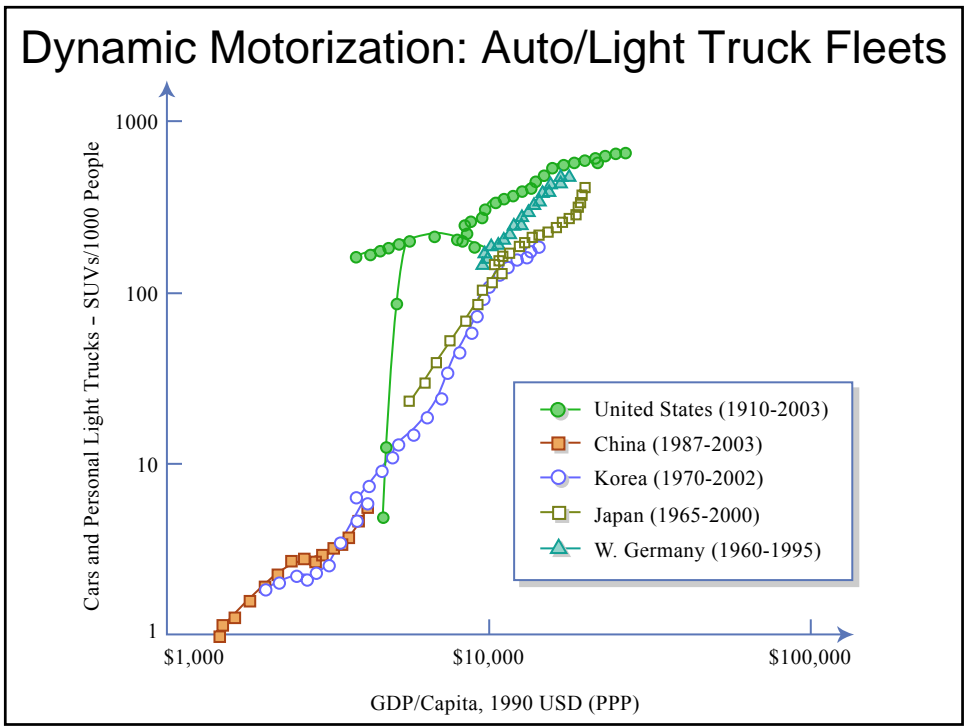


Figure by MIT OCW.

W.-S. Ng and Schipper, 2005.

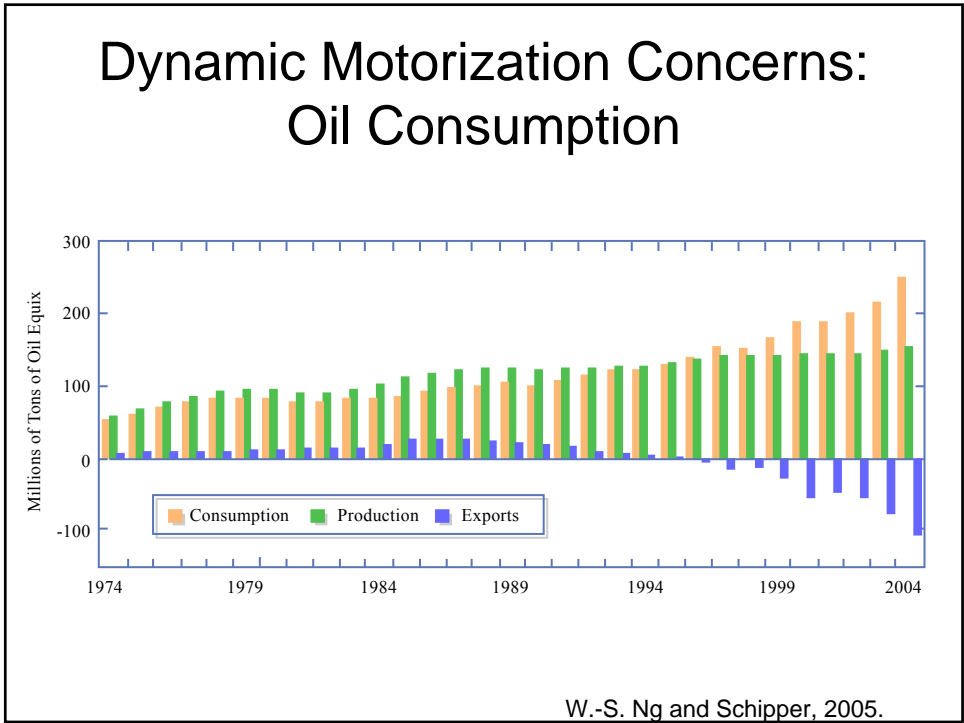


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## Dynamic Motorization Concerns: Air Pollution

<b>City</b>	<b>CO (%)</b>	<b>HC (%)</b>	<b>NOx (%)</b>
Beijing (2000)	77	78	40
Shanghai (2000)	86	96	56
Guangzhou (2000)	84	50	45

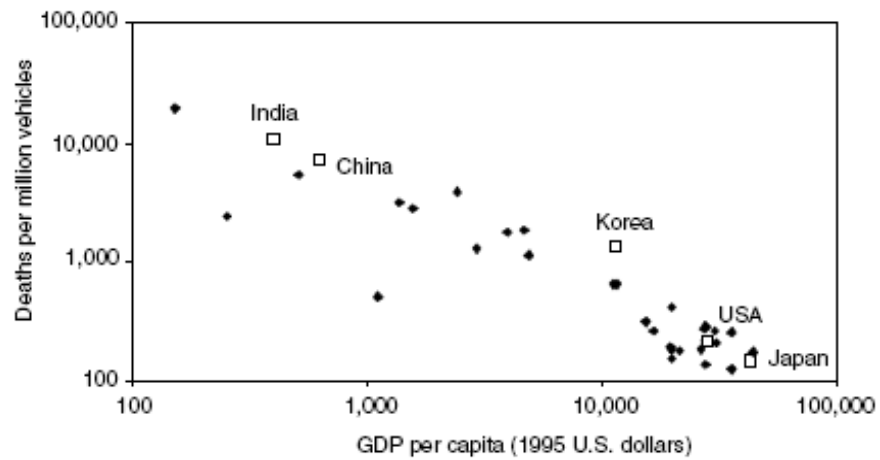
W.-S. Ng and Schipper, 2005.

## Dynamic Motorization Concerns: Air Pollution

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W.-S. Ng and Schipper, 2005.

## Dynamic Motorization Concerns: Accidents?



NAE, CAE, NRC, 2003.

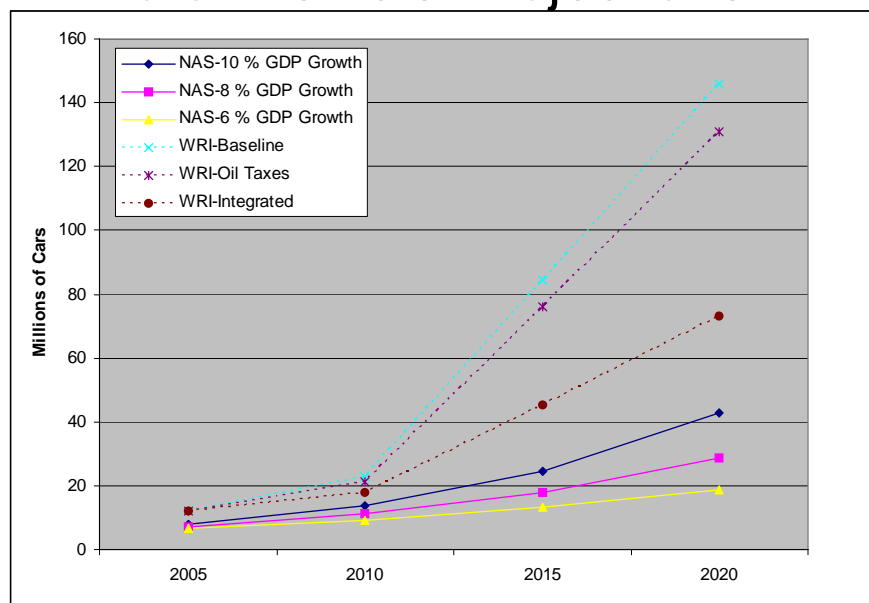
## Dynamic Motorization/Urbanization Concerns: Other?

## China's Automobile Industry

- Now world's third largest automobile producer
- "Pillar" of national economic development plans since 1988
- In 2004, China enacted fuel economy standards that are stricter than US standards
- Uncertainties over future vehicle demand composition
  - i.e., will the trend towards larger, heavier vehicles (SUVs) prevail?
- Motor vehicle emission standards now exist
  - Euro II-equivalent standards already implemented in Shanghai and Beijing

W.-S. Ng and Schipper, 2005.

## Motor Vehicle Projections...



W.-S. Ng and Schipper, 2005; NAE, CAE, NRC, 2003.

## Dynamic Metropolitan-ization: Government Responses

One Main Issue: *Excessive Density*

- National Development Standards
  - Require more parking, wider streets, higher per capita living space
  - Density Guidelines:
    - 10,000 – 12,500 persons per square km
  - Infrastructure guidelines, “road coverage”:
    - 8-15% for smaller cities; 15-20% for larger cities
    - Averages, including parallel 2-wheeler streets, parking and pedestrian facilities

NAE, CAE, NRC, 2003.

## Dynamic Metropolitan-ization: Government Responses

Another Main Issue: “Privatization”

- Municipalities allowed to acquire land and “lease” land (conveyance fees)
  - 40 (commercial), 50 (ind.), 70 (resid.) year terms
  - lump sum, up-front payments
  - Huge source of local government revenues
- Municipalities also collect taxes on land
- Expropriation
  - Rural compensation lower than urban...
- Break up of the “work unit” model...

## Time and NMT Share: Commuting

Moving Patterns		Number of workers	Commute time	Non-motorized transport	Share of non-motorized travel
Within sub-districts		161	30.0	121	75.2%
Beyond sub-districts		570	34.5	396	69.5%
Be- yond	Total	956	42.8	515	53.9%
	Parallel	337	42.7	154	45.7%
Dis- trict	Inward	105	30.7	81	77.1%
	Outward	514	45.5	280	54.5%

Yang, 2005.



## Commute Time = $f(?)$

	B	Std. Beta	T-Stat	Sign.
(Constant)	55.594		15.425	0.000
Private_motor	-30.387	-0.193	-8.504	0.000
Workunit_bus	-19.708	-0.230	-8.969	0.000
Walk	-48.433	-0.333	-14.573	0.000
Bicycle	-31.901	-0.530	-19.430	0.000
Worker>2	3.242	0.43	1.918	0.055
Reluctant	5.895	0.095	4.027	0.000
Affirmative	-4.779	-0.080	-3.684	0.000
Income	-0.064	-0.035	-1.568	0.117
Beyond_subdistrict	5.451	0.087	2.313	0.021
Beyond_district	9.184	0.153	3.648	0.001
Move_inward	-6.326	-0.052	-2.183	0.029
Move_outward	3.694	0.057	2.032	0.042

R<sup>2</sup> = 0.261

Yang, 2005.

## Interpretations & Implications?

## Dynamic Metropolitan-ization: Impacts

### Decentralizing forces

- Land cheaper on fringe
- Rural conversion generates more revenues for municipalities
- Growing demand for “campus”-like settings
- Government promotion of the “concentrated dispersion” model...

## Shanghai

- During 1990s, MV fleet grew by 30,000-50,000 vehicles per year.
- Average density in the range 14,000-40,000 persons per sq. km
  - NY Metro Area: 4,500
- Recent Years
  - Massive infrastructure investments
    - \$10 bn b/w 1991-1996: bridges, tunnel, inner ring road, first subway line
  - 2000 development plan
    - 200 kms of rail, 6 BRT corridors; 520 kms of new highways

NAE, CAE, NRC, 2003.

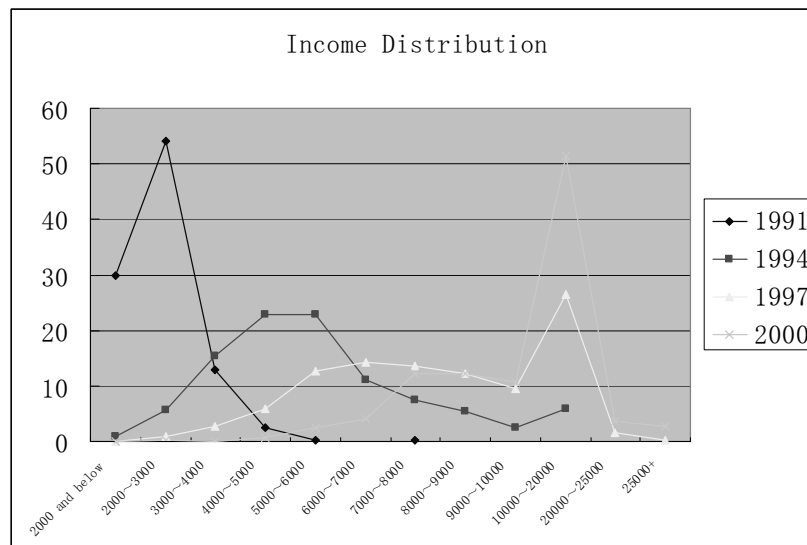
## Motorization Management

- Various vehicle restrictions in place
  - Freight place and time restrictions
  - High registration fees (\$2,500) and purchase taxes (10%) for private cars
  - Cap of 50,000 new vehicle registrations per year (as of 1998)
  - Bans/restrictions on many motorized two-wheelers
  - Also, bans on bicycles in some parts of city
- Motorization Rate
  - ~40 to 60 private vehicles per 1000 persons

## Shanghai Socioeconomics & Demographics

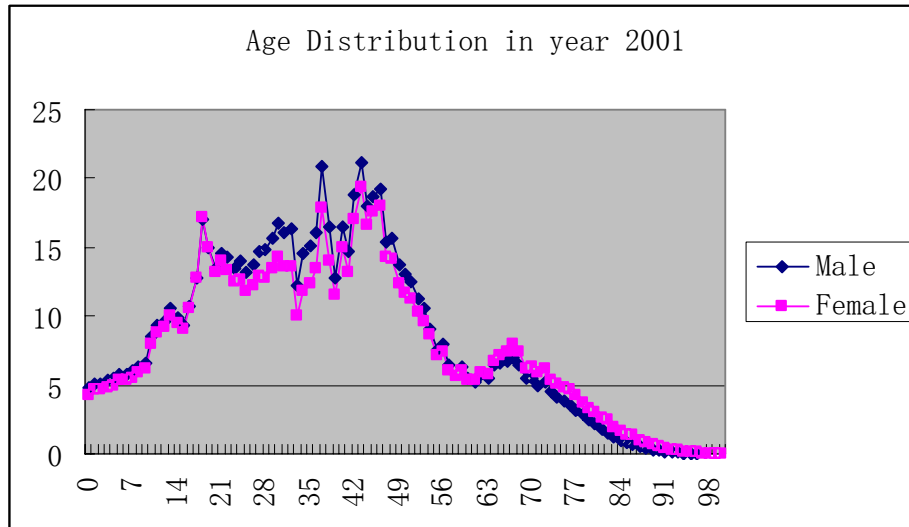
- Average personal incomes increasingly rapidly
  - Growing income disparity
  - Still significant low-income population, including “floating” pop.
- Larger than national average share of over 65
- Current population growth (official) 0.42% per year
  - 18-21 million by 2020

## Evolution in Income Distribution



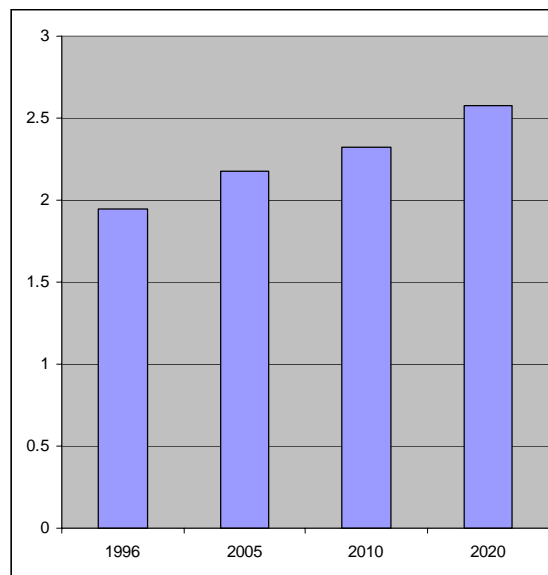
Zhao, 2003.

# Age Distribution



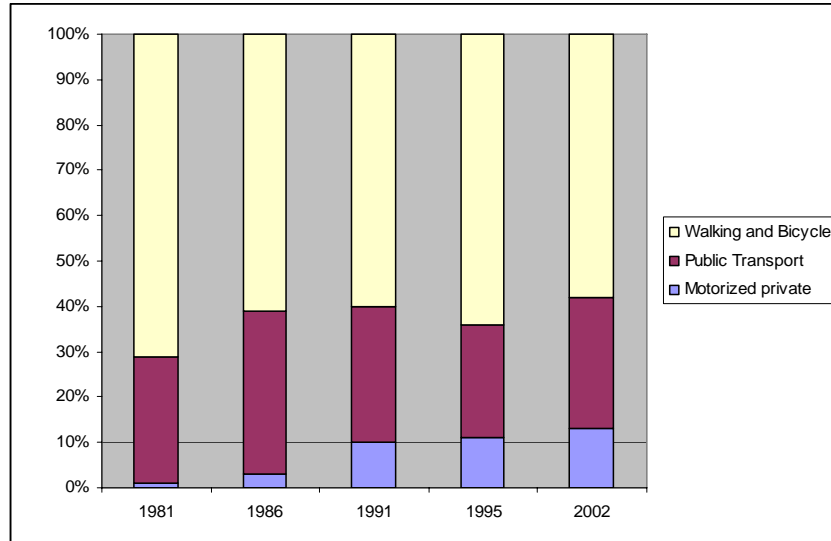
Zhao, 2003.

# Trip Rate: Estimated and Expected (Average Daily Trips/Capita)



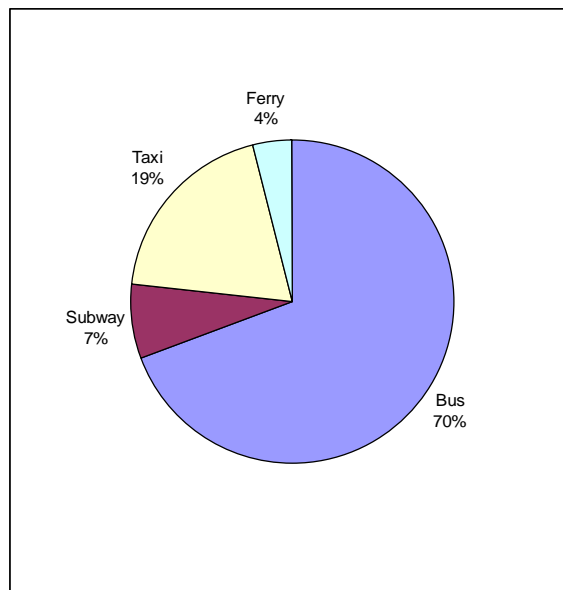
Zhao, 2003.

## Shanghai: Mode Share Evolution



ITDP, 2005.

## Public Transport Mode Shares



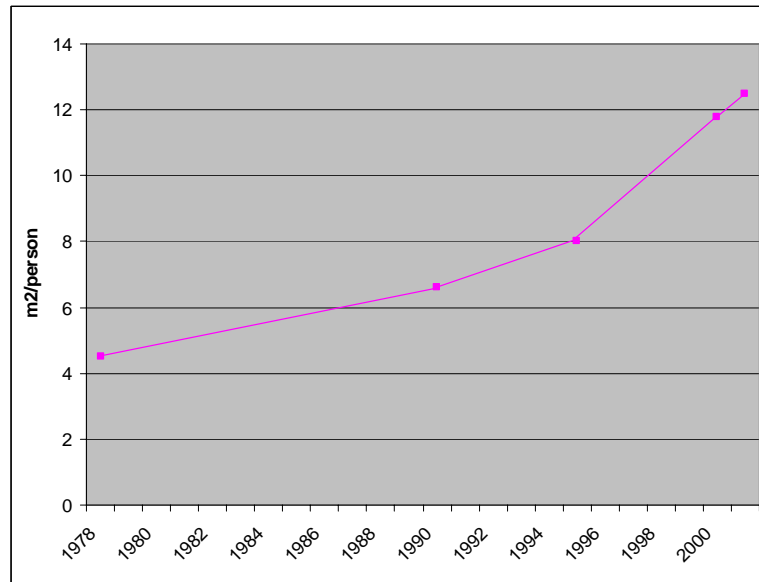
Zhao, 2003.

## Shanghai Urban Development Strategy

- Monocentricity to polycentricity
- Plan for five levels of hierarchical urban structure
  - CBD, Sub-Centers, Specialized Centers, District Centers, Community Centers
  - Aim to follow rail...

## Rail Transit Network and Centers/Sub-Centers

## Per Capita Living Area



Zhao, 2003.

## Rail Transit: Achieving its Aims?



# Rail Transit: Ridership Effects

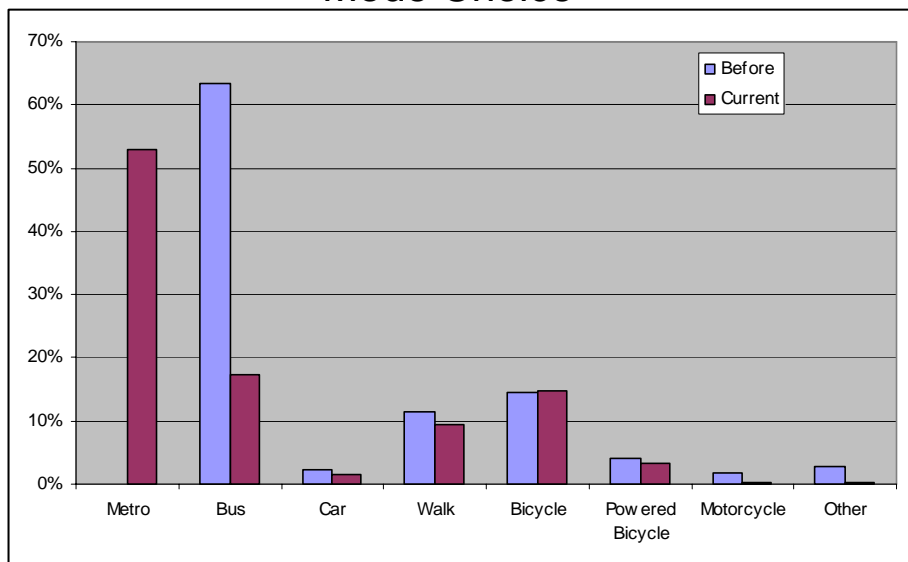
## Trip Purposes

Year	Work	School	Personal Business	Shopping	Recreational	Other
2000	20.4%	6.6%	3.3%	26.8%	30.5%	12.5%
2002	24.6%	3.8%	4.7%	33.9%	17.4%	15.6%
2003	36.5%	5.2%	10.9%	28.6%	9.4%	9.4%

Pan and Zhang, 2005.

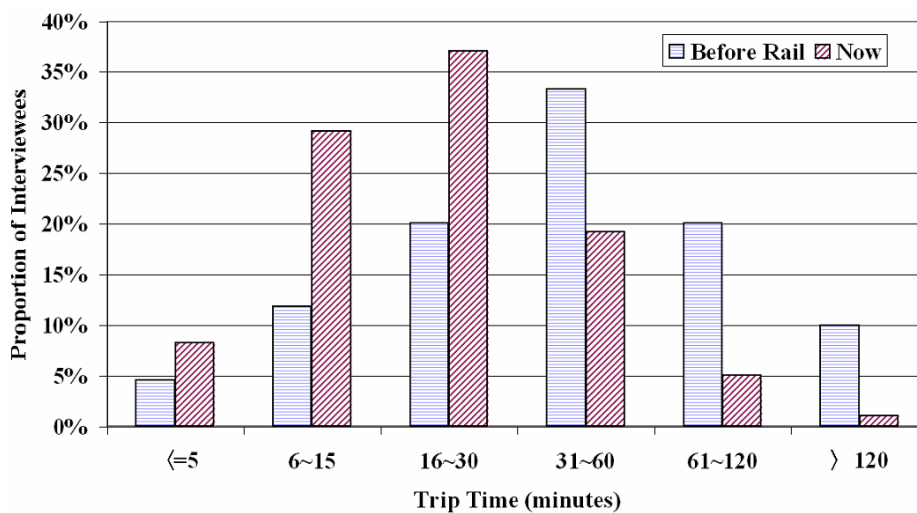
# Rail Transit: Ridership Effects

## Mode Choice



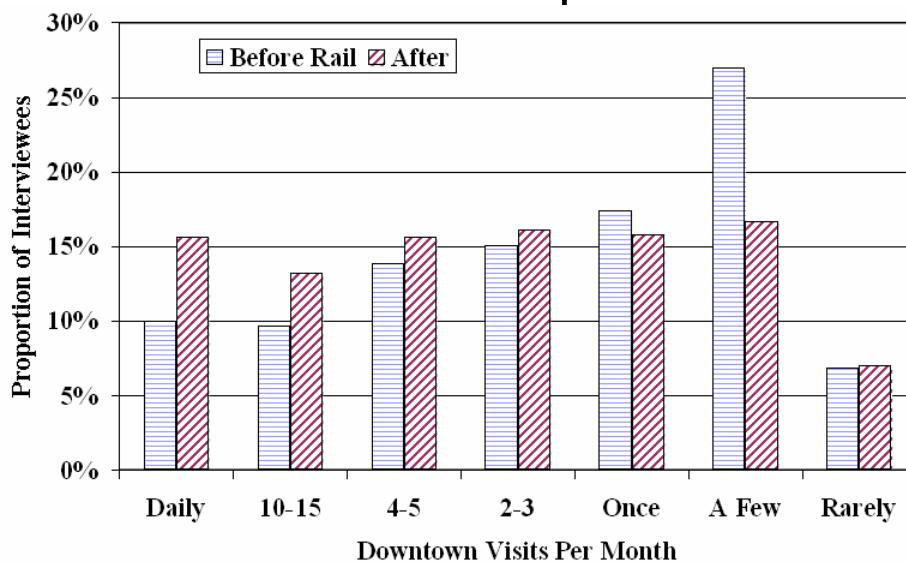
Pan and Zhang, 2005.

## Rail Transit Effects: Trip Times



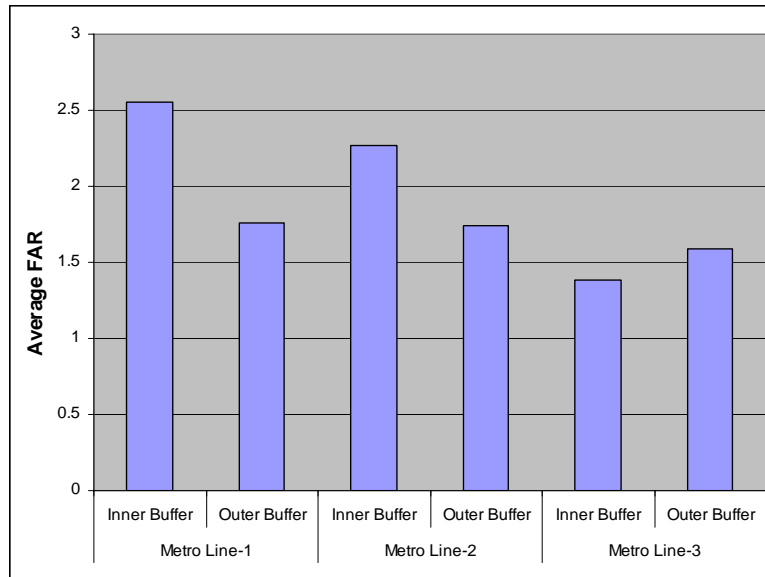
Pan and Zhang, 2005.

## Rail Transit Effects: Trip Distribution

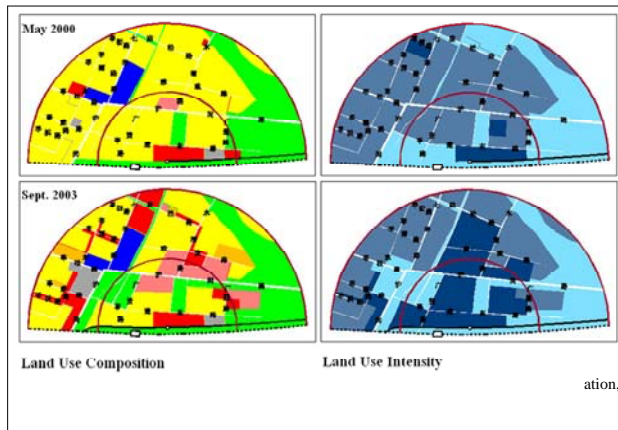


Pan and Zhang, 2005.

## Rail Transit Effects: Development



Pan and Zhang, 2005.



**Rail Transit  
Impacts:  
Land Use  
Changes at  
Xin-Zhuang  
Station**

Pan and Zhang, 2005.

## Rail Transit Impacts: Problems with Analysis?