Travel in the eternal city without public transit

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Public transit in question

- Omnipresent in western world
- Large spectrum in ownership from national to private
- Various finance approaches - subsidization to full fare-cost recovery
- Costly, hundreds of millions in subsidies annually for large towns
- Strike prone

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

- Excess tax burden to generate subsidy

- Cost inefficient use of labor and capital

Public transport and car use are substitutes?

How to examine the effect of public transport on car congestion?

Strikes!

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

Benefits of Public Transit

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

→ 0.04 minutes per km (all roads)

→ fare reduction justified, subsidies >90%

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

→ 0.12 minutes per km (highway)

→ benefits much larger than previously thought

Adler and Van Ommeren (2015). Does public transport reduce car travel externalities?

→ 0.017 min per km (highway) and 0.240 min per km (inner city)

→ 0.104 minutes per km (all roads)

→ large subsidy warranted for uncongested, medium-sized town

Our Arguments

1) Public transit absence (i.e. strikes) increases car use
2) Increase in car use increases travel time
3) Off-peak public transit has similar effect on on- and off-peak travel times
4) Transit strikes entail a welfare loss
5) Public transit benefit is larger for congested areas
6) Large subsidies to transit are justifiable by this congestion relief benefit

Rome

Is a large-sized city with 4.3 million inhabitants (metropolitan region).

Car modal share is high (67%) - high congestion levels.

Bicycle use (<1%) and walking (<7%) are almost absent.

Public transit modal share is 24% of trips , organized by one large and various small firms.

Trips per day	Italy	Germany
Number	2.7	3.4
Length in kilometers	12.2	11.5
Duration in minutes	21.8	24.2

Public transit strikes

Strikes in Rome are frequent

31 partial-day, off-peak, incomplete public transit strike days announced in 2014

19 in Rome city
14 take place and 5 are canceled
7 large strikes

and 12 in Lazio (Rome region)
7 take place and 5 canceled

Note: Regulation affects strike dates and set-up. There is strike heterogeneity in announcement, completeness and cause.

Hourly Data

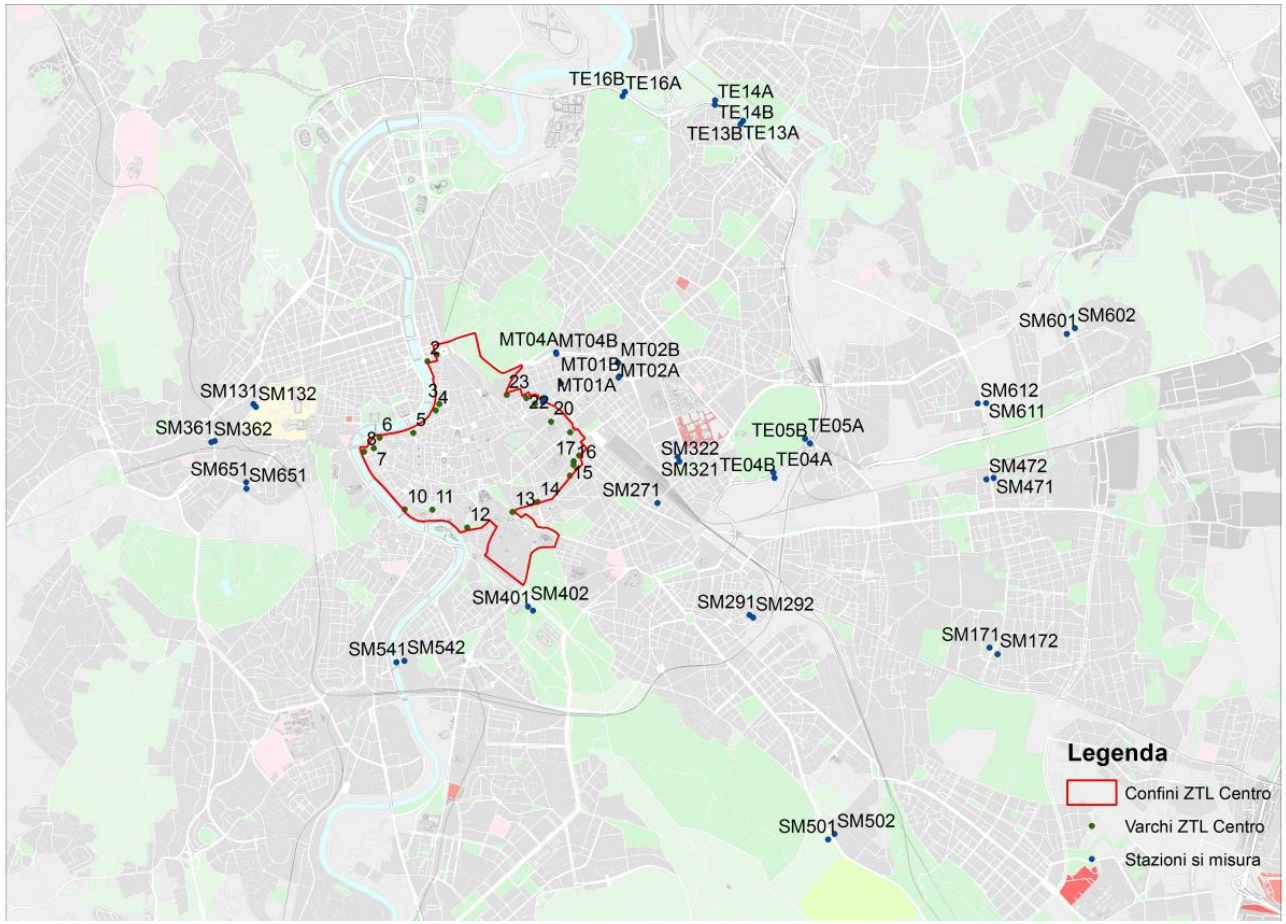
Inner City Traffic

37 speed and flow measurement points

ZTL

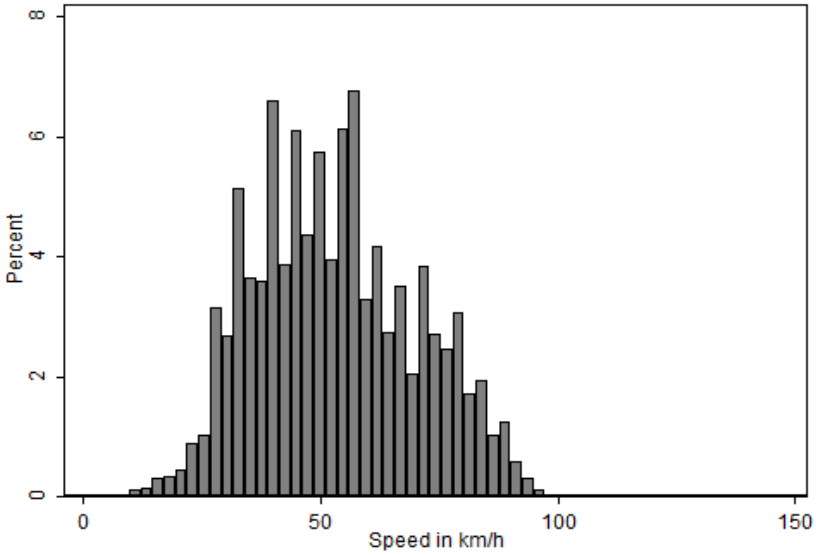
28 flow measurment points

Weather data

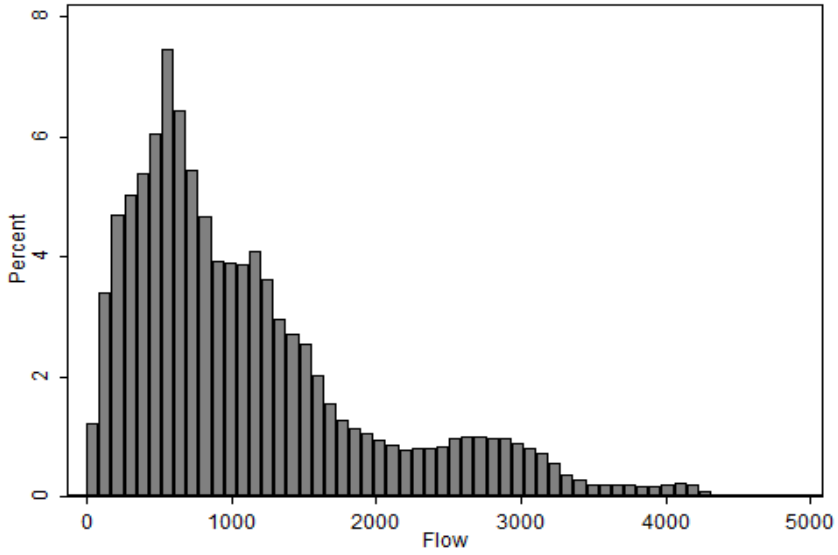


Descriptives – Inner City Traffic

Car speed

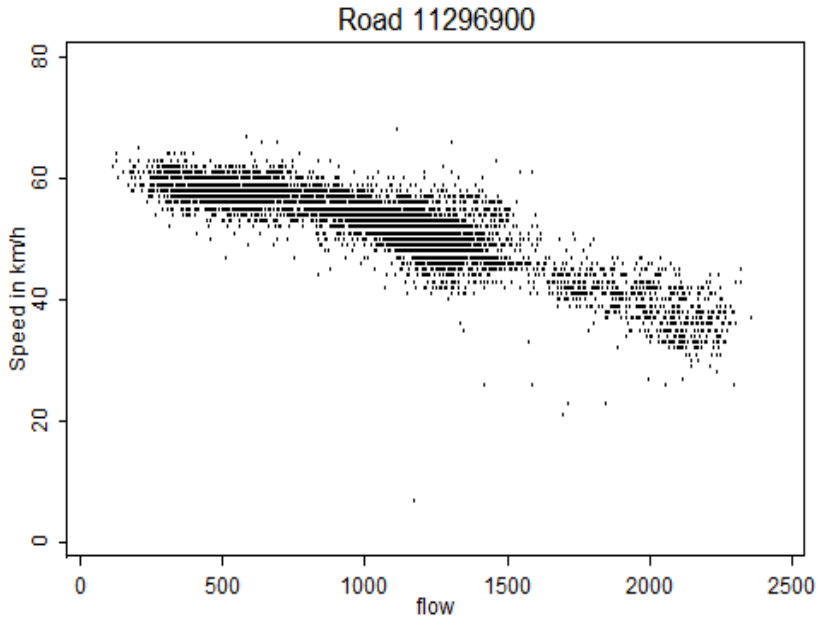


Car flow

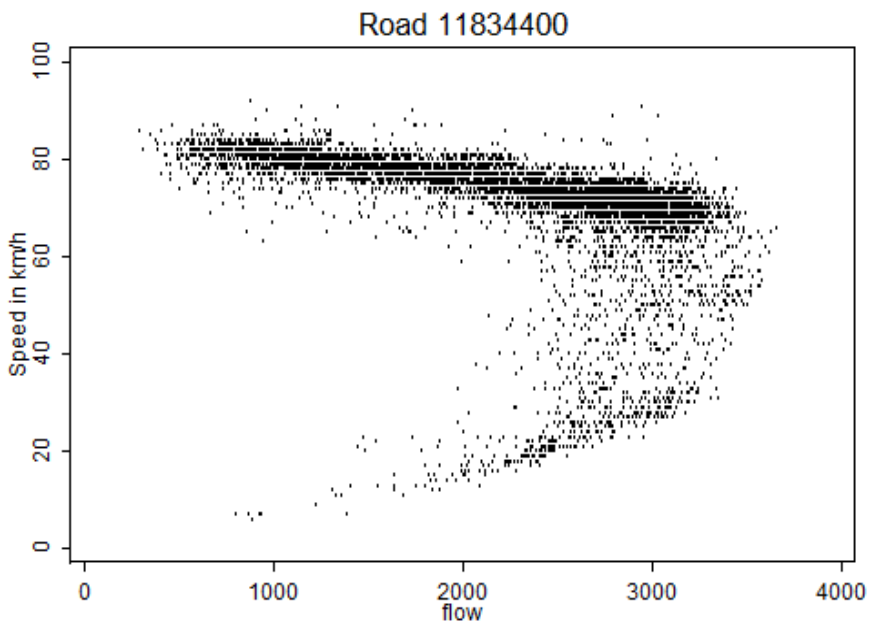


Traffic flows

Congested road

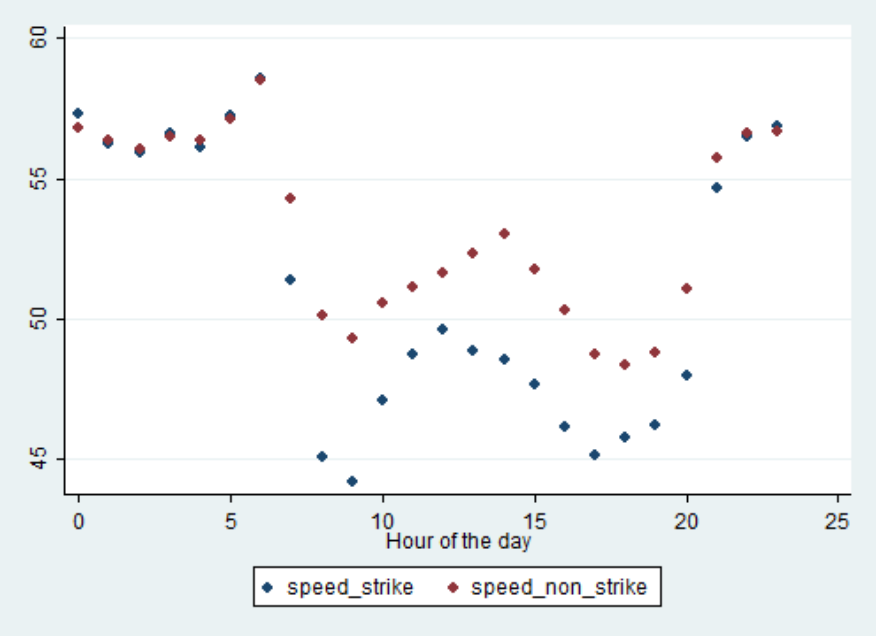


Hyper-congested road

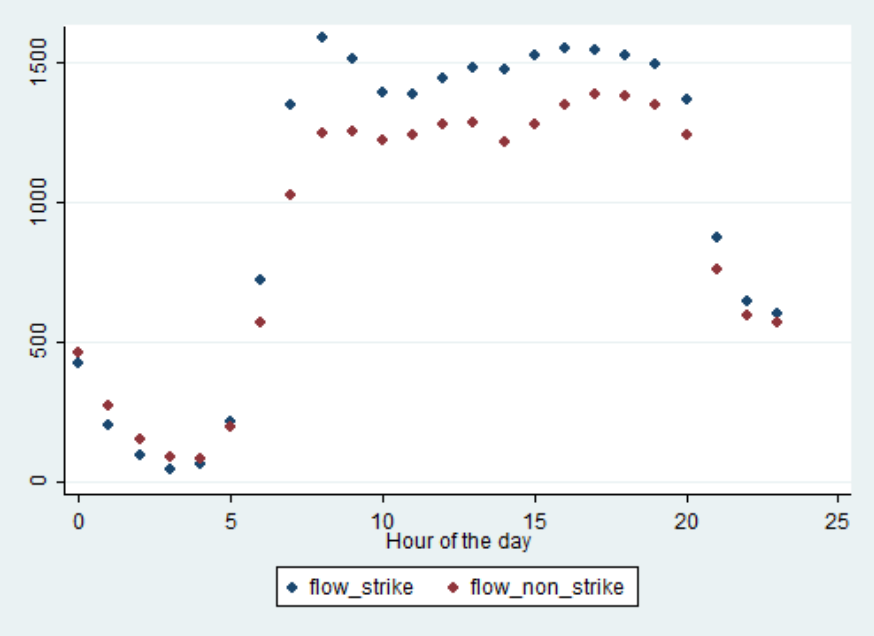


Descriptives – Inner City Traffic

Speed strike day



Flow strike day



We focus on public transit hours between 6am and 9pm.

Theoretical Model

Travel demand is constant in´peak (P) and off-peak hours (O) with three modes:

Car Public transit Teleworking

Travel demand $$\overline{D} = C_P + C_O + PT_P + PT_O + T_P + T_O \quad (1)$$

On a strike day, off-peak public transit is unavailable:

Strike day $$\overline{D} = C_P + C_O + PT_P + T_P + T_O \quad (2)$$

Average effect vs marginal effect

Travel time car

Empirical Model

Peak Non-strike Off-peak Strike hours

$$Y_{i,t,D} = \alpha_i + \beta_x X_{t,D} + (\beta_1 P_t + \beta_2 (1 - P_t)) S_{t,D} + u_{i,t,D} \qquad (3)$$

$X_{t,D}$ Controls:

- Smaller (TPL) strikes
- Rail 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

	Travel time (min/km)	Car flow (log)
ATAC citywide strike		
Strike hour (off-peak)	0.092 ***	0.052
	(0.034)	(0.036)
Non-strike hour (peak)	0.064 **	0.077 **
	(0.026)	(0.034)
Other strikes	Included	Included
Time and weather controls	Included	Included
Number of observations	192,797	192,797
R^2	0.5066	0.8776

Off-peak strike hours increase travel times by 0.092 minutes per km, €0.03 per km. Effect on peak non-strike hours similar than off-peak strike hours effect.

Results – Inner City Traffic

	Hyper-congested Travel time (min/km)	Congested Travel time (min/km)
ATAC citywide strike		
Strike hour (off-peak)	0.134 ***	0.020 **
	(0.051)	(0.009)
Non-strike hour (peak)	0.086 **	0.026 **
	(0.041)	(0.013)
Other strikes	Included	Included
Time and weather controls	Included	Included
Number of observations	118,914	73,883
R^2	0.4705	0.6202

Hyper-congested locations benefit substantially more from pubic transit provision.

Comparison Highway and Inner City

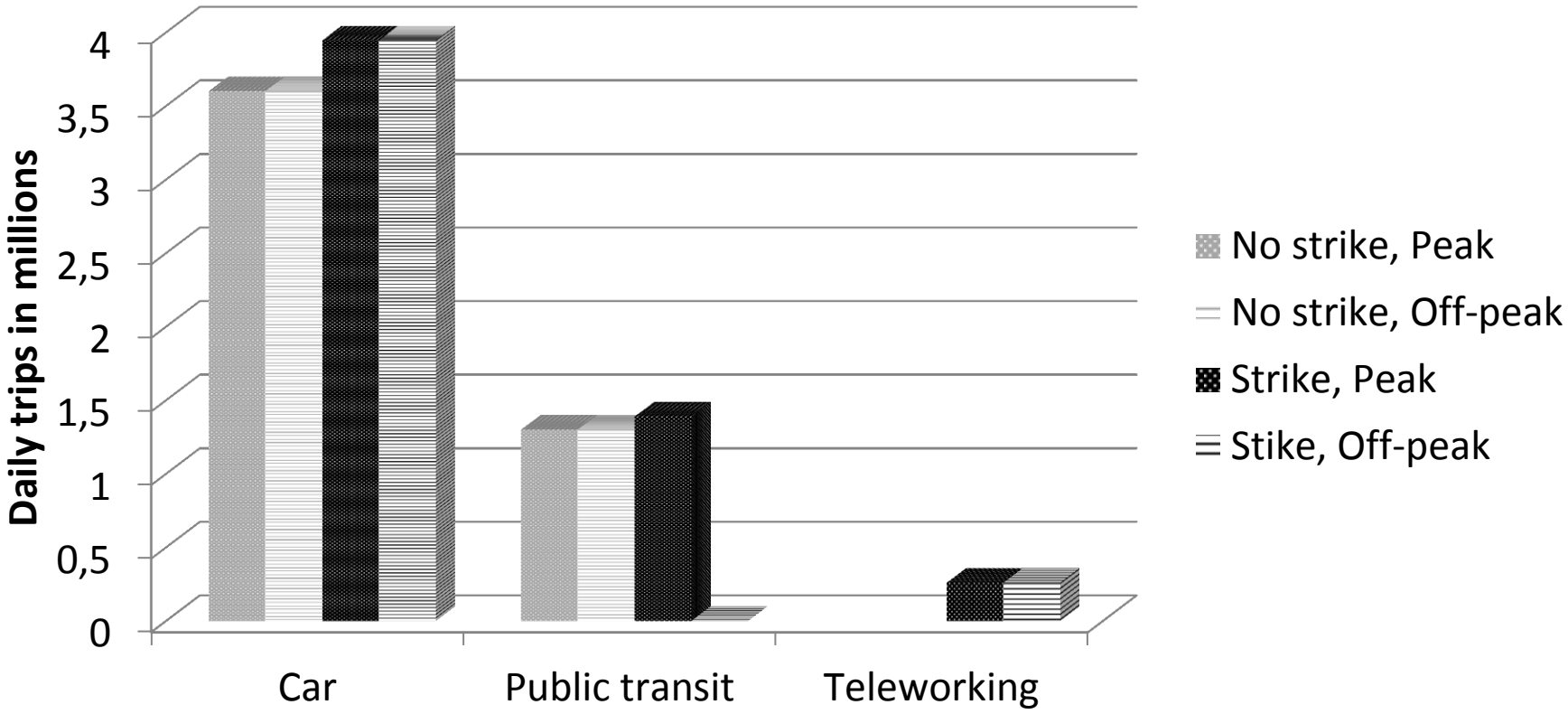
	Parry and Small (AER, 2009)	Anderson (AER, 2014	Adler and van Ommeren (2015)	Current paper
Inner city			0.240	0.12
Highway and arterial roads		0.12	0.017	0.07
All roads	0.04		0.102	0.09
Strike hours	No strike	Full-day	Full-day	Off-peak
City size	Large	Large	Medium	Large

Modal substitution

Car Public transit Teleworking

Travel demand $\bar{D} = C_P + C_O + PT_P + PT_O + T_P + T_O$ (1)

Strike day $\bar{D} = C_P + C_O + PT_P + T_P + T_O$ (2)



Strike loss

Inner City Traffic
2,788,000 trips
0.08 minutes per km
10km trip distance and €20 VOT
€1.7 million strike cost
€12 million annual transit strike welfare loss in 2014

Limitations Welfare Analysis

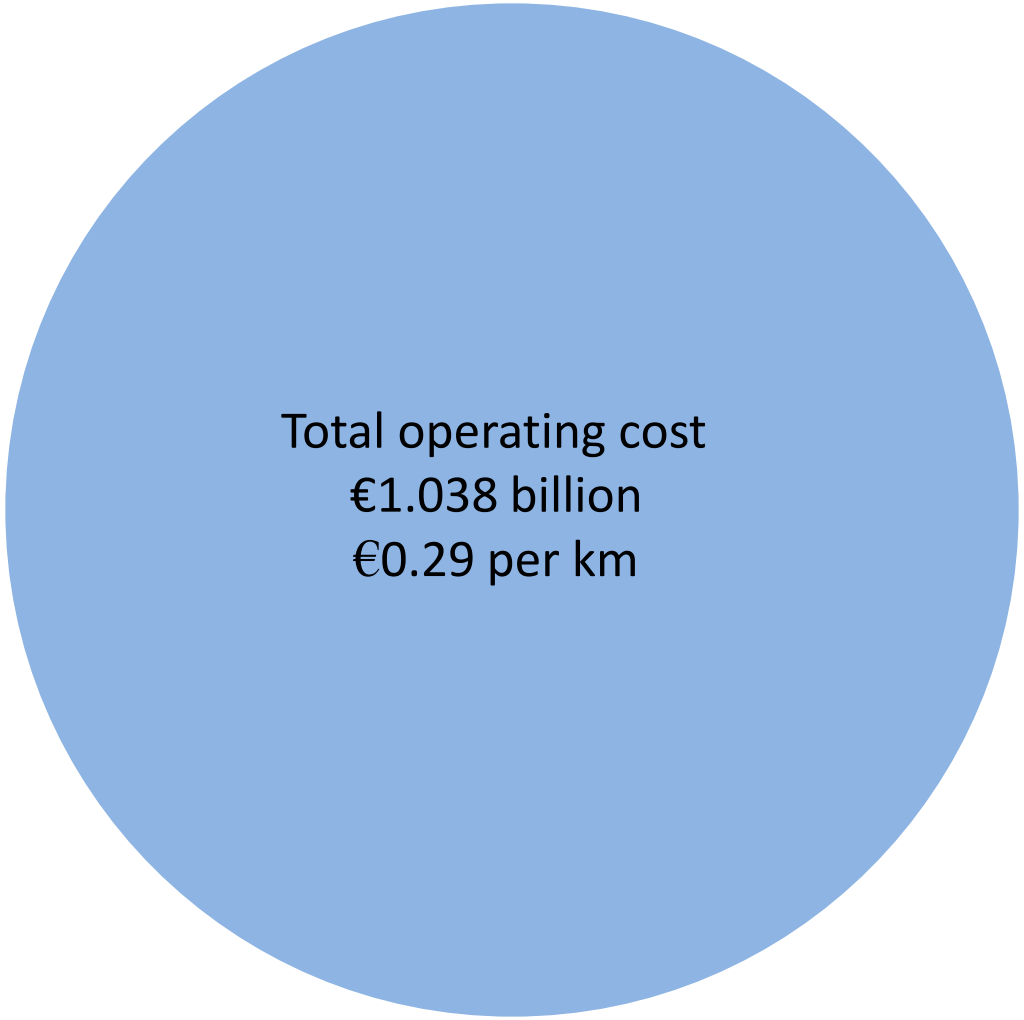
No short-term equilibrium due to trip-cancellations and sub-optimal route choice

Uncertain bias of long-term equilibrirum without approximation of location and mode changes

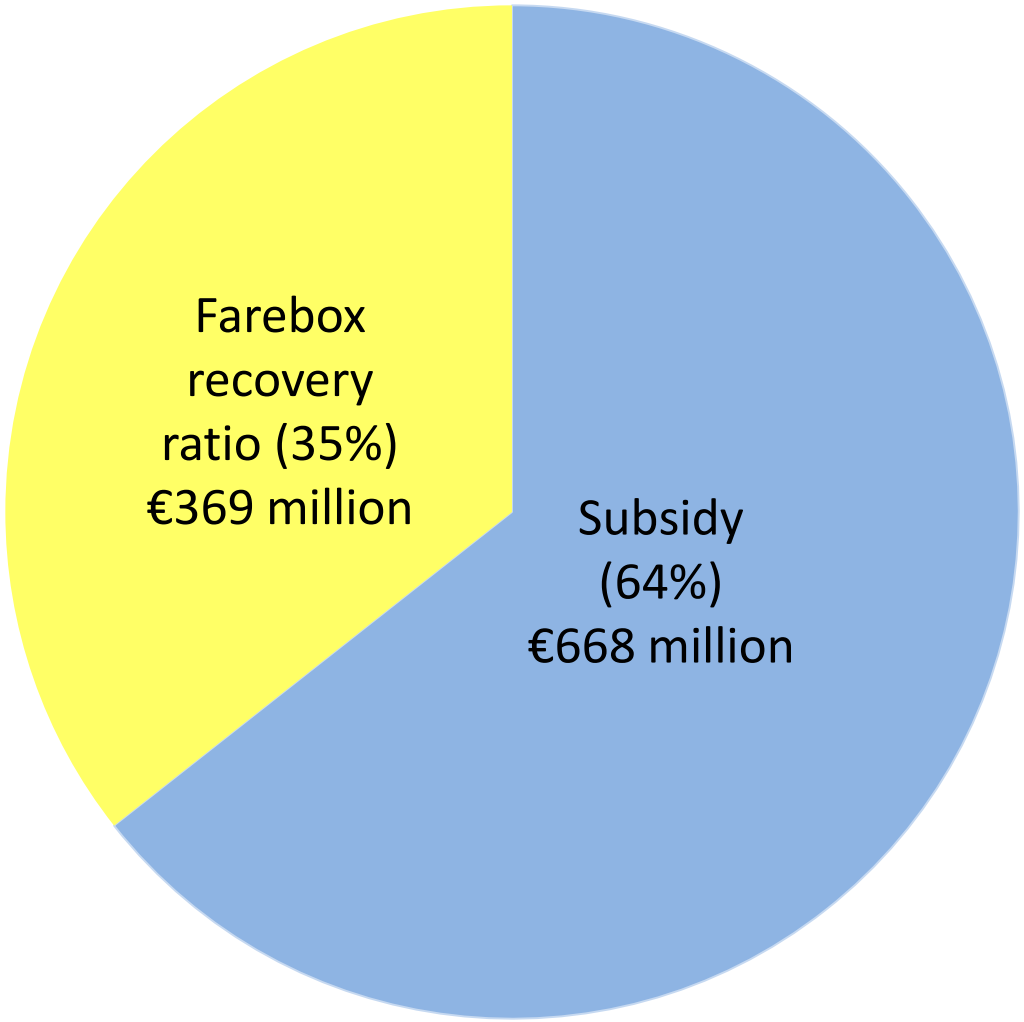
Marginal effect vs. average effect

External validity for cities with similar traffic situation and topography

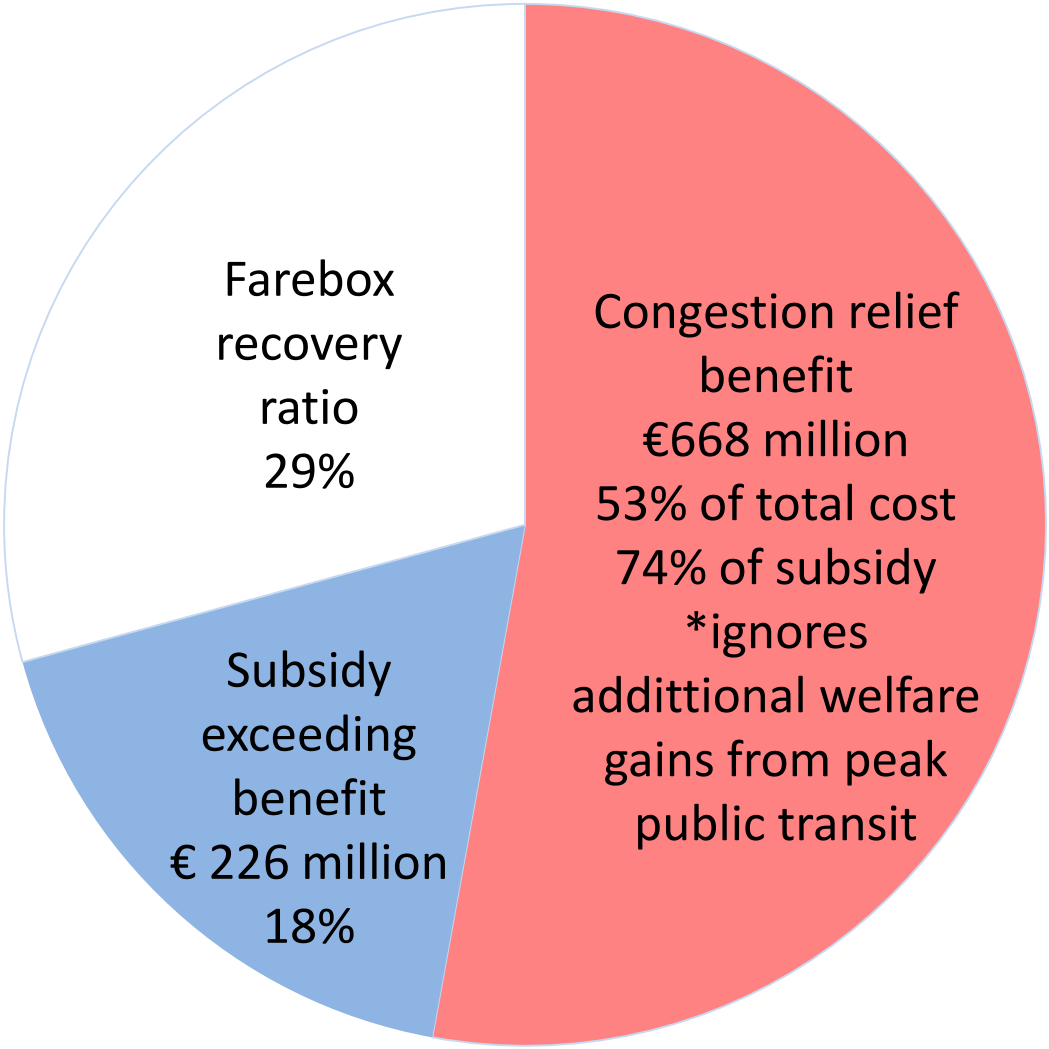
Cost vs. Benefit



Cost vs. Benefit



Cost vs. Benefit



Conclusion

Public transit strikes incresae car travel and travel times substantially. Public transit provision offers a congestion relief benefit.

The congestion relief benefit is larger for heavily congested roads and cities.

The benefit for off-peak transit justifies three-quarters of the subsidy.

Public transit is one of the policy measures to deal with transport market inefficiencies. Other measures are bicycle promoting policies and parking regulation.

Thank you for your attention!