

Does public transit reduce car travel externalities? Quasi-natural experiments' evidence from transit strikes

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Economics of Public Transit

Advantages of Public Transit

- +Scale economies: Marginal social cost of supplying public transport is lower than the average cost (large fixed costs, Mohring effect)
- +Second-best argument: unpriced negative externalities of car use
- +Equity considerations: low income groups use public transport

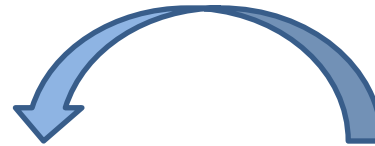
Disadvantages of Public Transit

- Low cross price elasticity between public transit and car use
- Welfare loss through taxation to generate subsidy
- Cost inefficient use of labor and capital

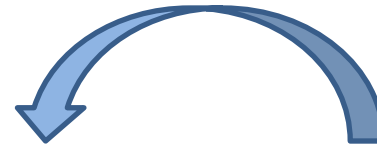
How?



How?



How?



Literature

Transport

van Excel and Rietveld (TRA, 2009) When strike come to town

Lo and Hall (TRA, 2006) Effects of the Los Angeles transit strike on highway congestion

Labor

Shalev (JLR, 1980) Trade unionism and economic analysis: The case of industrial conflict

Literature

Benefit of Public Transit

Nelson, Baglino, Harrington Safirova and Lipman (JUE, 2007). Transit in Washington, DC: Current benefits and optimal level of provision

→ *benefits exceed subsidies*

Parry and Small (AER, 2009). Should Urban Transit Subsidies Be Reduced?

→ *fare reduction justified even at 50% of operating cost*

→ *0.04 minutes per km (all roads)*

Anderson (AER, 2014). Subways, Strikes and Slowdowns: The Impacts of Public Transit Strikes

→ *benefits much larger than previously thought*

→ *0.12 minutes per km (highway)*

Rotterdam

1.2 million inhabitants (metropolitan region).

RET is private company that receives €200 million annual subsidies (€166 per capita).
Public transit modal share is 21% of trips , 350,000 trips each day of the week.
Annual 721 million passenger kilometers.

Car household ownership (57%) and modal share (40%) are large for NL.
Average trip distance is 15km with a duration of 31 minutes, a average of 30km/h..
An uncongested city.
Annual 3.1 billion passenger kilometers.

Strikes

Strikes in Rotterdam (2000-2011)

13 City-wide strikes

7 Full-day strike

6 Partial-day strike (Strike & non-strike hours)

3 Rail strike

1 Regional bus strike

3 Placebo strikes

Strike heterogeneity in announcement, completeness and cause.

Data

Inner City Traffic

Pneumatic tube measurement
4 Car speed
12 Car flow and 36 bicycle flow

Highway Traffic

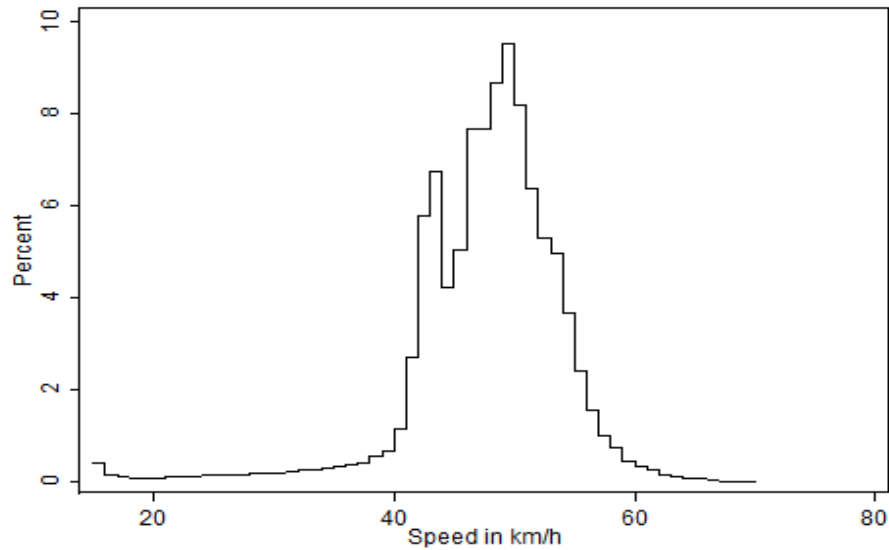
Virtual induction loops
7.6 km A16 ring-road

Weather and accident data

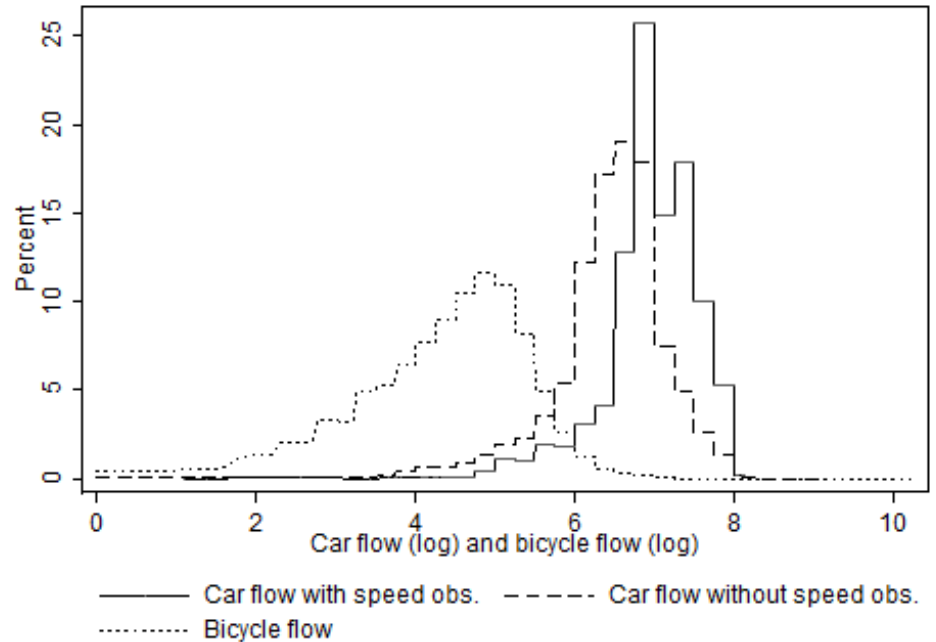


Descriptives – Inner City Traffic

Car speed

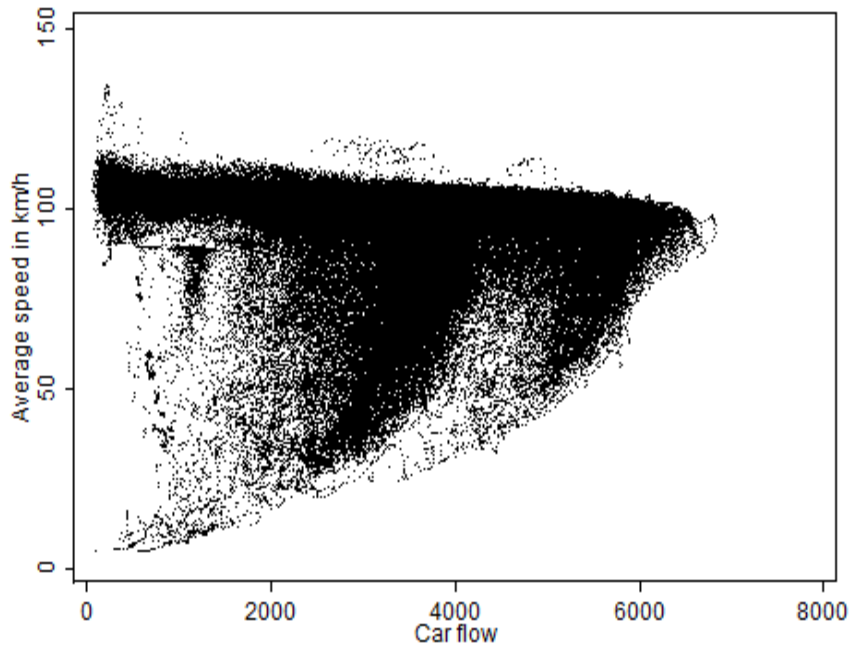


Car and Bicycle flows

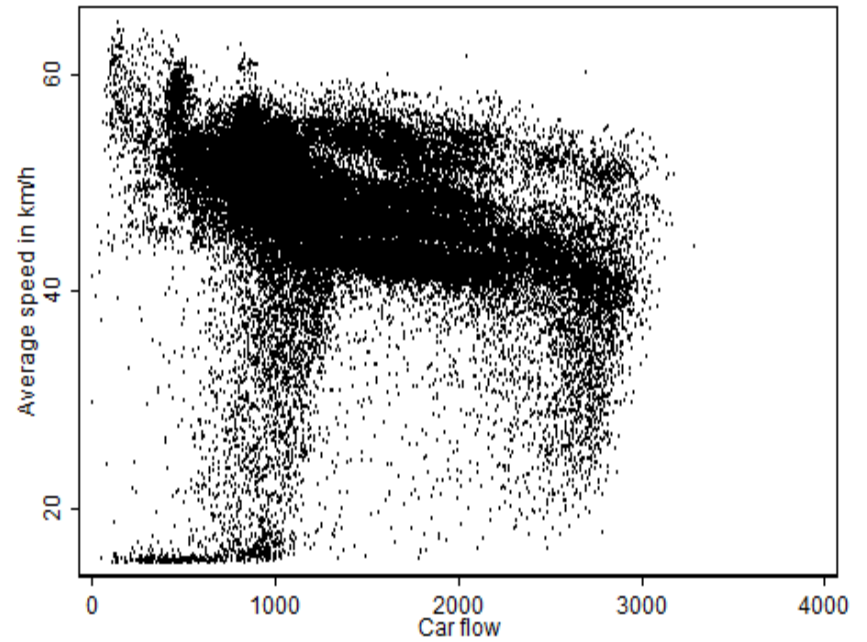


Traffic flows

Highway Traffic

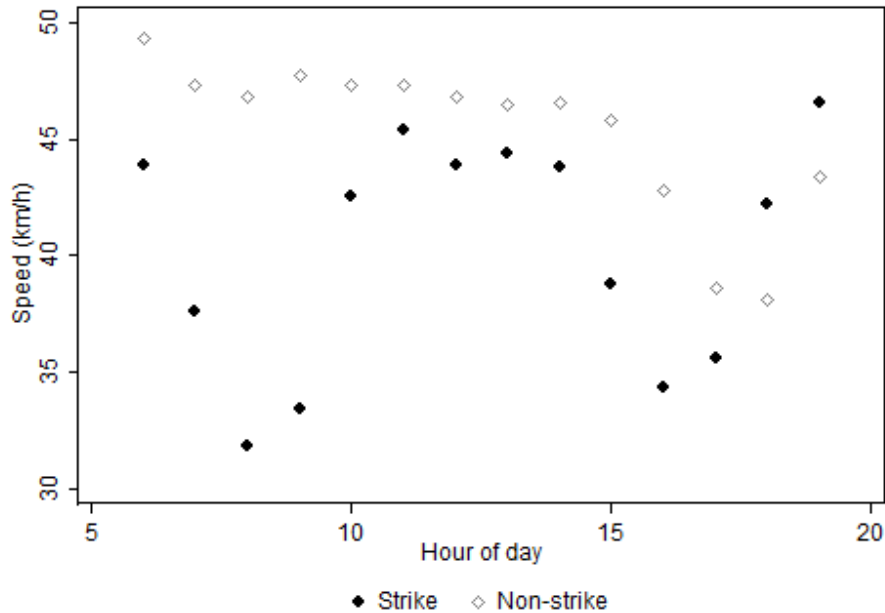


Inner City Traffic

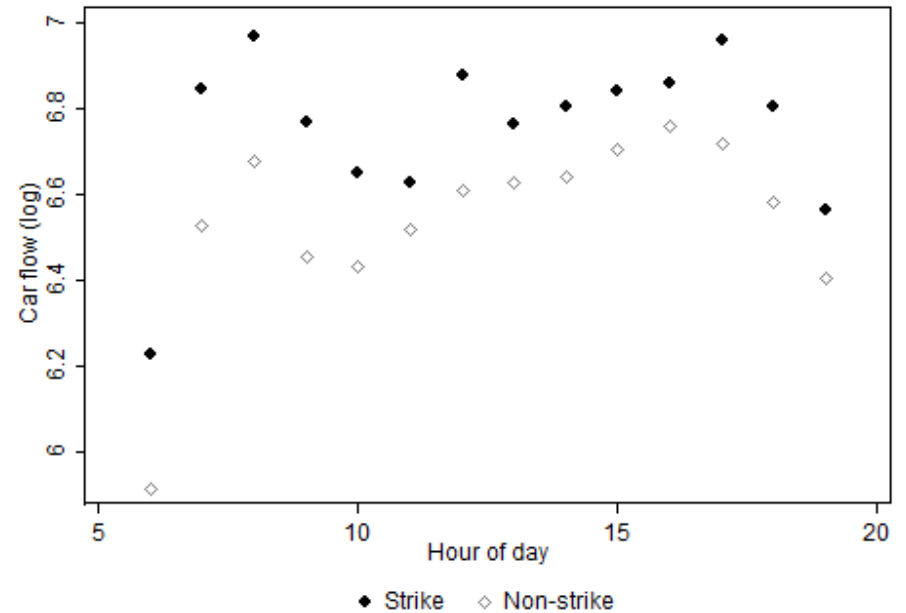


Descriptives – Inner City Traffic

Car speed on Wednesdays May 2011

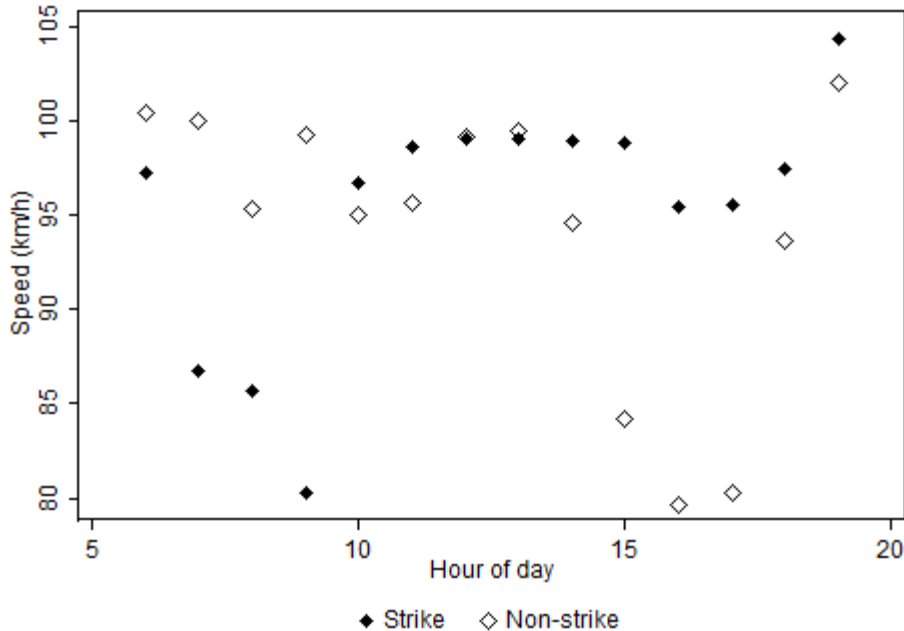


Car flow on Wednesdays May 2011

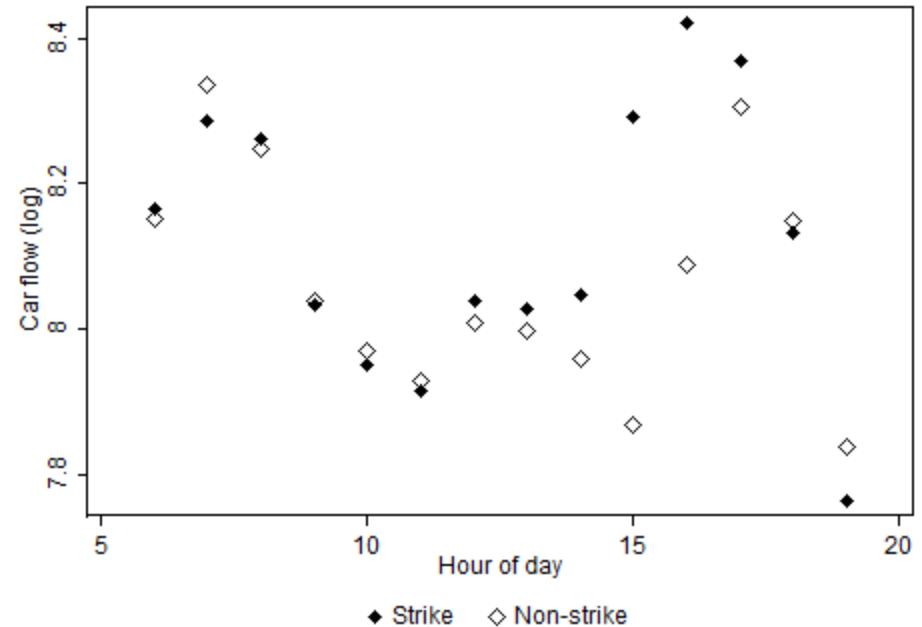


Descriptives – Highway Traffic

Car speed on Wednesdays May 2011



Car flow on Wednesdays May 2011



Method

$$\log Y_{i,t,D} = \alpha_i + \beta_x X_{t,D} + \underbrace{[\beta_1 R_t + \beta_2 (1 - R_t)] F_D}_{\text{Full-day strike}} + \underbrace{[(\beta_3 R_t + \beta_4 (1 - R_t)) S_{t,D} + (\beta_5 R_t + \beta_6 (1 - R_t)) (1 - S_{t,D})] P_D}_{\text{Partial-day non-strike hours}} + u_{i,t,D}$$

Partial-day strike hours

$X_{t,D}$

Controls:

- Rail, regional bus and placebo strikes
- Location fixed effects
- Hour of the week fixed effects
- Week of the year fixed effects
- Year fixed effects
- Weather

Results – Inner City Traffic

	Car speed (log)	Car flow (log)	Bicycle flow (log)
Full-day city-wide strike			
Rush hour	-0.151 *** (0.053)	0.094 *** (0.021)	0.244 *** (0.057)
Non-rush hour	-0.064 ** (0.029)	0.069 *** (0.024)	0.145 ** (0.062)
Other strikes	Included	Included	Included
Controls	Included	Included	Included
Number of observations	88,106	338,782	719,661
R ²	0.4002	0.7789	0.7474

For full-day strike, speed reduction is 8.3%.
 Additional 0.129 minutes travel time per kilometer (4.3 cent).

Results – Inner City Traffic

	Car speed (log)	Car flow (log)	Bicycle flow (log)
Partial-day city-wide strike			
Rush and strike hour	-0.209 *** (0.051)	0.142 *** (0.020)	0.257 *** (0.047)
Non-rush and strike hour	-0.006 (0.010)	0.027 (0.020)	0.100 ** (0.047)
Rush and non-strike hour	-0.071 *** (0.022)	0.014 (0.024)	-0.009 (0.050)
Non-rush and non-strike hour	-0.020 (0.012)	0.010 (0.012)	0.065 (0.040)
Placebo strike	0.001 (0.013)	-0.000 (0.013)	-0.023 (0.050)
Regional bus strike	-0.032 ** (0.014)	0.033 (0.024)	0.186 *** (0.037)
Rail strike	0.004 (0.017)	0.068 *** (0.017)	0.117 (0.092)
Number of observations	88,106	338,782	719,661
R ²	0.4002	0.7789	0.7474

Sensitivity Analysis – Inner City Traffic

	Average speed calculation	Complete strikes only
	Car speed (log)	Car speed (log)
Full-day citywide strike		
Rush hour	-0.073 *** (0.023)	-0.201 *** (0.045)
Non-rush hour	-0.032 ** (0.014)	-0.081 ** (0.034)
Controls	Included	Included
Number of observations	88,106	87,882
R ²	0.6500	0.4007

Results – Highway Traffic

	Car speed (log)	Car flow (log)
Full-day city-wide strike		
Rush hour	-0.037 *** (0.010)	0.031 * (0.017)
Non-rush hour	-0.025 *** (0.010)	-0.017 (0.028)
Placebo strike	-0.015 (0.010)	0.002 (0.021)
Partial-day city-wide strikes	Included	Included
Controls	Included	Included
Number of observations	771,019	771,019
R ²	0.2152	0.8175

For full-day strike, speed reduction is 2.7%.
Additional 0.019 minutes travel time per kilometer (0.6 cent).

Comparison Highway to Inner City

Highway Traffic

0.019 minutes per km < 0.12 minutes per km of Anderson (AER, 2014)

Inner City & Highway Traffic


$0.129 * 0.62 + 0.019 * 38 = 0.081$ minutes per km

0.081 minutes per km > 0.04 minutes per km of Parry and Small (AER, 2009)

Congestion Relief Benefit

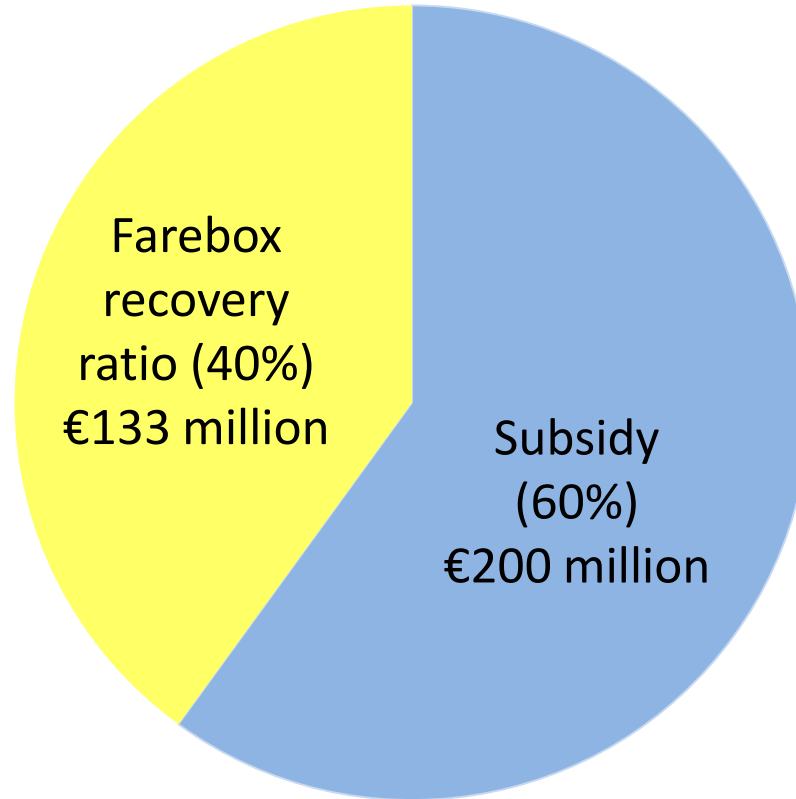
Inner City Traffic	Highway
532,556 trips	331,744 trips
0.129 minutes per km	0.019 minutes per km
15km trip distance and €20 VOT	
€345,633	€31,201
= €376,835 per day	
= €95 million per year	

Cost vs. Benefit

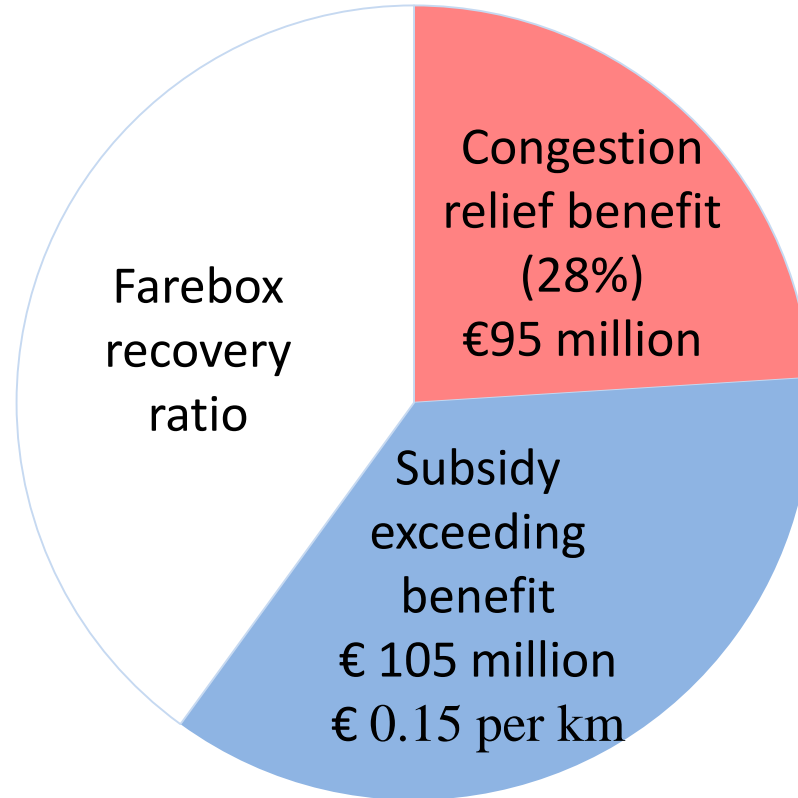


Total operating cost
€333 million
€0.46 per km

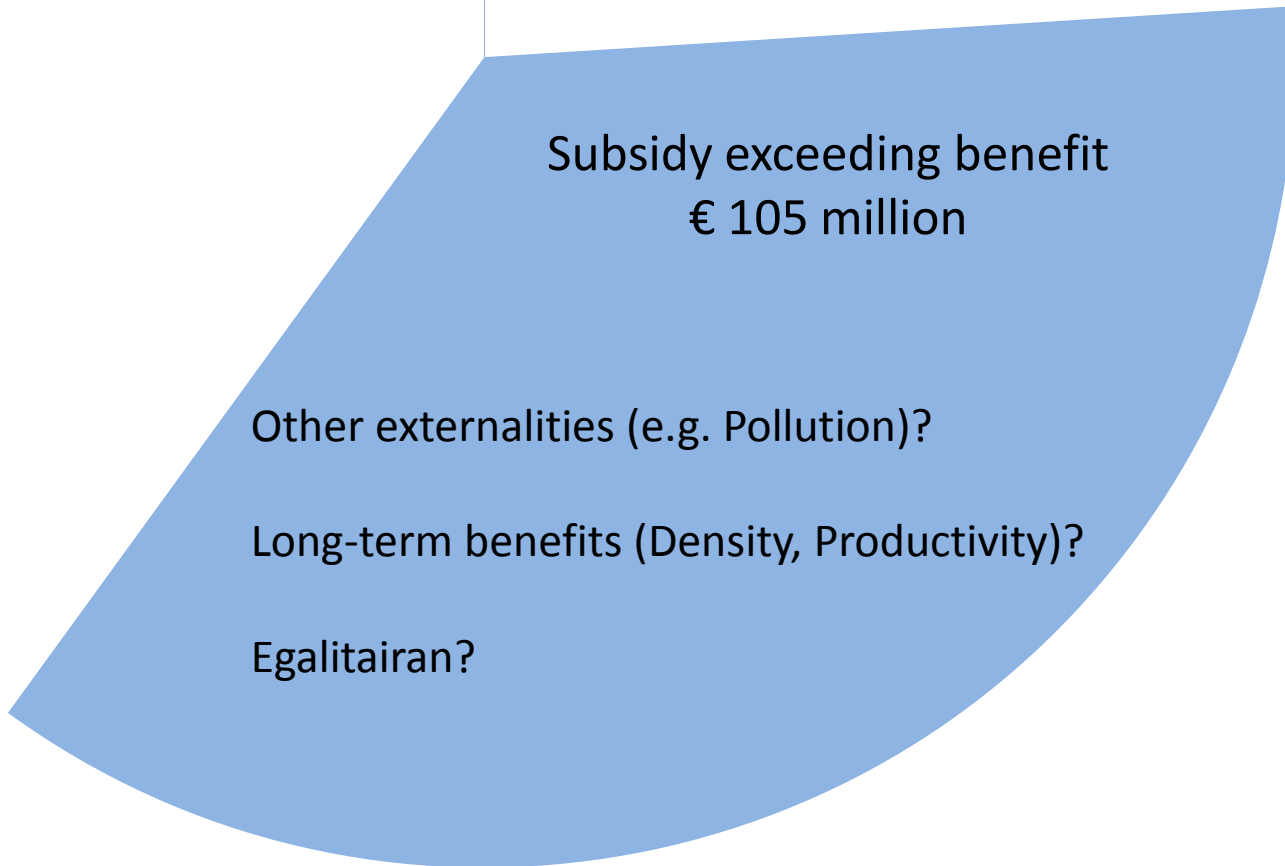
Cost vs. Benefit



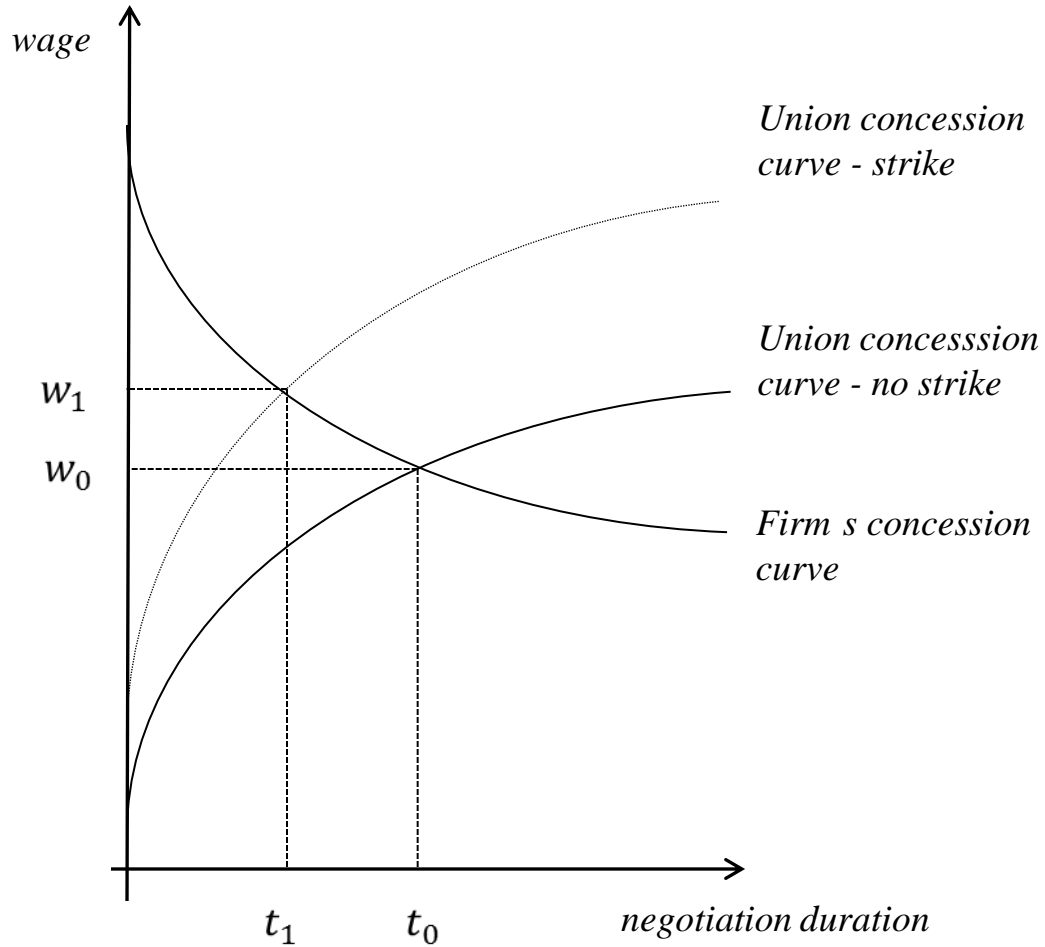
Cost vs. Benefit



Cost vs. Benefit



Labor negotiation



Conclusion

Yes, it does. Public transit congestion relief benefit is 0.081 minutes per kilometer for a medium-sized, uncongested city.

The benefit is five times larger for inner city traffic than highway traffic.

The benefit is half of the subsidy and one third of total cost.

Note: Public transit is one of the policy measures to regulate transport market inefficiencies (see., Basso and Silva, 2014).

Bicycle promoting policies might be a very cost-effective policy measure.

Thank you for your attention!

