

# Transport infrastructure, “lock-out”, and urban form

Andrew Coleman

Motu Economic and Public Policy Research,  
Wellington.

July 2010

This paper is about the way that choices about public and private transport infrastructure networks can have long lasting effects on urban form

The main argument:

large scale highway networks create sprawling cities that are unsuited for public transport.

*"Big roads beget little roads, and so to infinitum."*

## Background: city transport systems

### Cross-city transport comparisons

Newman & Kenworthy(1989), Kenworthy & Laube(1999)

46 cities in North America, Asia, Europe, Australia,

detailed data on transport, income, density: 1990

# Car usage patterns by continent



otu

	Cities	Income				
USA	13	\$27000				
Aust	6	\$20000				
Canada	7	\$22500				
Europe	11	\$31500				
Asia \$\$	3	\$21500				
Asia \$	6	\$2500				

# Car usage patterns by continent



otu

	Cities	Income	Cars /1000	(% US)		
USA	13	\$27000	604			
Aust	6	\$20000	491	81%		
Canada	7	\$22500	524	87%		
Europe	11	\$31500	392	65%		
Asia \$\$	3	\$21500	123	20%		
Asia \$	6	\$2500	102	17%		

# Car usage patterns by continent



	Cities	Income	Cars /1000	(% US)	km /capita	(% US)
USA	13	\$27000	604		11100	
Aust	6	\$20000	491	81%	6600	60%
Canada	7	\$22500	524	87%	6600	60%
Europe	11	\$31500	392	65%	4500	40%
Asia \$\$	3	\$21500	123	20%	1500	13%
Asia \$	6	\$2500	102	17%	1900	17%

# Public transport usage by continent



	Cities	trips /capita				
USA	13	63				
Aust	6	92				
Canada	7	161				
Europe	11	318				
Asia \$\$	3	496				
Asia \$	6	334				

# Public transport usage by continent



	Cities	trips /capita	Density Persons /ha			
USA	13	63	14			
Aust	6	92	12			
Canada	7	161	28			
Europe	11	318	50			
Asia \$\$	3	496	153			
Asia \$	6	334	166			

# Public transport usage by continent



	Cities	trips /capita	Density Persons /ha	Km service /capita		
USA	13	63	14	28		
Aust	6	92	12	60		
Canada	7	161	28	58		
Europe	11	318	50	92		
Asia \$\$	3	496	153	114		
Asia \$	6	334	166	108		

# Public transport usage by continent



	Cities	trips /capita	Density Persons /ha	Km service /capita	Rail km /ha	
USA	13	63	14	28	153	
Aust	6	92	12	60	287	
Canada	7	161	28	58	390	
Europe	11	318	50	92	3651	
Asia \$\$	3	496	153	114	4914	
Asia \$	6	334	166	108	639	

# Public transport usage by continent



	Cities	trips /capita	Density Persons /ha	Km service /capita	Rail km /ha	% km public
USA	13	63	14	28	153	3%
Aust	6	92	12	60	287	8%
Canada	7	161	28	58	390	10%
Europe	11	318	50	92	3651	23%
Asia \$\$	3	496	153	114	4914	64%
Asia \$	6	334	166	108	639	40%

# Transport usage by continent



	Income	Density Persons /ha		Car km /capita		
USA	\$27000	14		11100		
Aust	\$20000	12		6600		
Canada	\$22500	28		6600		
Europe	\$31500	50		4500		
Asia \$\$	\$21500	153		1500		
Asia \$	\$2500	166		1900		

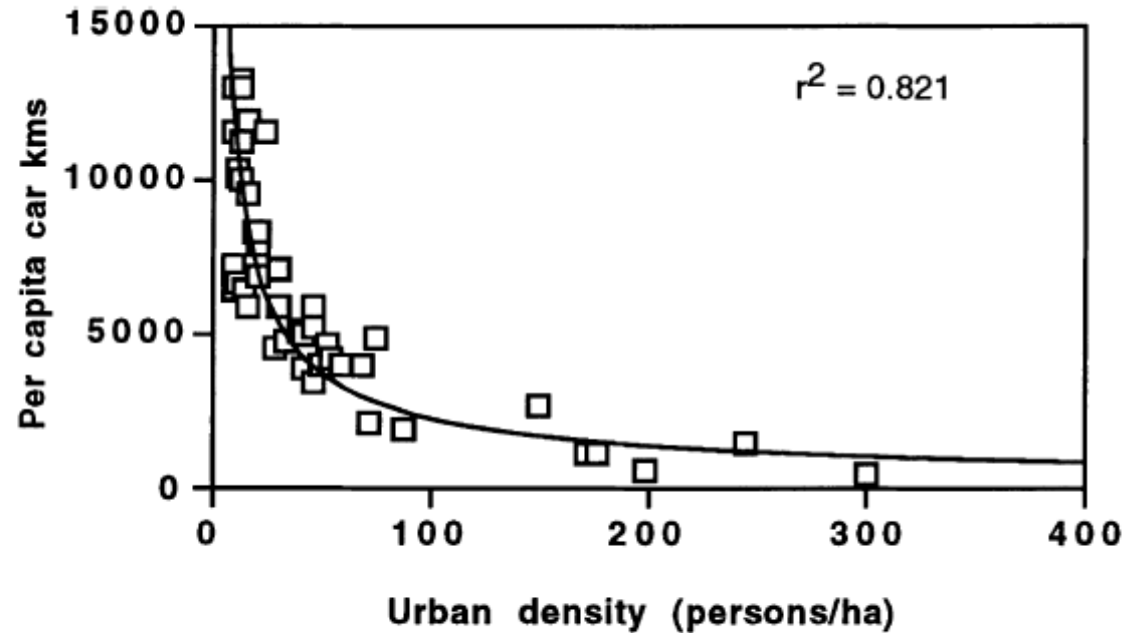


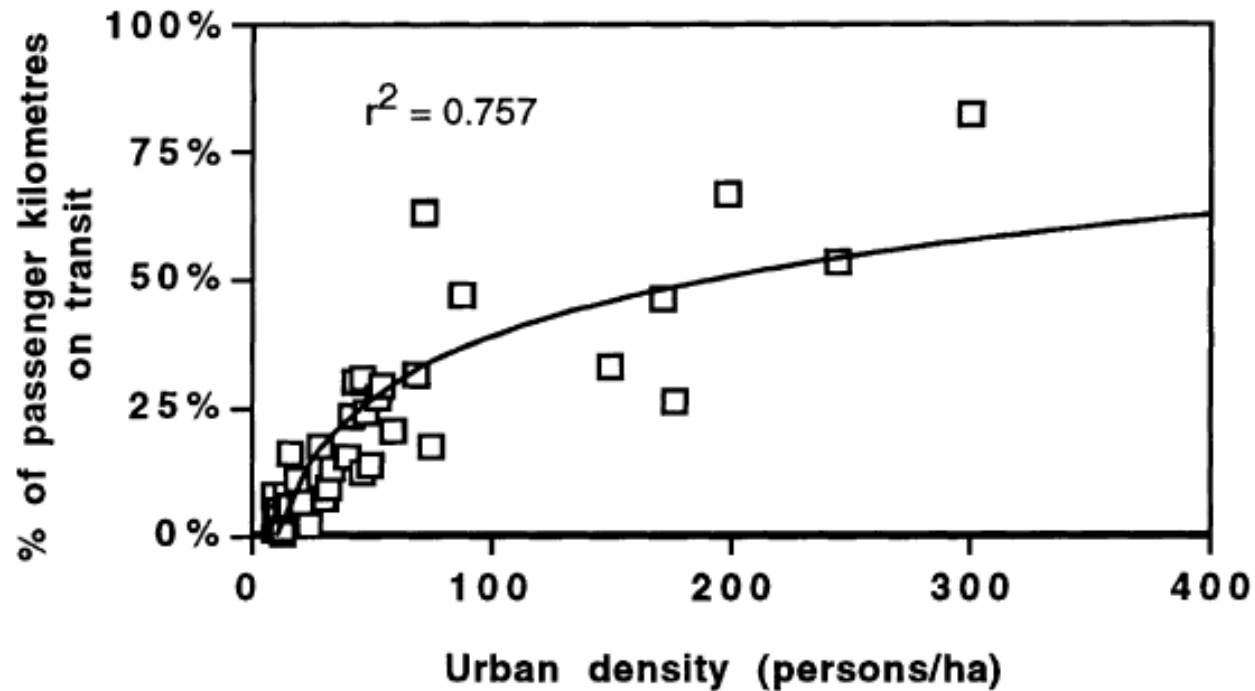
Fig. 5. Urban density versus car use in developed and developing cities, 1990.

**Kenworthy and Laube (1999)**

# Transport usage by continent



	Income	Density Persons /ha		Car km /capita	% km public	
USA	\$27000	14		11100	3%	
Aust	\$20000	12		6600	8%	
Canada	\$22500	28		6600	10%	
Europe	\$31500	50		4500	23%	
Asia \$\$	\$21500	153		1500	64%	
Asia \$	\$2500	166		1900	40%	



Urban density versus the proportion of total motorised transport on transit

**Kenworthy and Laube (1999)**

# Transport usage by continent



	Income	Density Persons /ha		Car km /capita	% km public	% GDP transport
USA	\$27000	14		11100	3%	12%
Aust	\$20000	12		6600	8%	13%
Canada	\$22500	28		6600	10%	7*%
Europe	\$31500	50		4500	23%	8%
Asia \$\$	\$21500	153		1500	64%	5%
Asia \$	\$2500	166		1900	40%	16%

Low density cities have high private car use  
and low public transport use

High density cities have high public transport  
use and low private car use

## Questions of causality: roads and density

Baum-Snow (2007, 2010) analysed location of people and jobs in US cities.

Identification strategy:

US interstate highway system (1940s/50s)

Exogenous variation in the number of highways to city centres

## The main findings

- Building an extra highway *caused* a city to decentralise

### (1) Population moved into the suburb

- Each highway “ray” reduced central city population by 9%
- Highways account for 1/3 relative decline in central city populations since 1960



+



=

e00003725 fotosearch.com

k0723905 www.fotosearch.com



k0723905 www.fotosearch.com

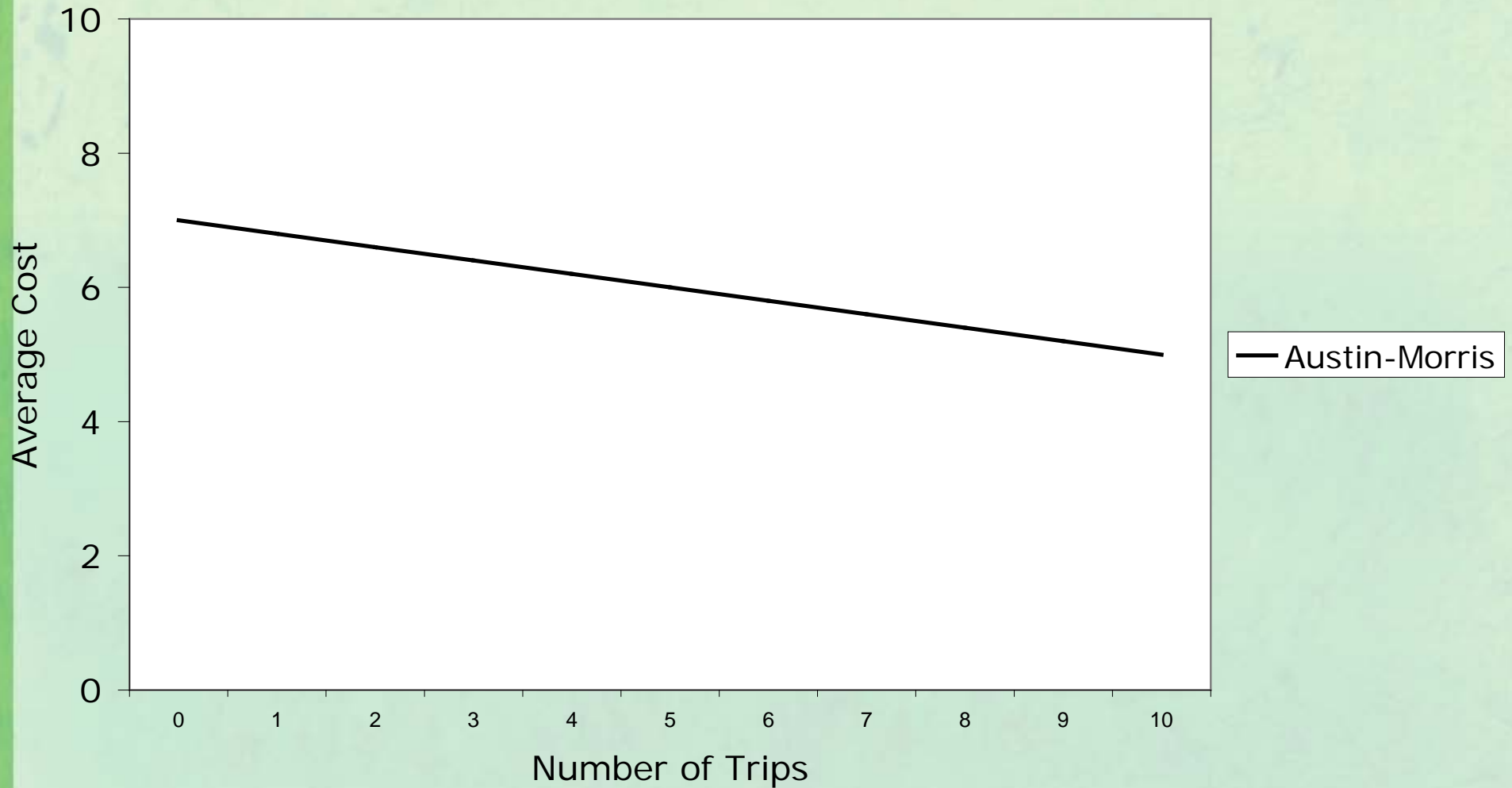
# The main findings

## (2) Jobs moved into the suburbs

- Each highway increased number of people living and working in suburbs by 25%
- Highways account for 1/3 of increase in suburban workers

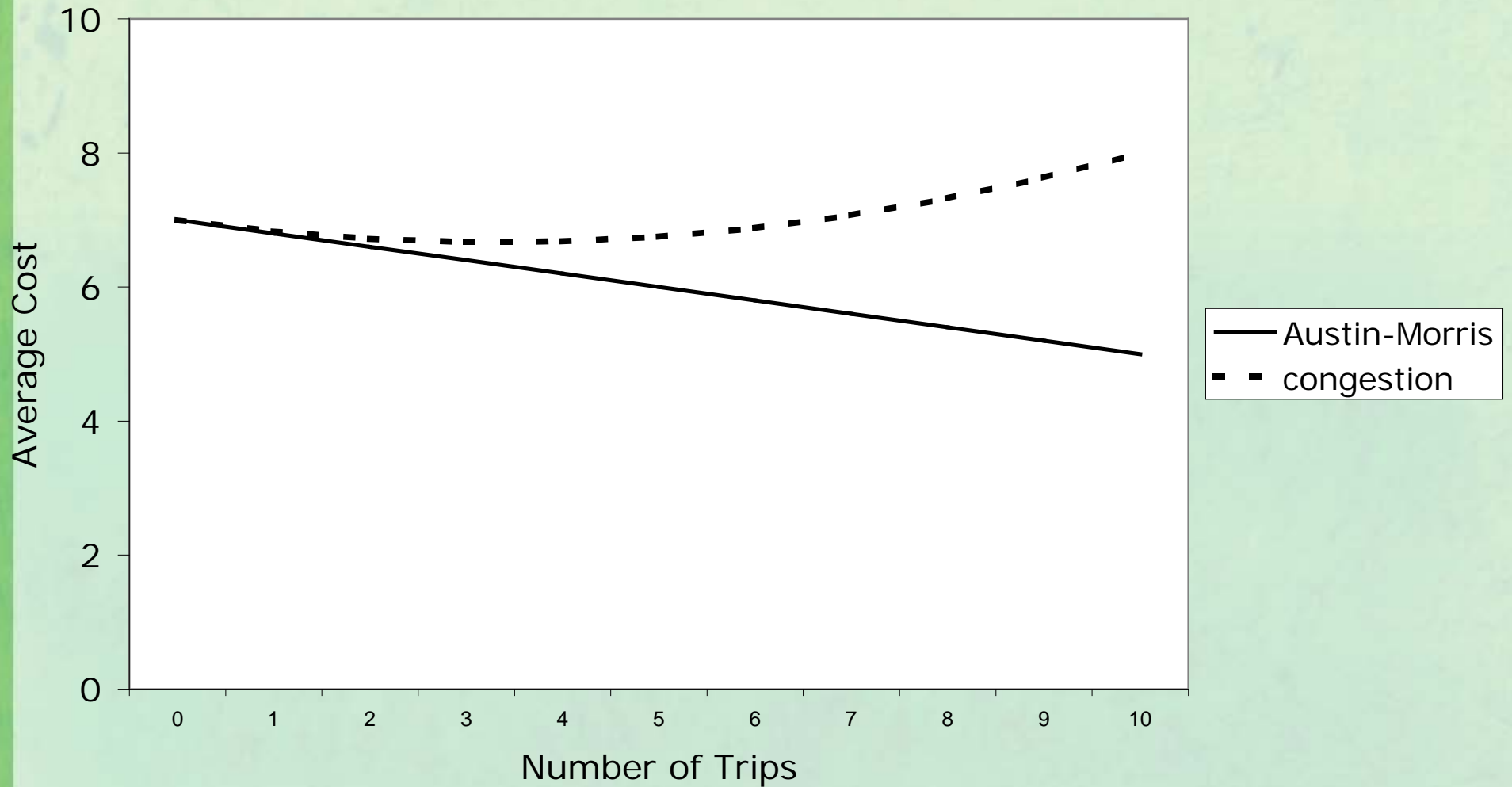
# Technological Lock-out (1)

## Road Transport



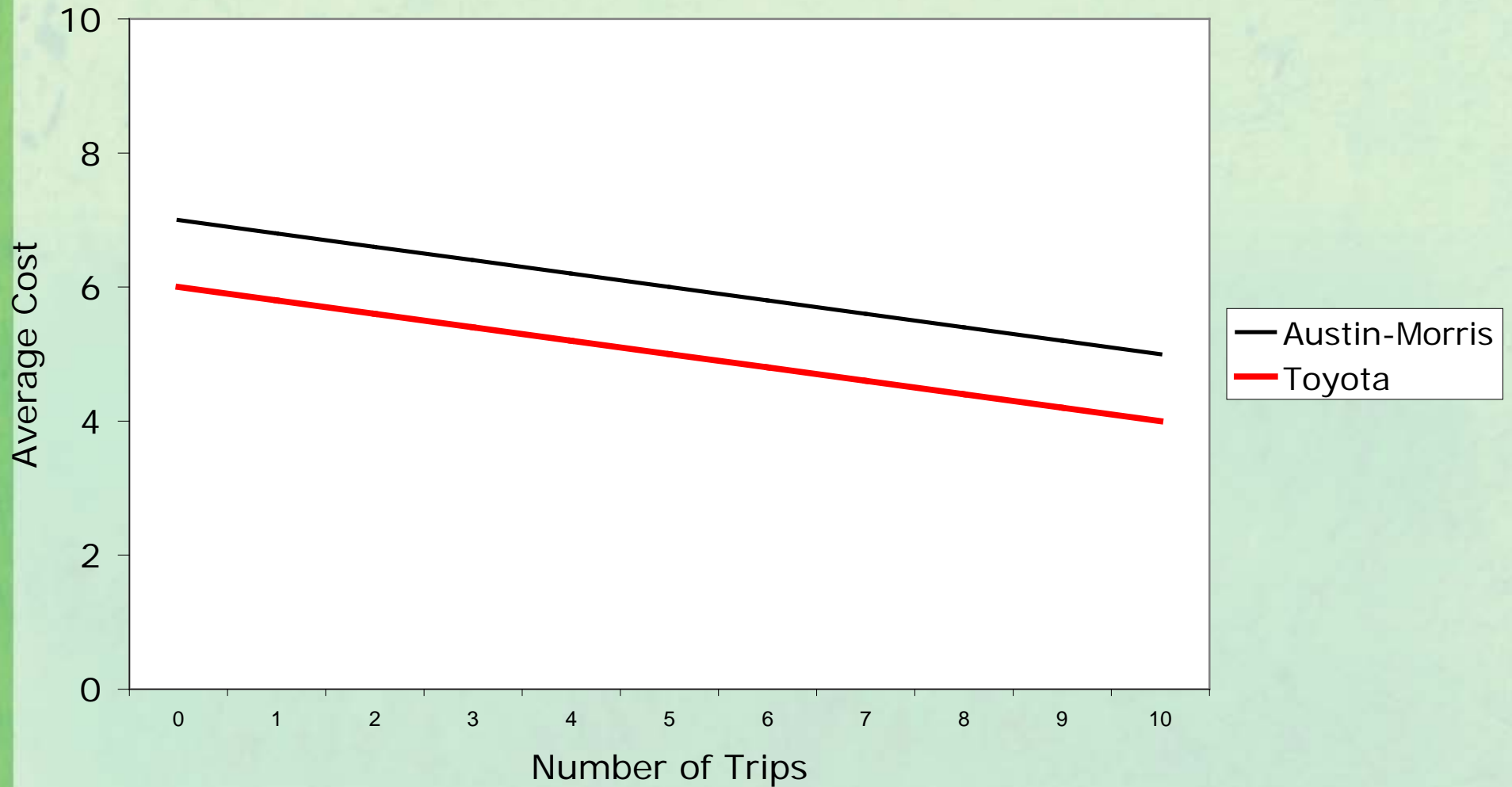
# Technological Lock-out (1)

## Road Transport



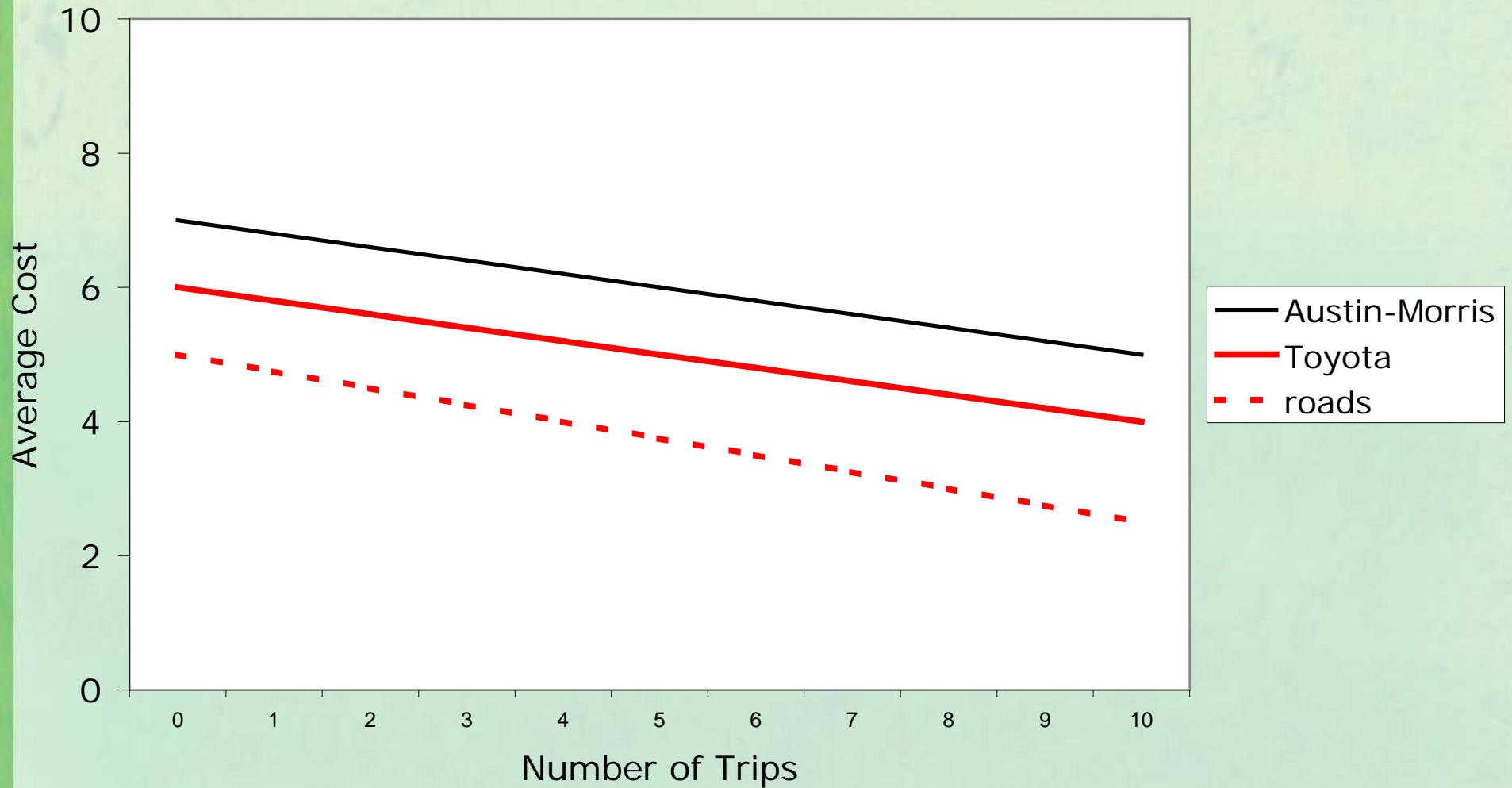
# Technological Lock-out (1)

## Road Transport



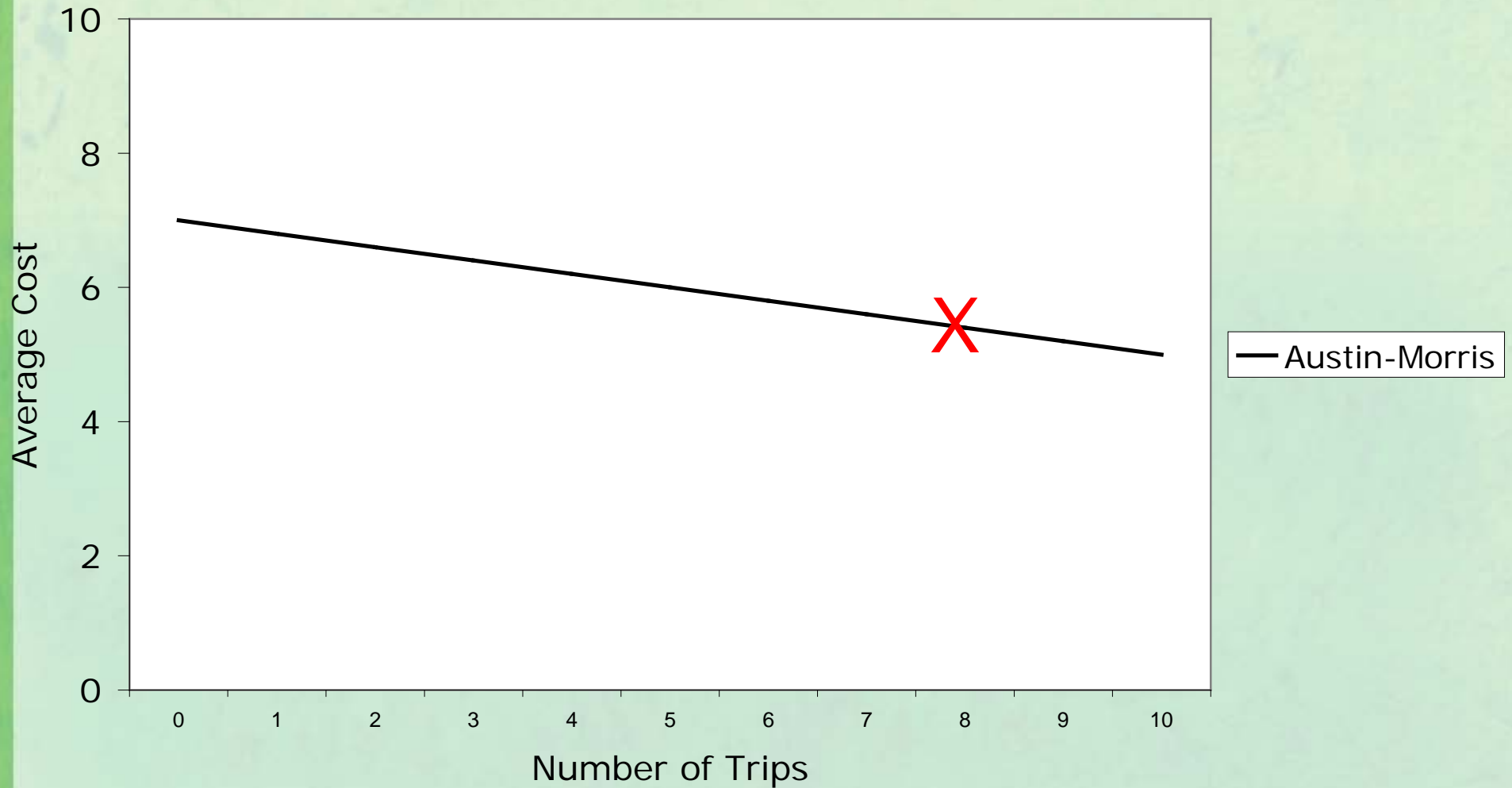
# Technological Lock-out (1)

## Road Transport



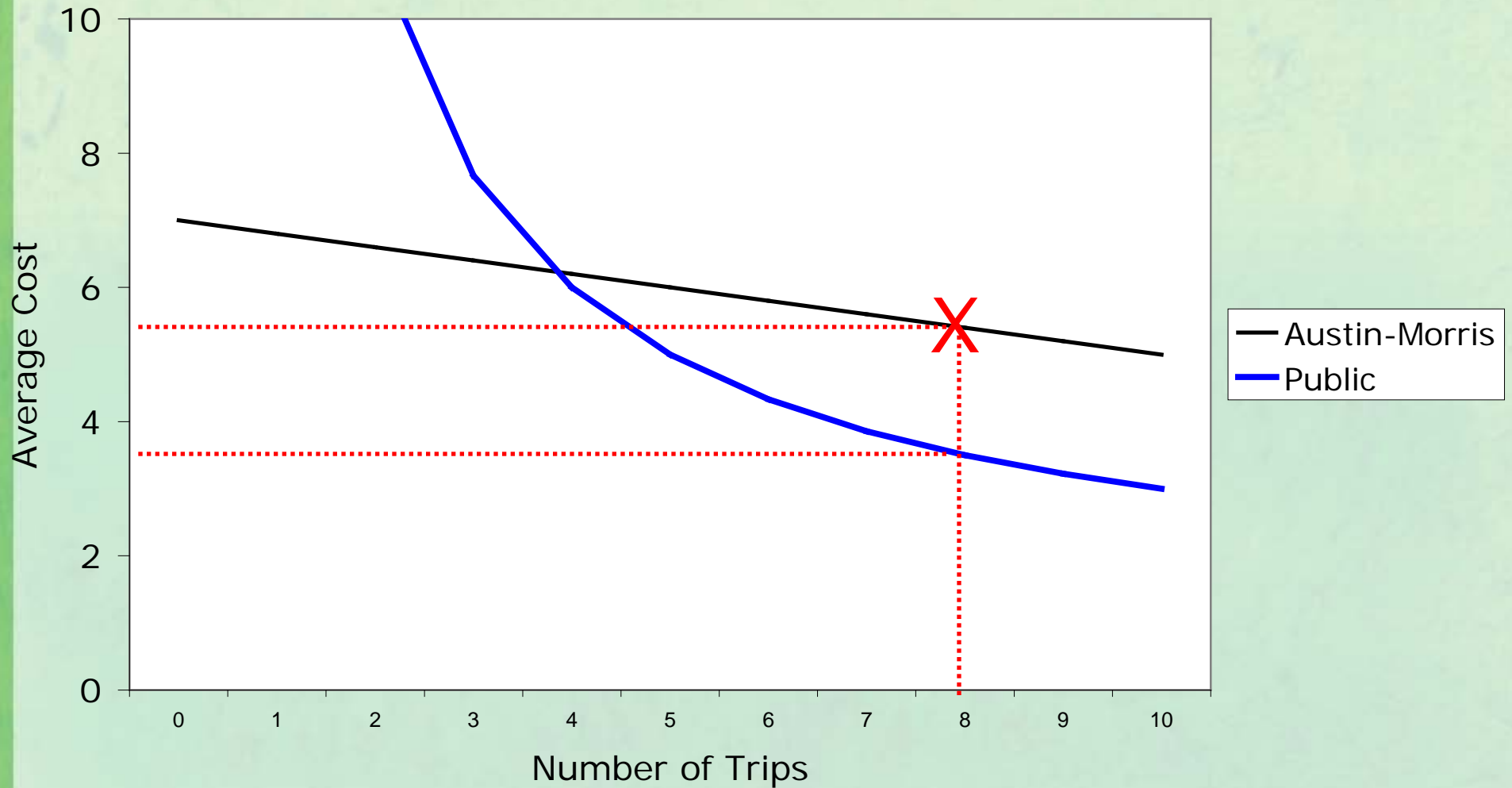
# Technological Lock-out (1)

## Road and Public Transport



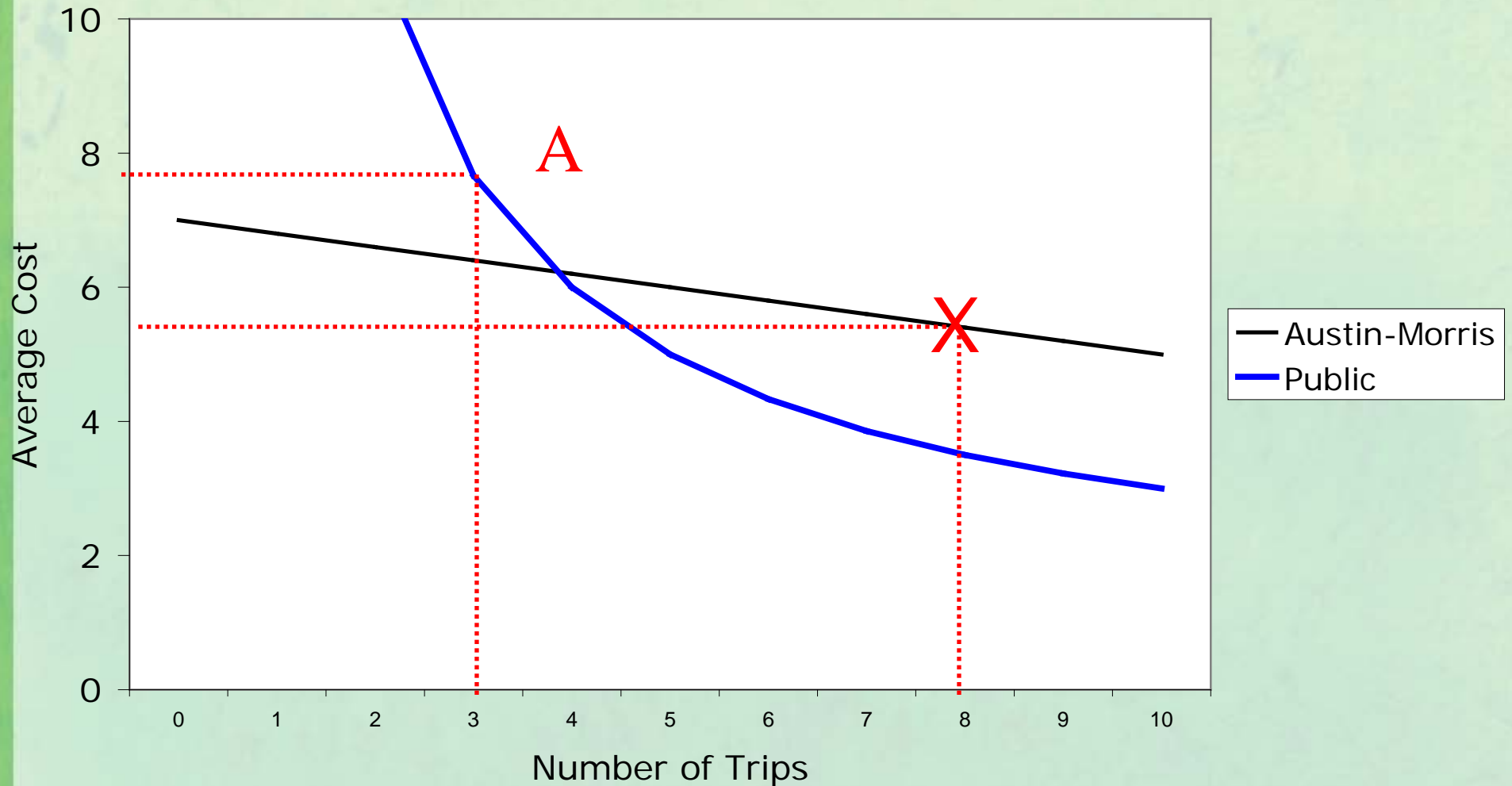
# Technological Lock-out (1): history

## Road and Public Transport



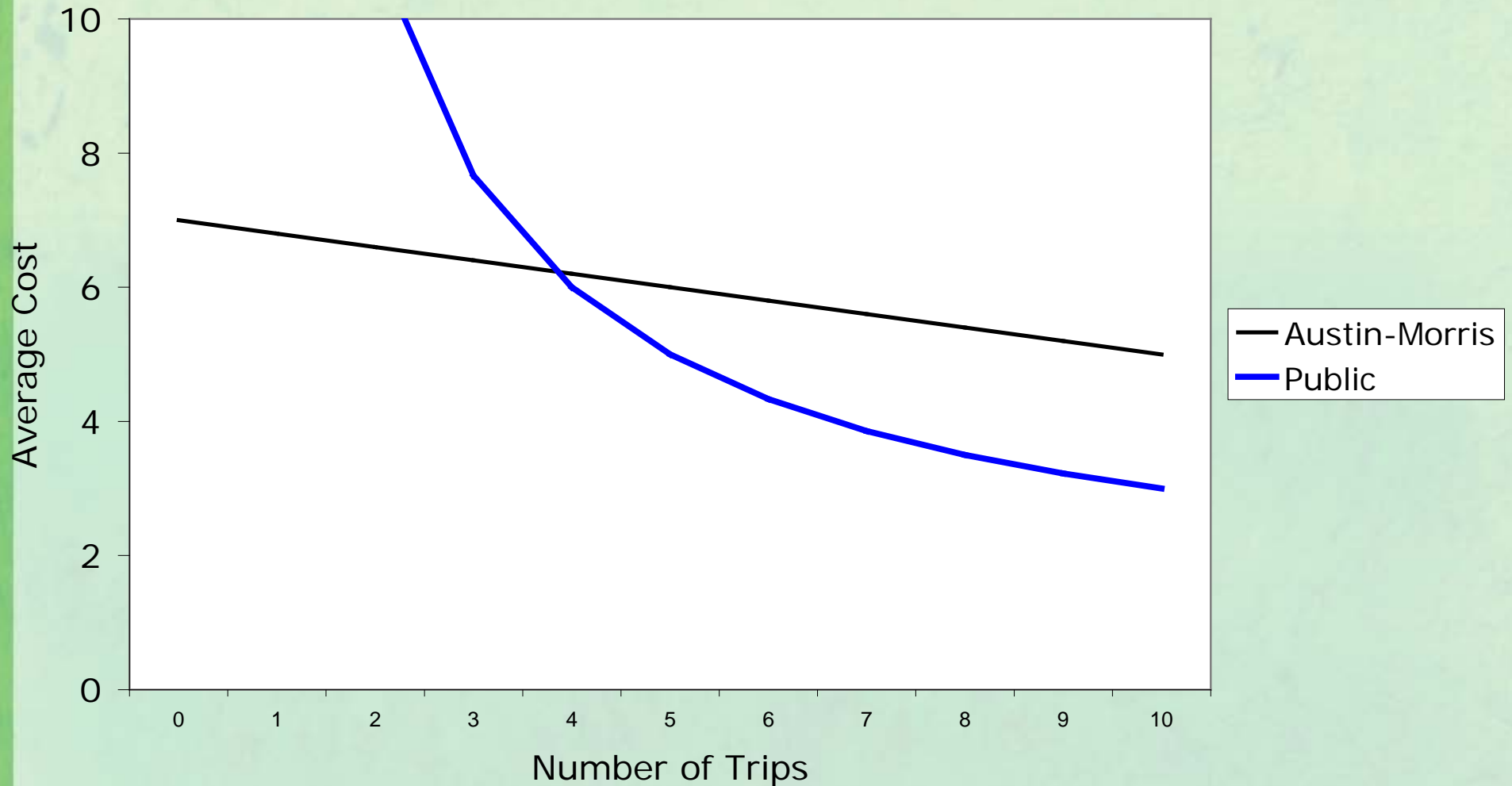
# Technological Lock-out (1): history

## Road and Public Transport



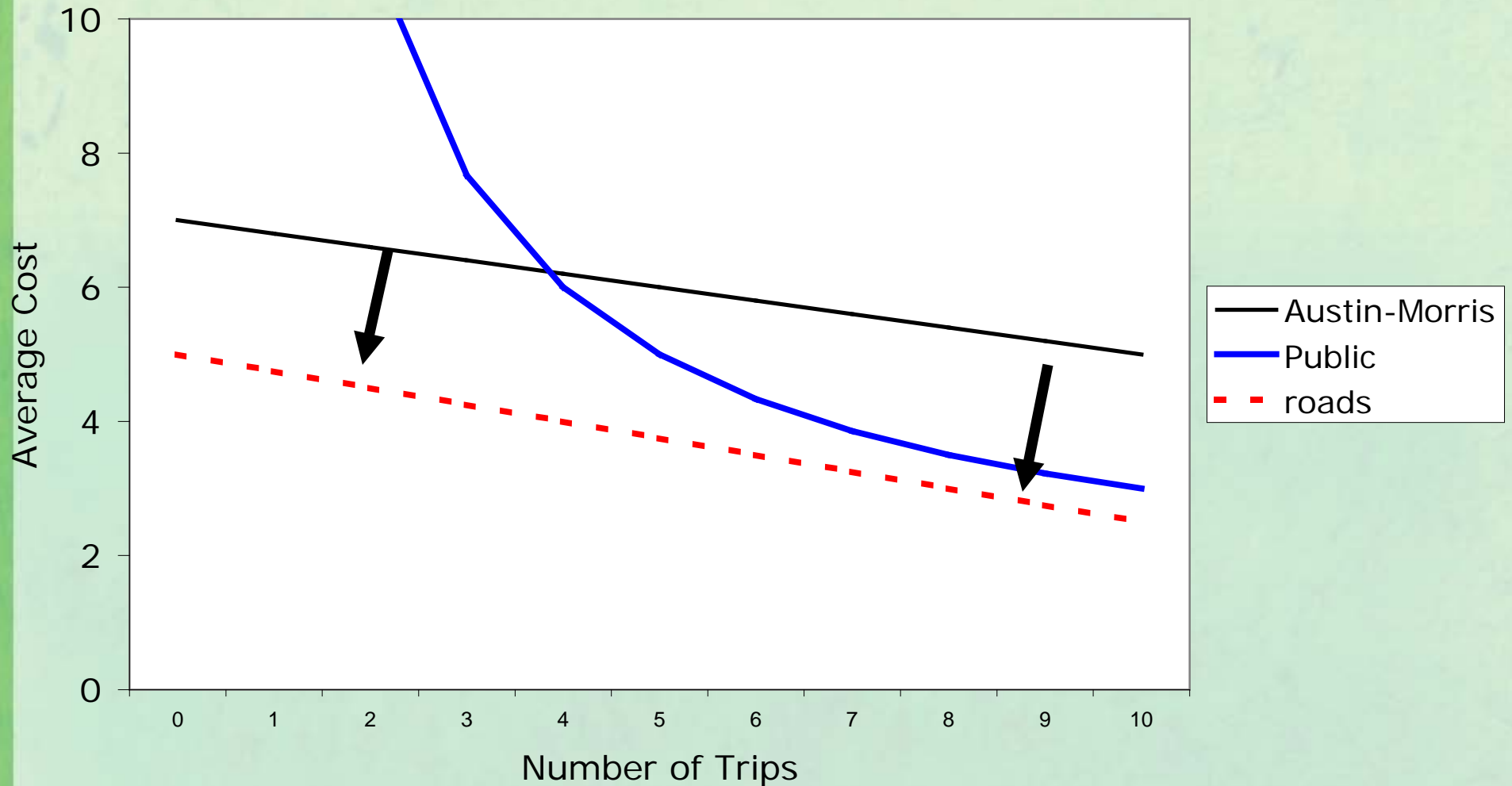
# Technological Lock-out (1): history

## Road and Public Transport



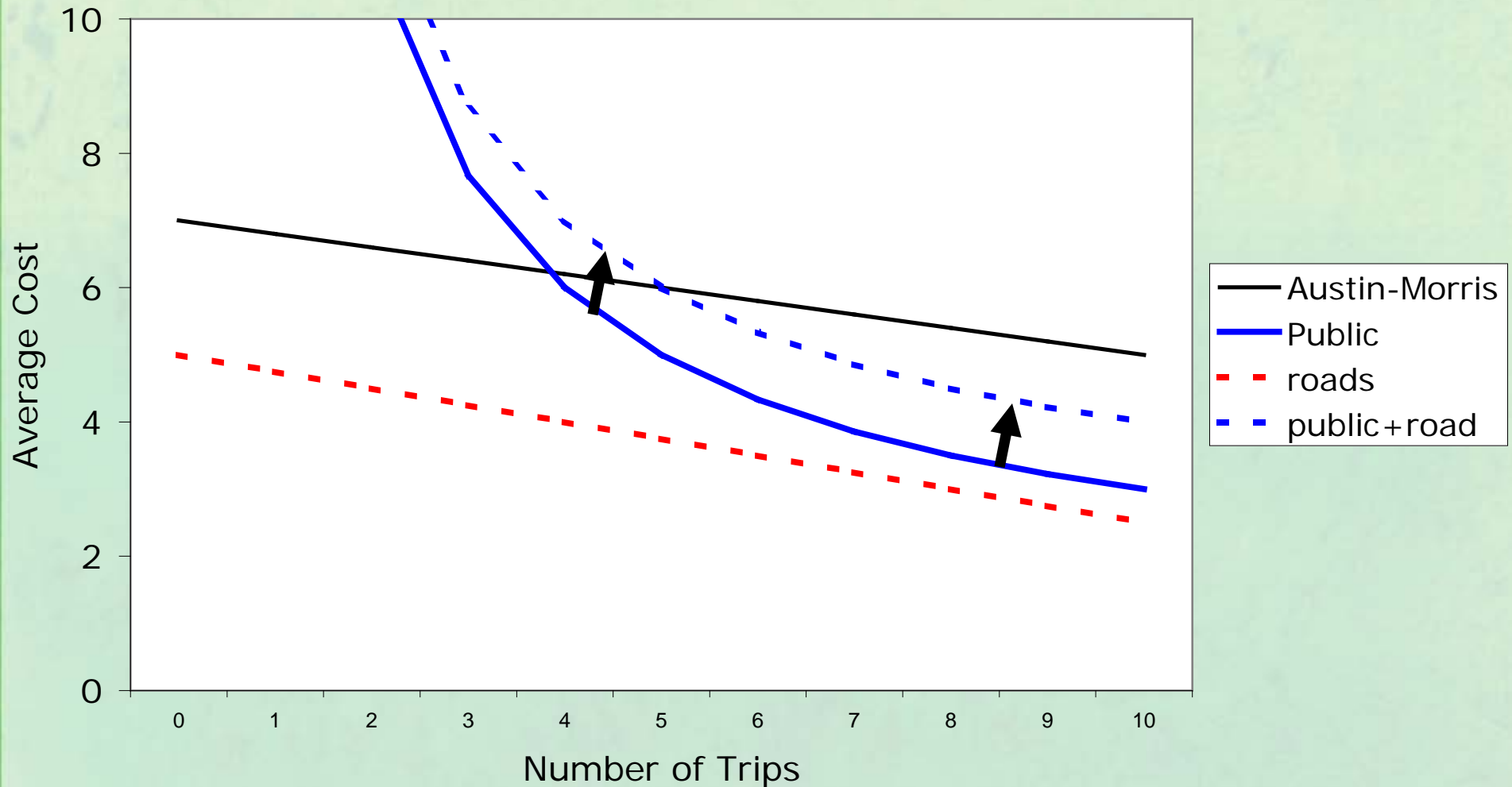
# History, road-building, and Lock-out

## Road and Public Transport



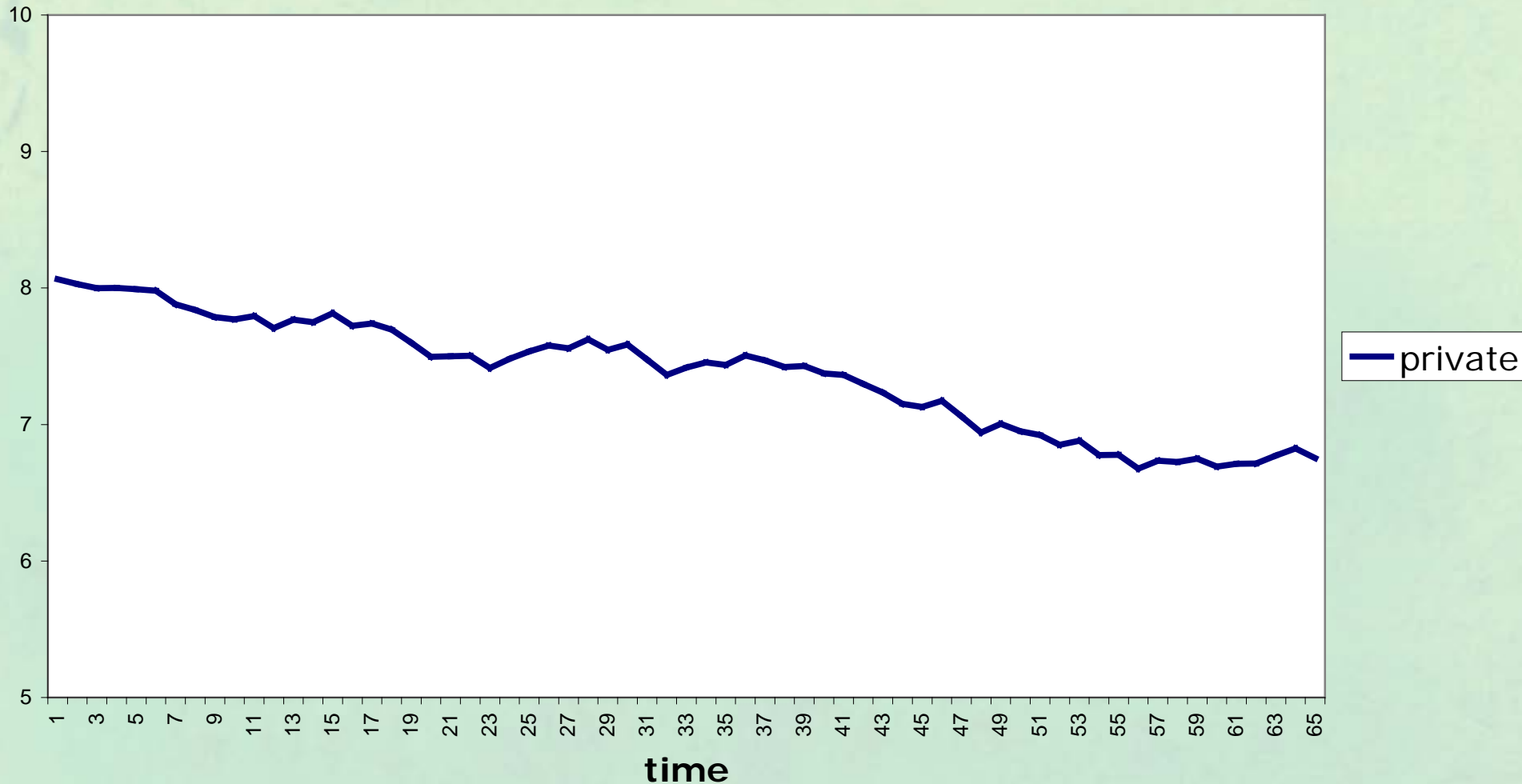
# History, road-building, and Lock-out

## Road and Public Transport



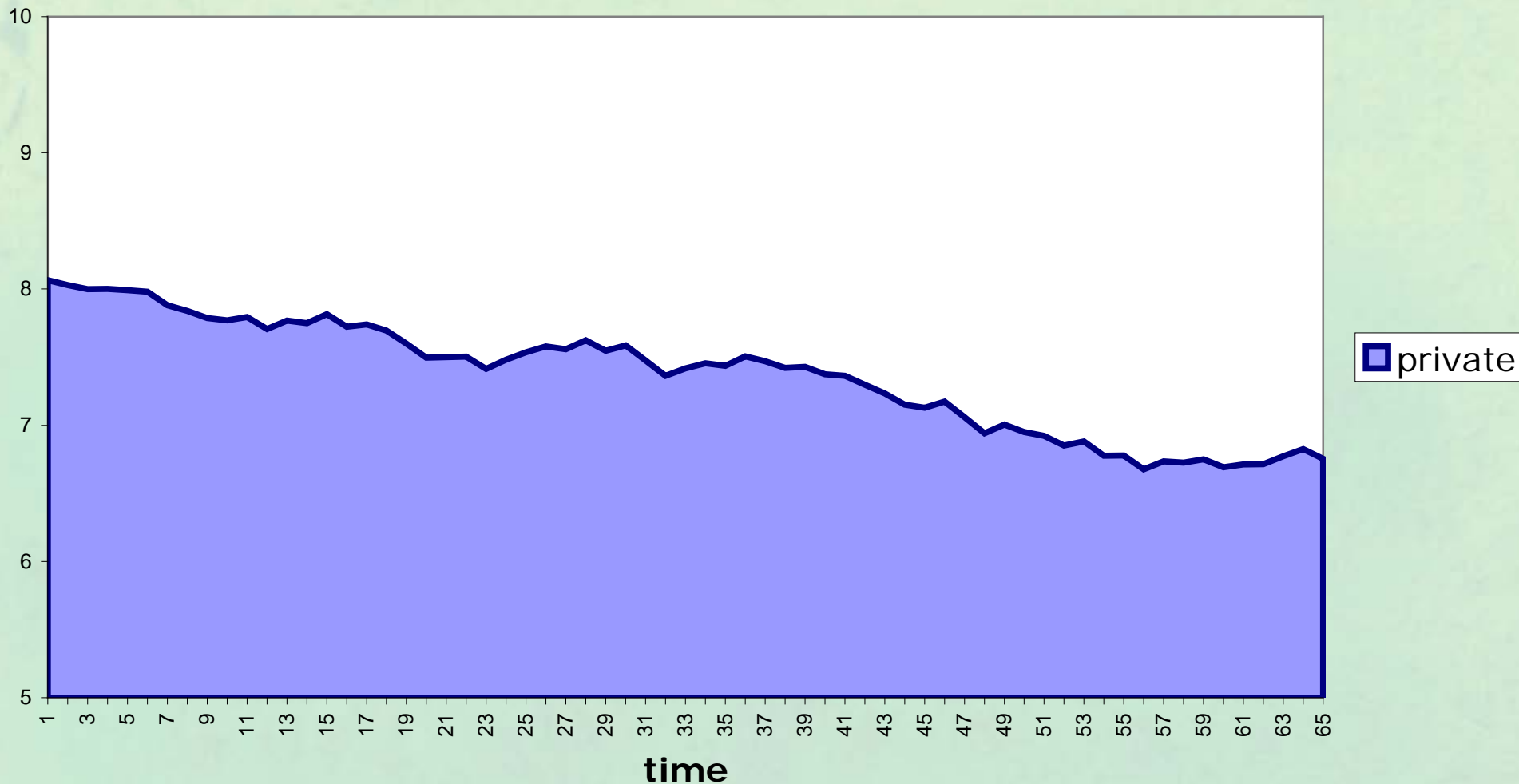
# Technological Lock-out (2): evolution

## Technological progress through time



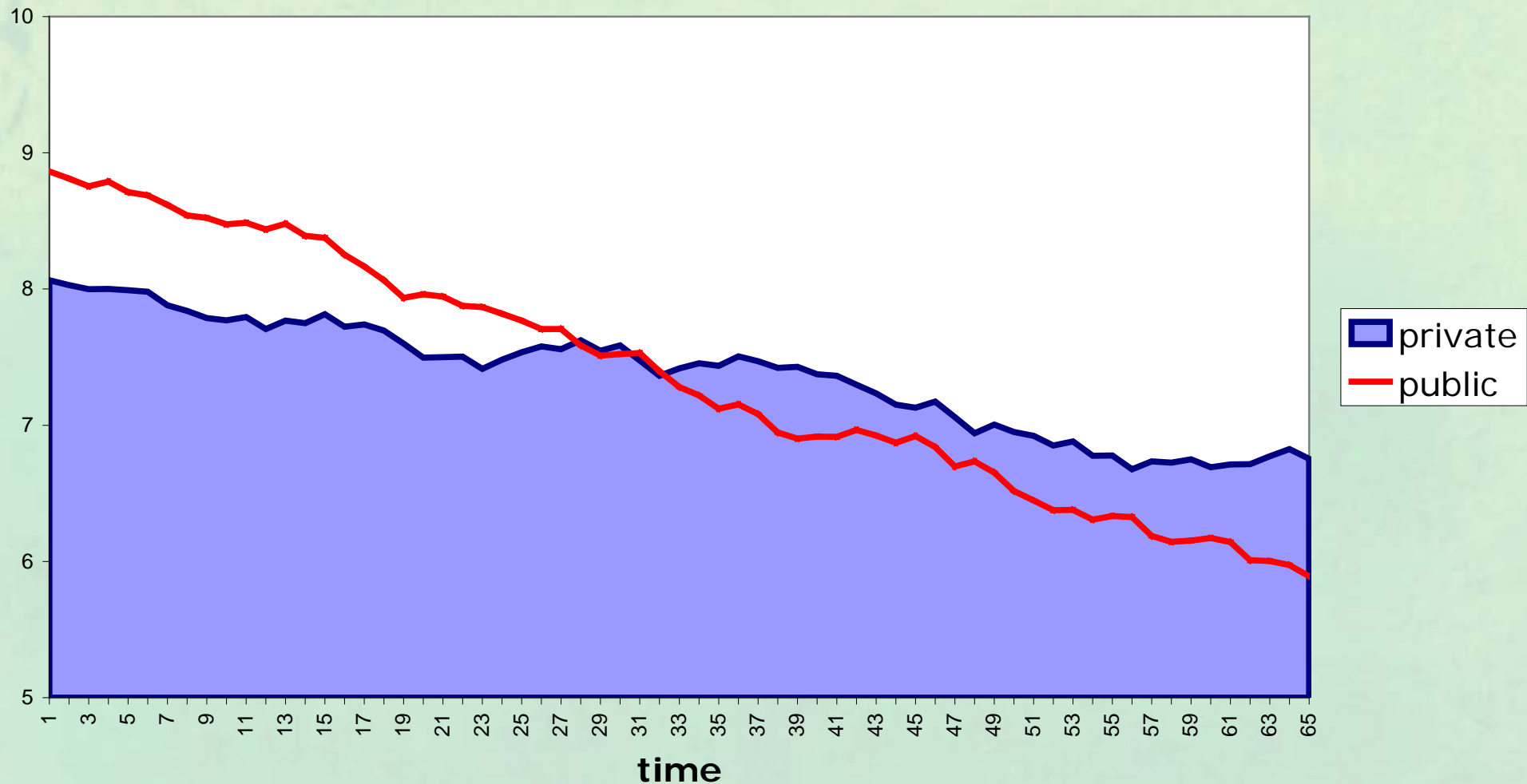
# Technological Lock-out (2): evolution

## Technological progress through time



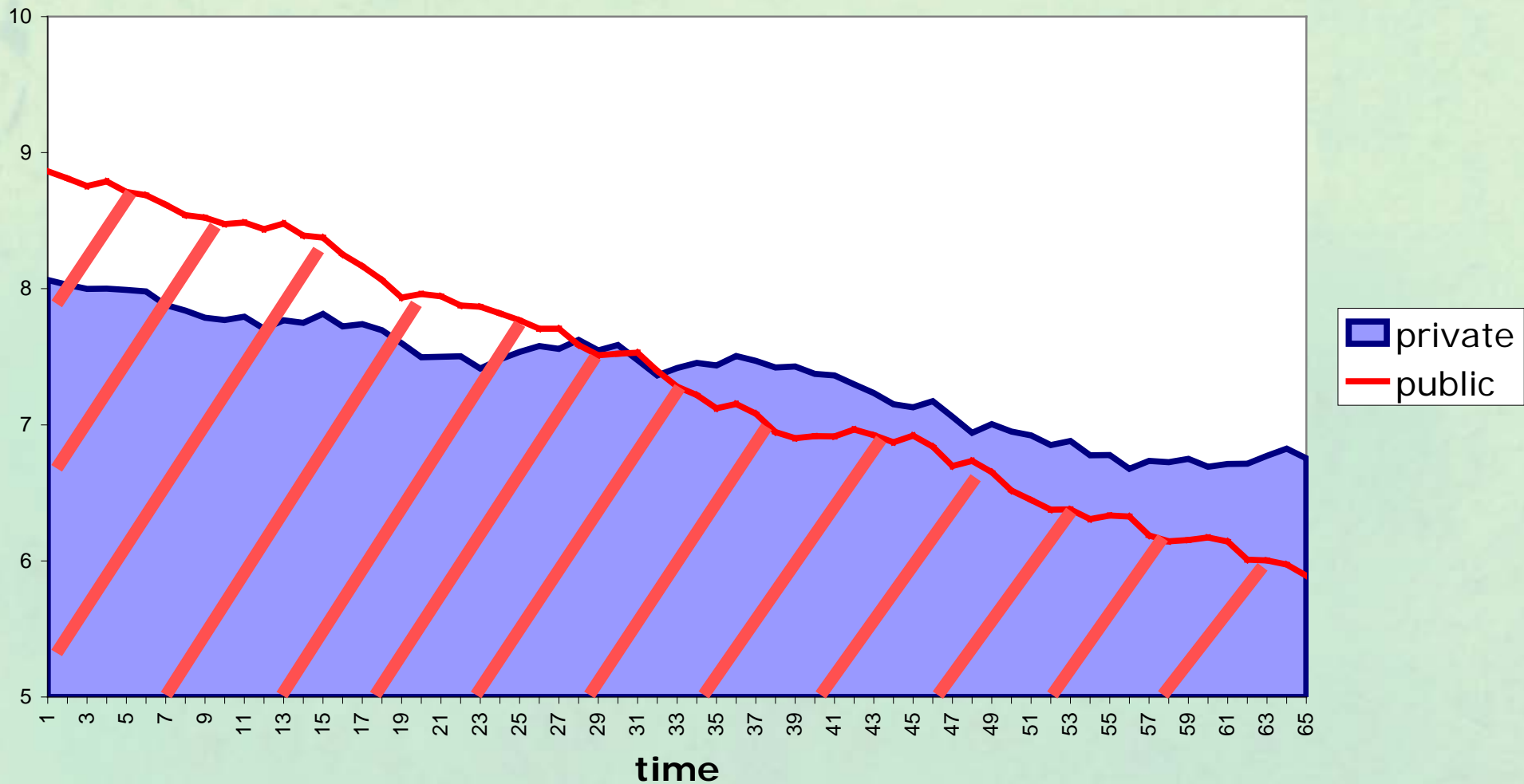
# Technological Lock-out (2): evolution

## Technological progress through time



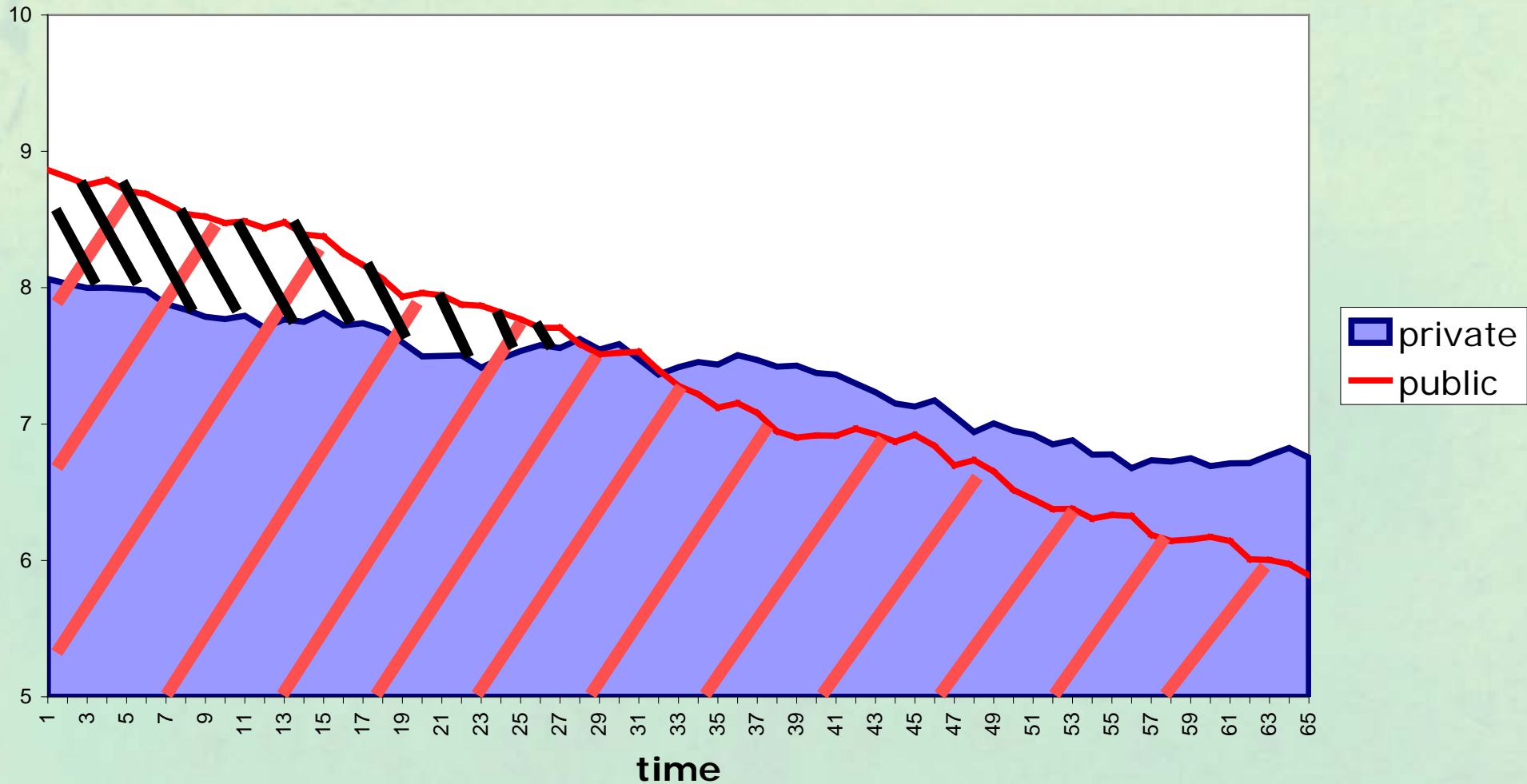
# Technological Lock-out (2): evolution

## Technological progress through time



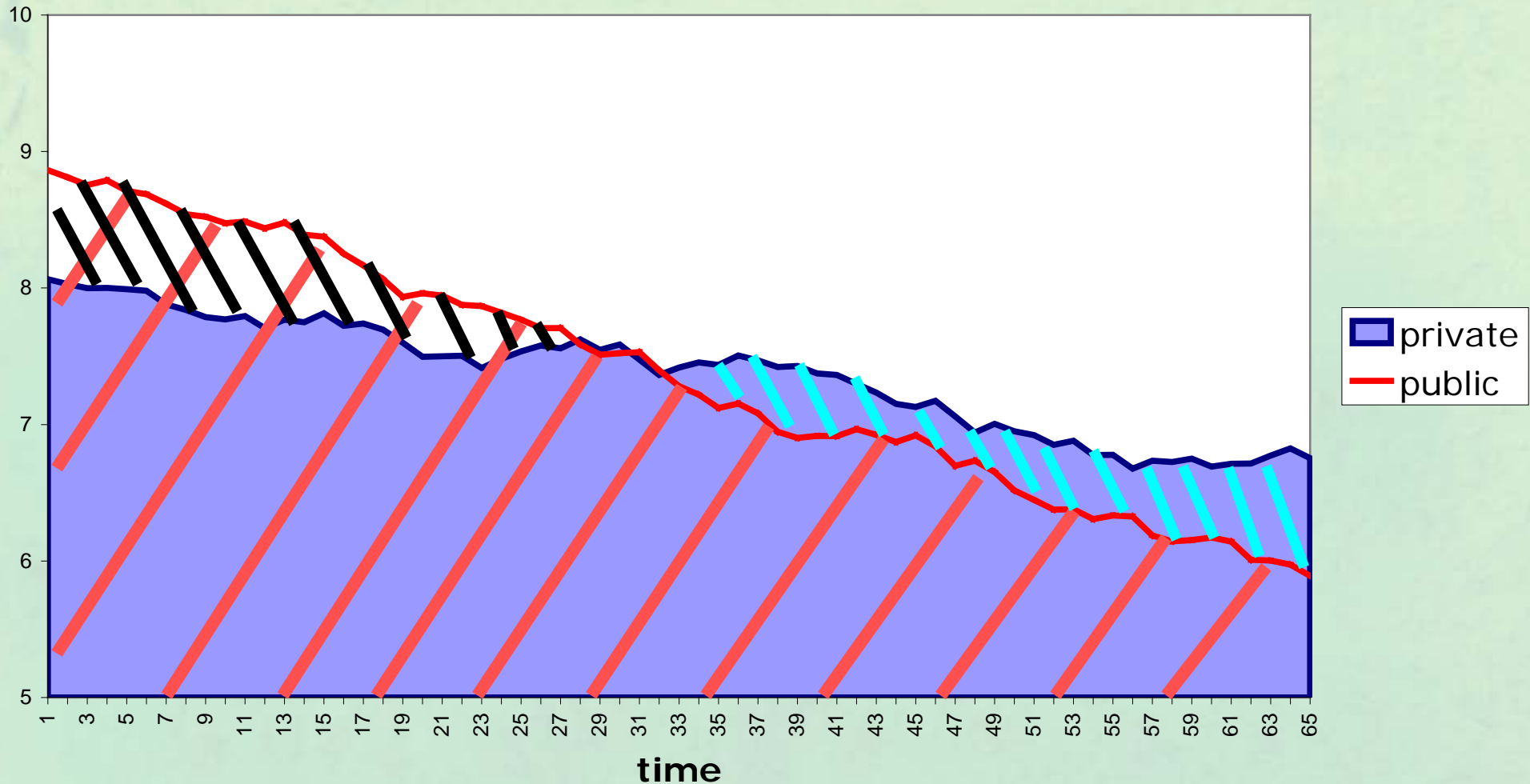
# Technological Lock-out (2): evolution

## Technological progress through time



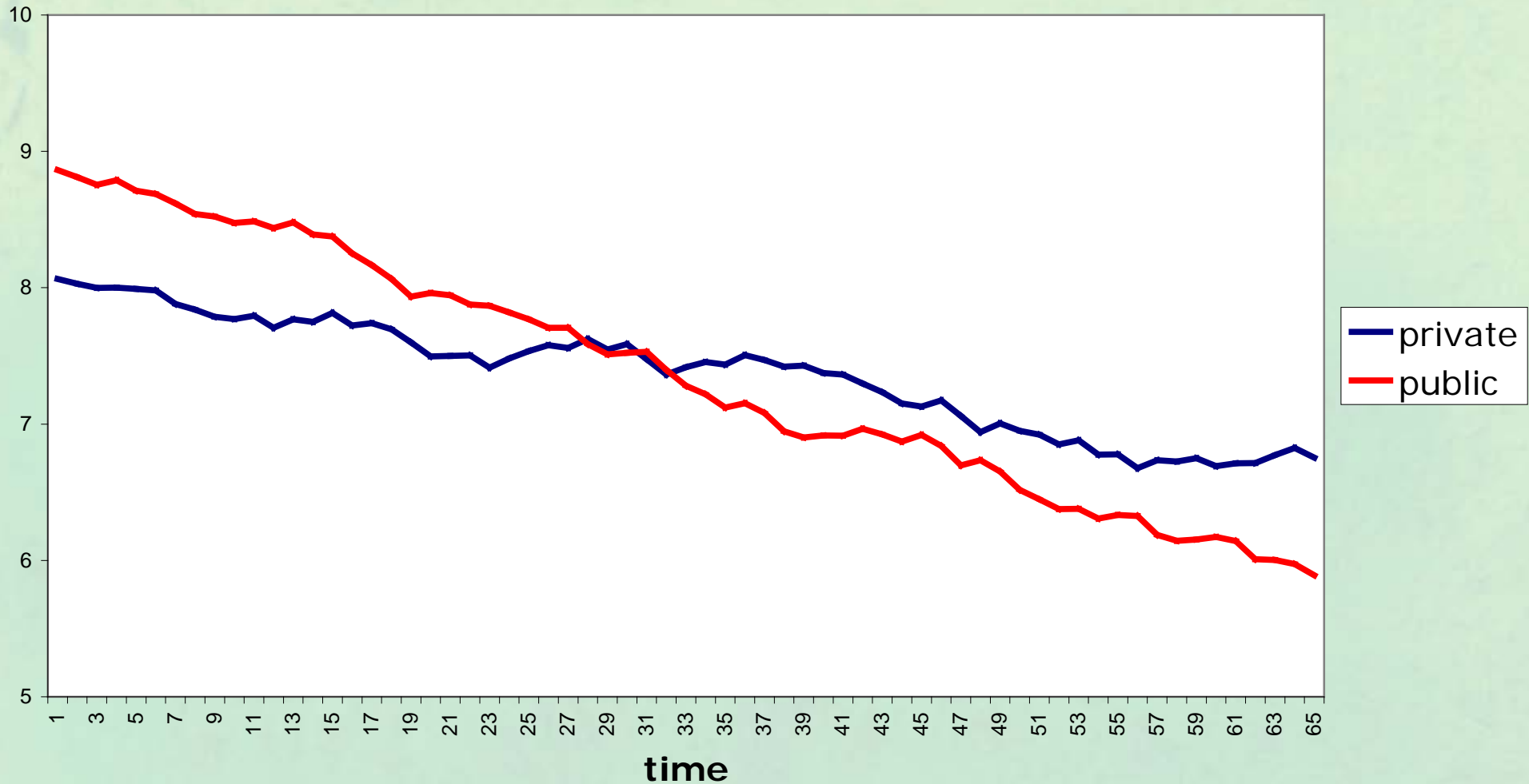
# Technological Lock-out (2): evolution

## Technological progress through time



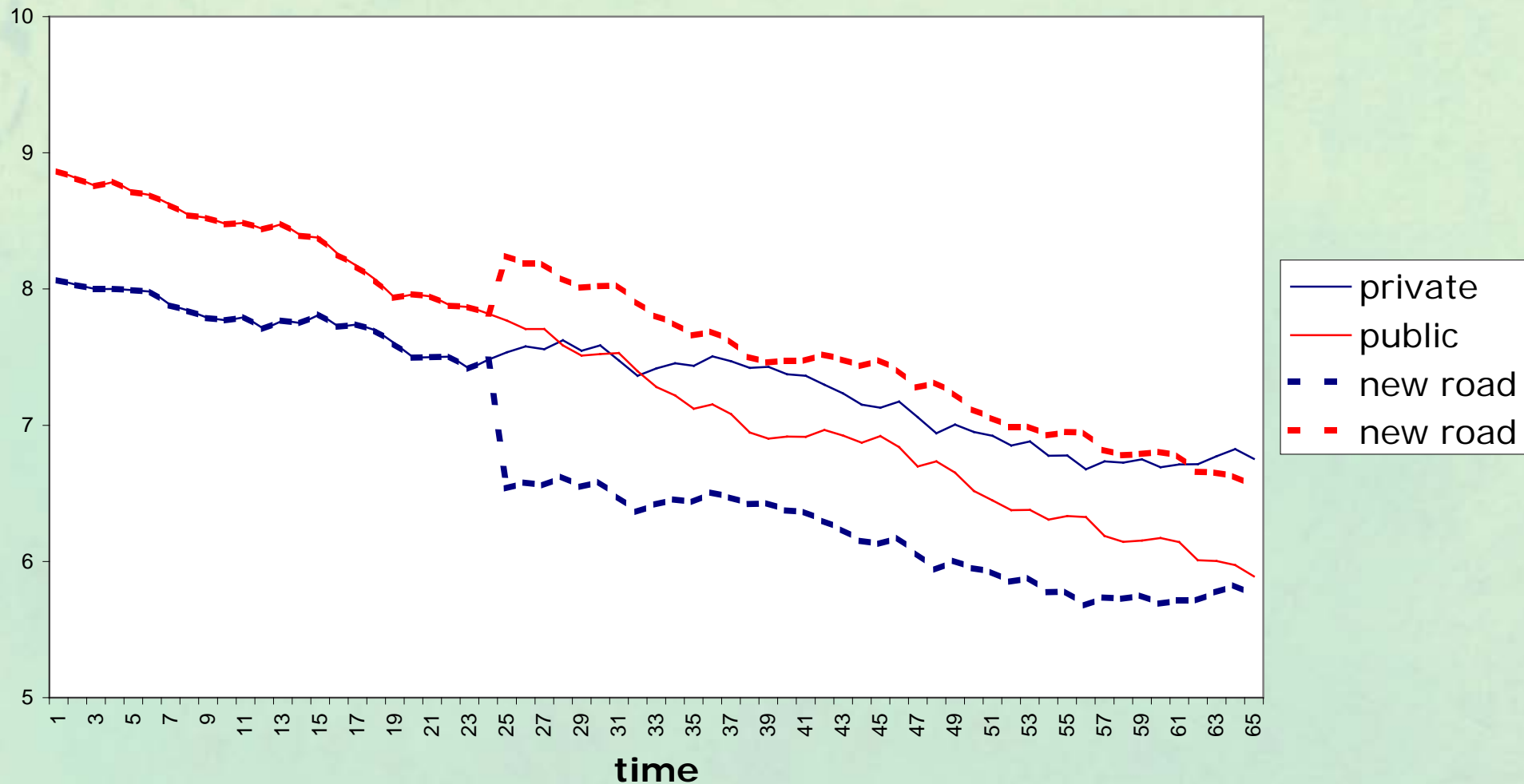
# Technological Lock-out (2): evolution

## Technological progress through time



# Technological Lock-out (2): evolution

## Technological progress through time



# Why do some cities sprawl?

Lionel Frost:

## 1. Transport costs at time of birth?

- Young cities grown in the car era have more sprawl than old cities
- But many European cities expanded this century without so much sprawl

# Why do some cities sprawl?

Lionel Frost:

## 2. High incomes at time of birth?

- Workers could afford “big” houses in the suburbs, and streetcar fares, so cities start with sprawl

# Why do some cities sprawl?

Lionel Frost:

## 3. Taste for suburban living?

- Anglo-Saxon peoples have preference for peaceful leafy suburbs, not cosmopolitan living

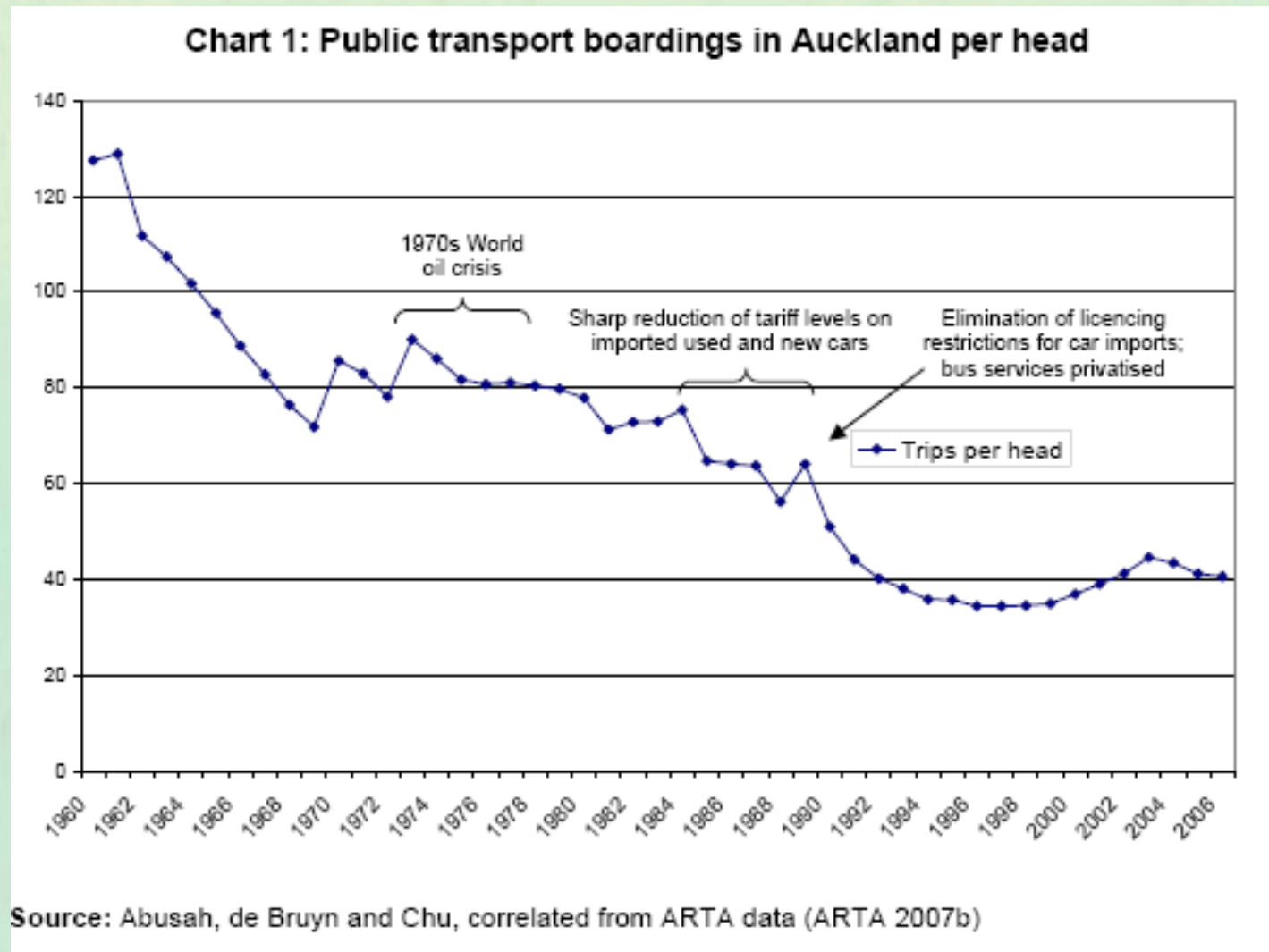


# Why do some cities sprawl?

## 4. Infrastructure choices

- Cities that plan public infrastructure rather than highways have less sprawl
- Auckland used to have 290 public transport trips per annum prior to the rejection of rail and choice of highways in 1950s (Abusah & de Bruyn 2007)

# Abusah and de Bruyn (2007) Getting Auckland on track: public transport and New Zealand: economic transformation



## Conclusion

Infrastructure choices have long term effects on average transport costs because highways induce sprawl.

Cars aren't necessarily bad – Houston – but they are expensive.

A key issue: relative preferences over suburban/ urban living versus cost of suburban/urban living.