

# The Economics of Efficient Road Pricing

XV. European Transport Congress  
X. Budapest International Road Congress  
9th June 2017

DANIEL HÖRCHER

Imperial College  
London



## CONTENTS

1. The role(s) of pricing in transport
2. The economics of road congestion
3. Policy evaluation
4. Conclusions

## THE ROLE OF PRICING

What's the purpose of pricing at all?



### Financial

Balance of monetary costs and revenues



### Economic

Balance of monetary and non-monetary costs and benefits



### Political

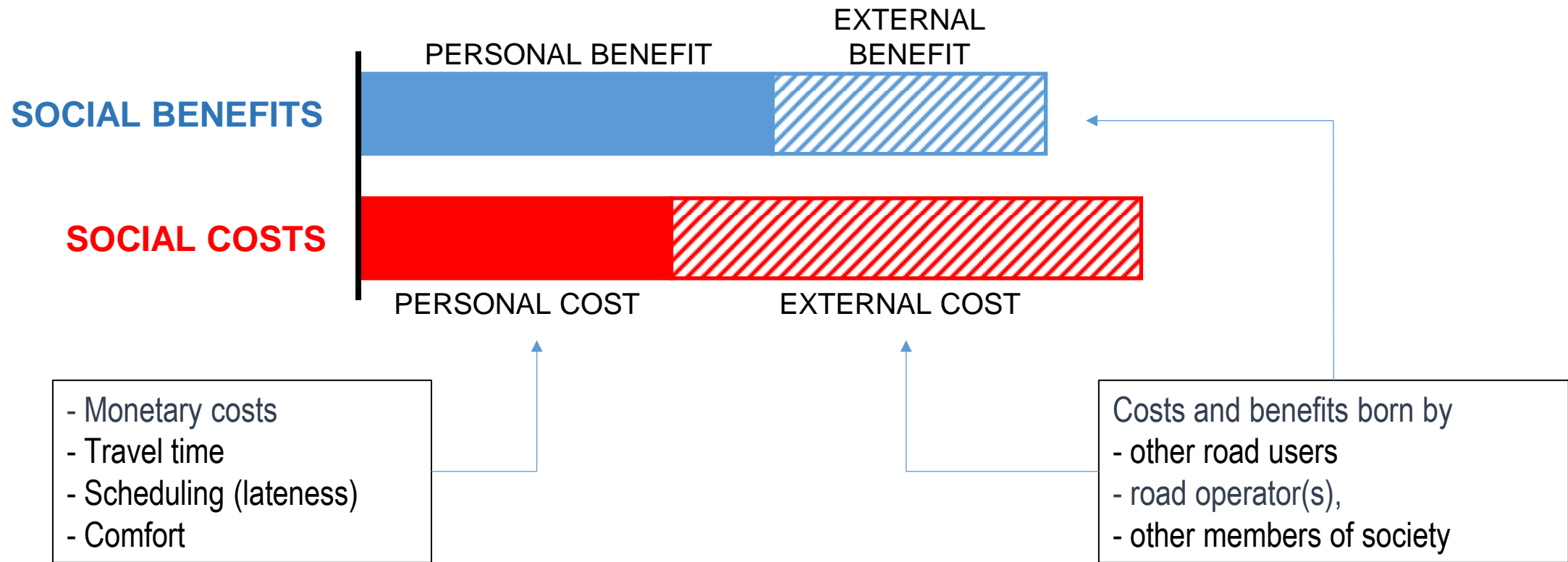
Balance of voter preferences

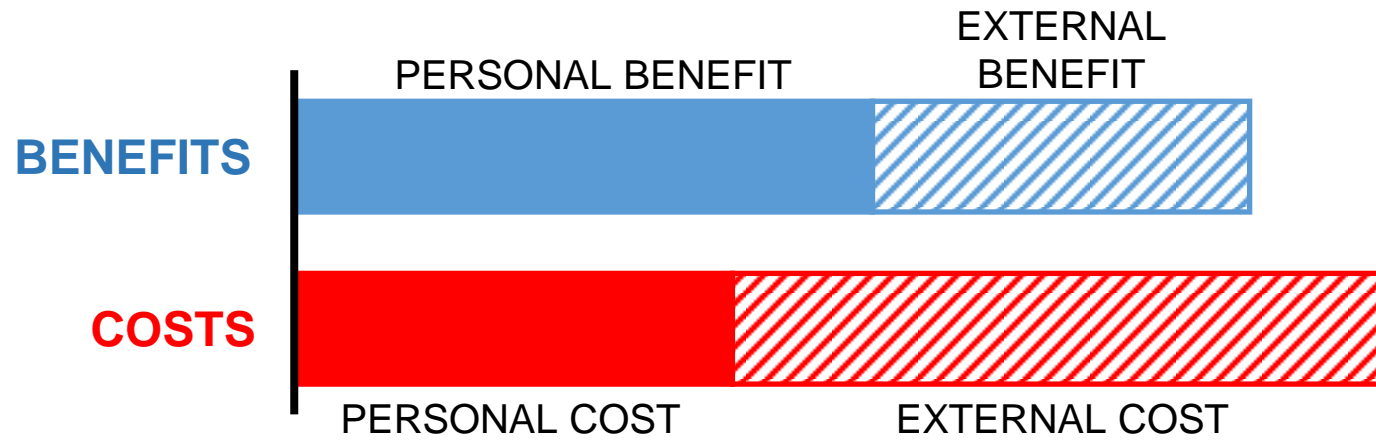


### Ethical

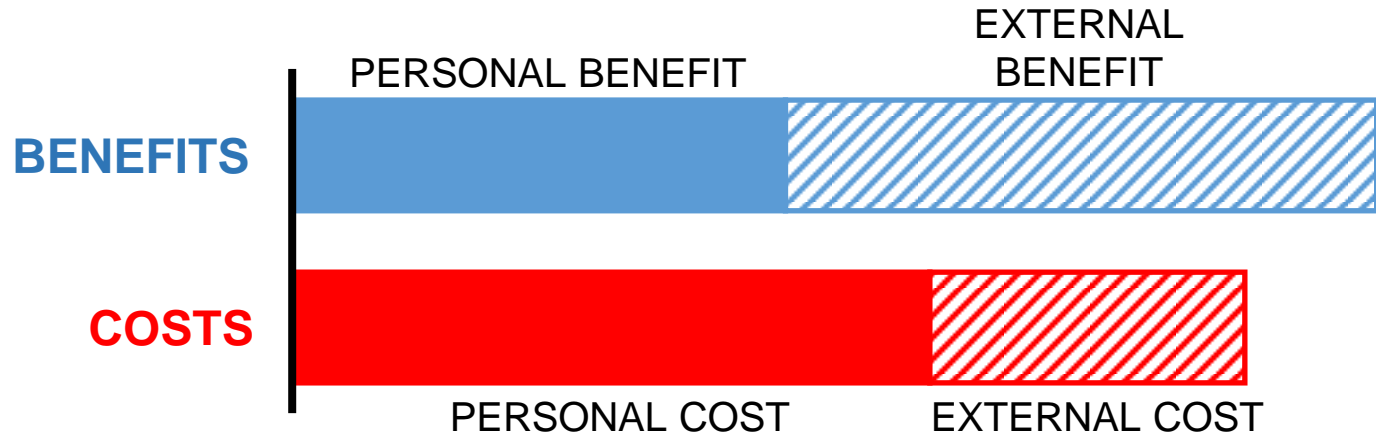
Balance of moral considerations

EFFICIENCY OF THE  
ELEMENTARY TRIP



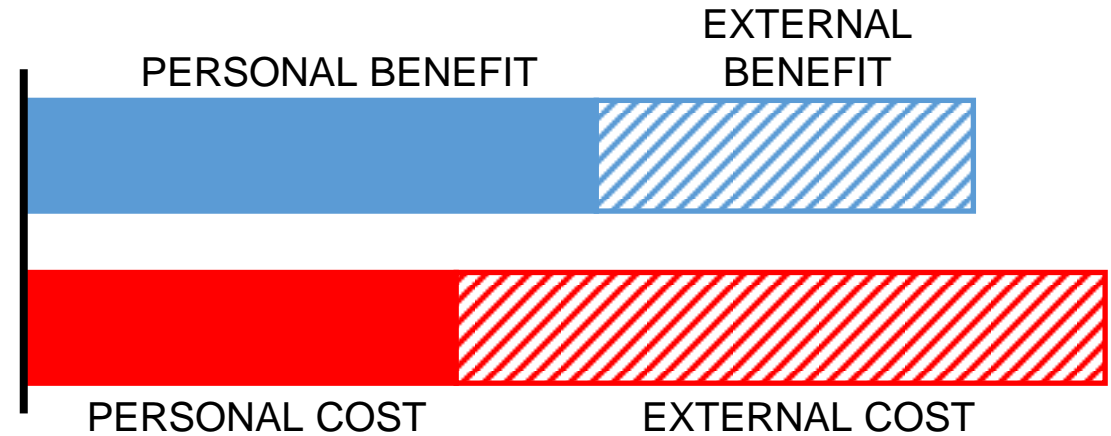


### WASTEFUL TRIP GETTING REALISED

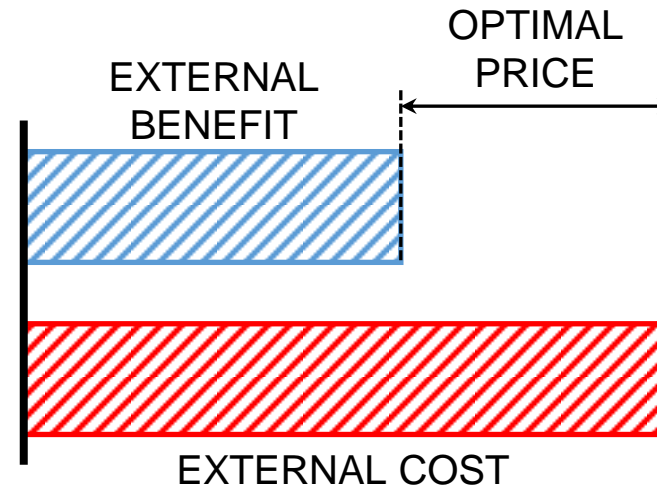


### USEFUL TRIP WHICH IS NOT REALISED

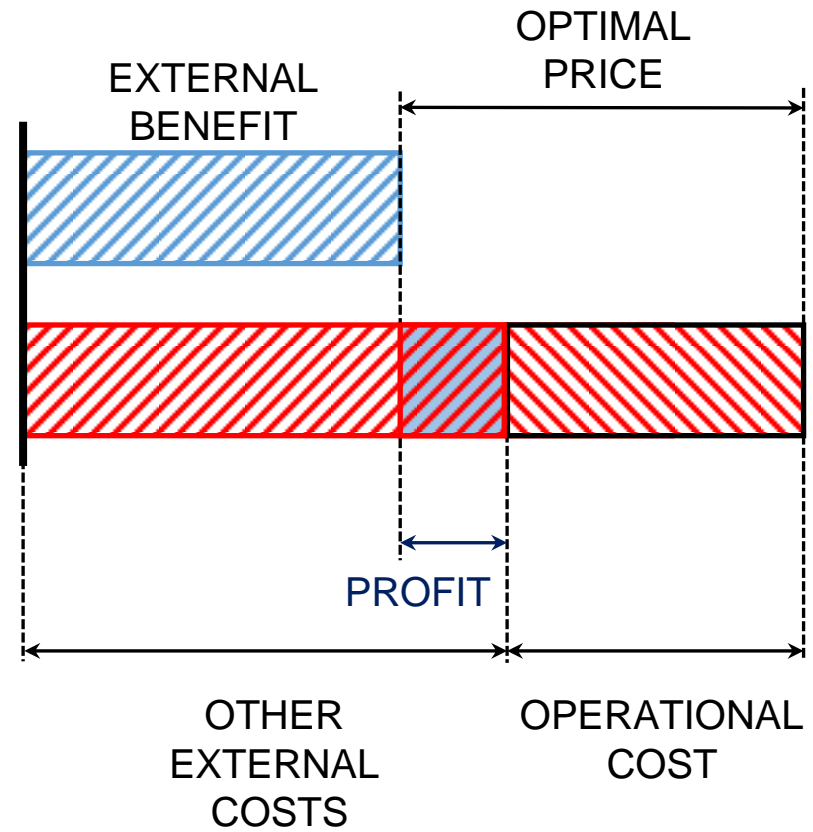
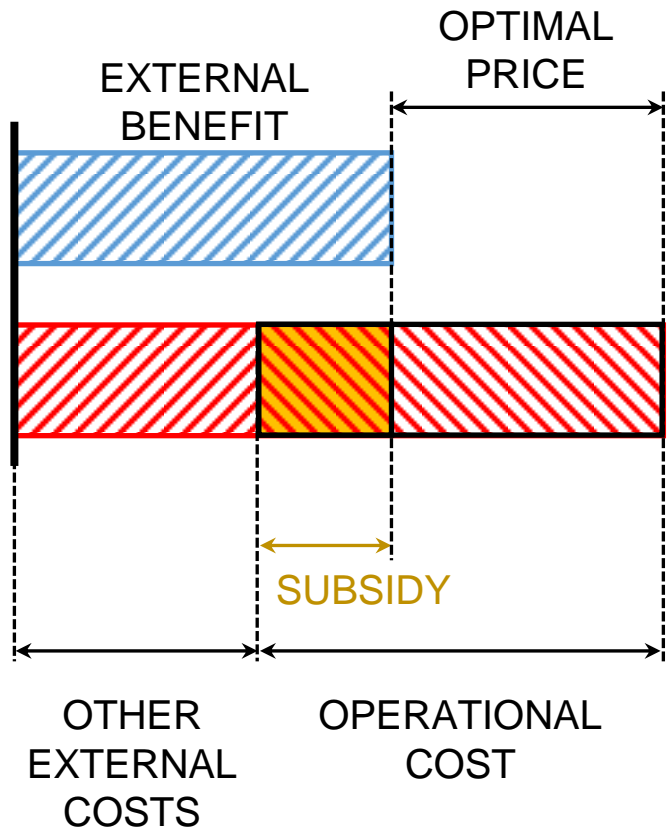
OPTIMAL PRICING FOR  
THE ELEMENTARY TRIP



Note: to ensure economic efficiency with pricing, **personal costs and benefits do not need to be known.**



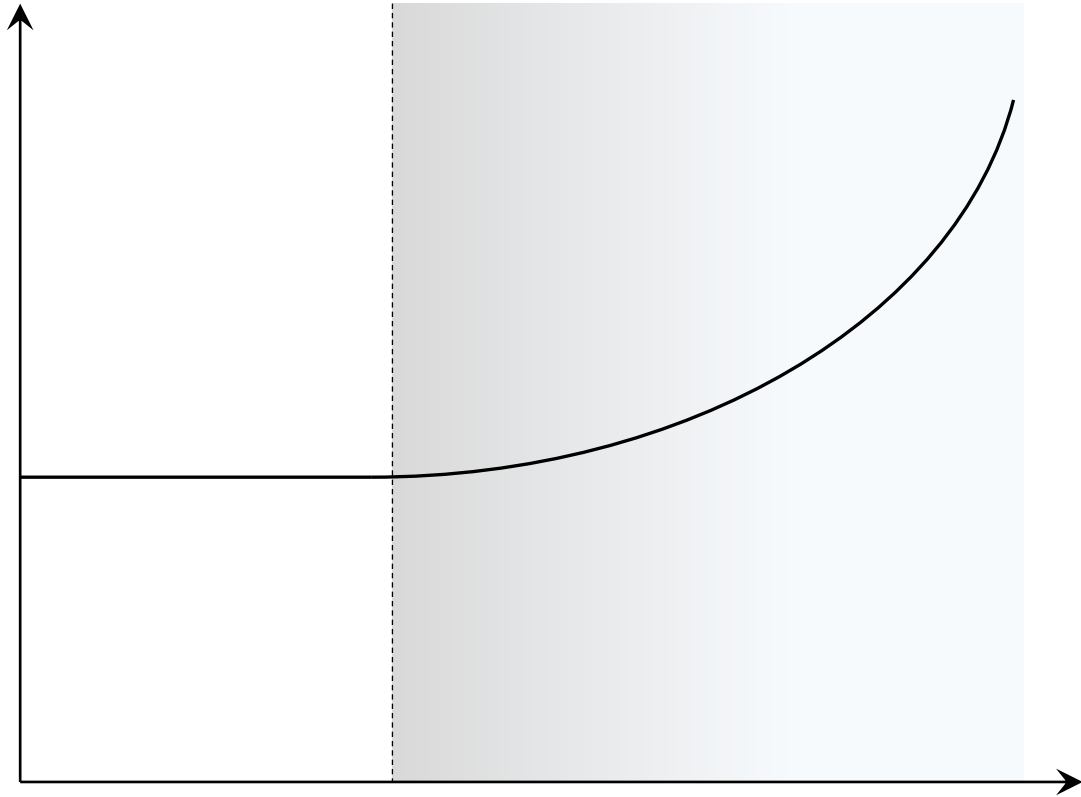
# SUBSIDISATION AND PROFITABILITY





## ROAD CONGESTION

Average  
travel time



Free-flow  
speed

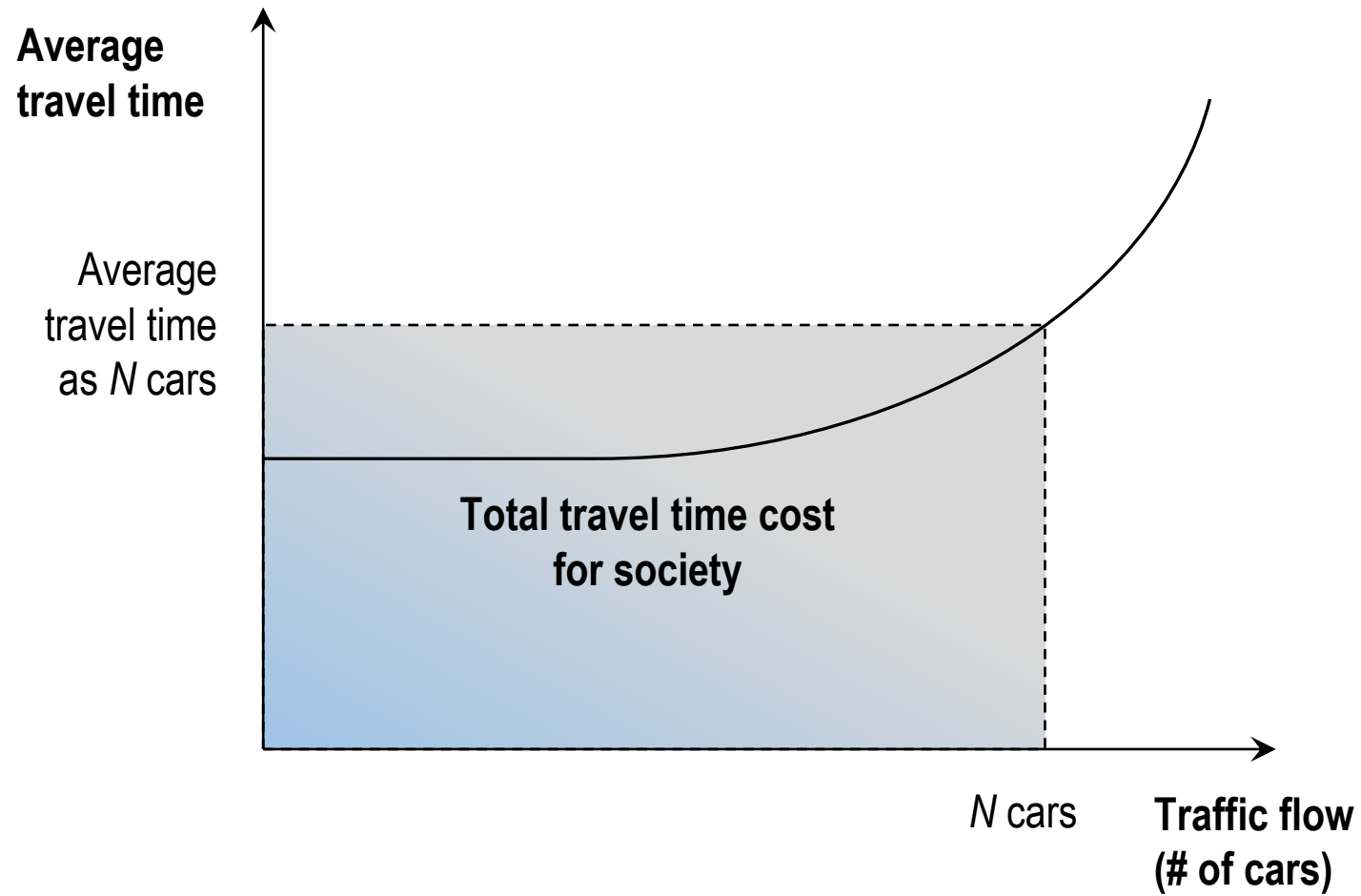
Congestion

Traffic flow  
(# of cars)





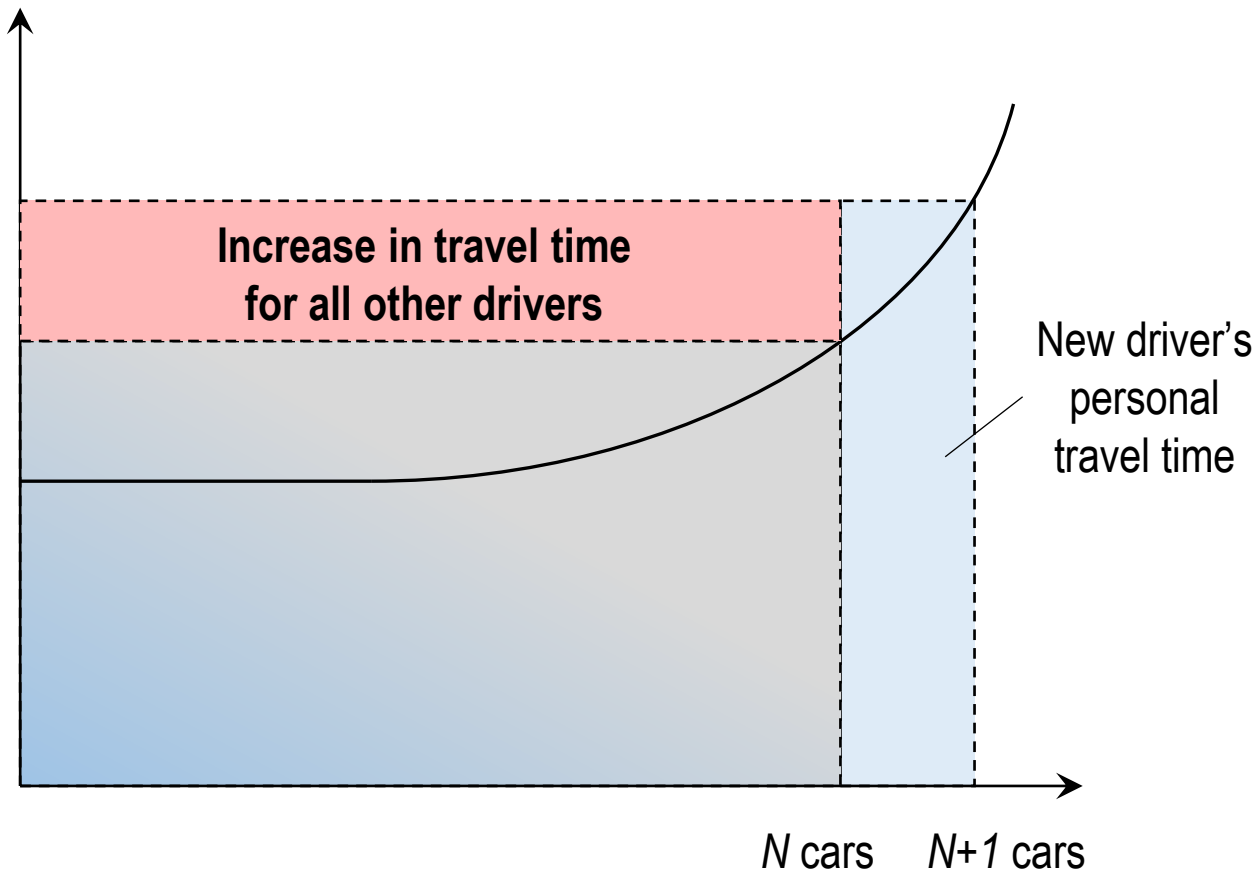
## ROAD CONGESTION





## ROAD CONGESTION

Average  
travel time



## NUMERICAL EXAMPLE

How severe is the congestion externality?

### Assume

- 3-lane highway
- 60 min free-flow travel time
- 4000 HUF/hour value of time
- US BPR congestion function

### 3000 vehicles/hour

- Travel time (loss) 69 min (+9 min)
- Personal cost **4600 HUF**
- Congestion externality **2400 HUF (39 min)**

### 4000 vehicles/hour

- Travel time (loss) 89 min (+29 min)
- Personal cost **5900 HUF**
- Congestion externality **7560 HUF (113 min)**

**EU EXTERNALITY  
ESTIMATES**

	URBAN		RURAL	
	min	max	min	max
<b>Congestion</b>	<b>0</b>	<b>100-200</b>	<b>0</b>	<b>30-130</b>
Accident	0.2	0.3	0.1	0.2
Local pollution	0.7	3.7	0.1	0.8
Noise and vibration	8.8	38.9	0.1	0.4
Climate change	2.4	3.9	1.5	2
Up- and downstream processes	1.2	1.9	0.8	1
Infrastructure depreciation	0.3	0.5	0.3	0.8
<b>Total excl. congestion</b>				
<b>€/100 km</b>	<b>13.6</b>	<b>49.2</b>	<b>2.9</b>	<b>5.2</b>
HUF/100 km	4,080	14,760	870	1560

**Units: €/100 km**

Source: *European Commission*  
Update of the Handbook on  
External Costs of Transport (2014)

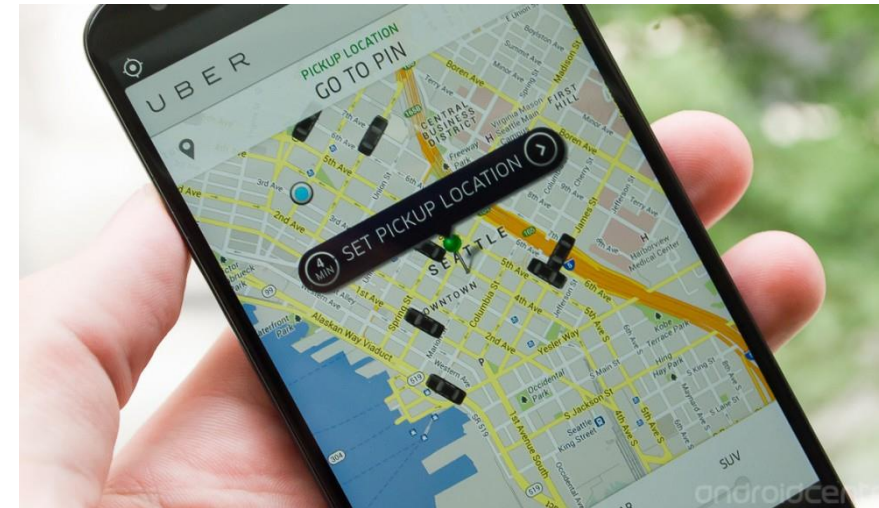
## IMPLEMENTATION



## CONCLUSIONS SO FAR

**We need road user charges differentiated by**

- Time (peak and off-peak)
- Space (urban and rural areas)
- Direction (only in congestion)





## FUTURE CHALLENGES THE AUTONOMOUS VEHICLE

- Driving becomes more convenient
- Travel time can be used more productively

That is, the **value of in-vehicle travel time decreases**, while, as a consequence, **demand for driving increases**

**CONGESTION  
EXTERNALITY  
BECOMES  
LESS HARMFUL**

**MORE  
CONGESTION  
ON THE ROADS**

## FUTURE CHALLENGES ELECTRIC VEHICLES

Lower emissions, but the **congestion externality remains persistent**

Lower usage-dependent operating costs:  
**electric vehicle owners drive more**

**LESS  
ENVIRONMENTAL  
BURDEN**

**MORE  
CONGESTION  
EXTERNALITY**

	Billion HUF/year	%
Fuel taxes	593	78
<i>... of which gasoline</i>	<i>214</i>	<i>28</i>
Highway vignettes	47	6
Ownership taxes	46	6
Company car taxes	27	3
Accident taxes	25	3
Registration taxes	21	2
Total	759	100

## SUMMARY

Ultimately, is this a feasible policy?



### Financial

Balance of monetary costs and revenues



### Economic

Balance of monetary and non-monetary costs and benefits



### Political

Balance of voter preferences



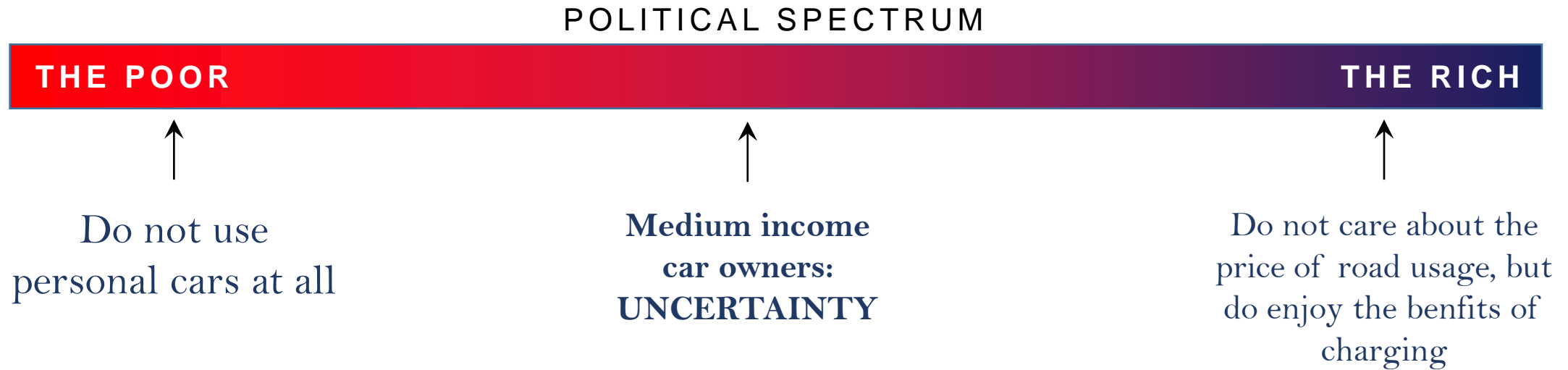
### Ethical

Balance of moral considerations



## POLITICAL ECONOMY

Who wins and who loses with congestion charging?



Major determinants of political acceptability

1. What happens with **road pricing revenues**?
2. **Prior expectations** – trial period (e.g. Stockholm)
3. Simultaneous adjustment of **other car taxes**

## INTERNATIONAL OUTLOOK

# The global approach towards congestion charging

### SOME EARLY EXAMPLES



**SINGAPORE**



**LONDON**



**STOCKHOLM**

### EU POLICY IN GENERAL

- Disproportionate interpretation of the *user pays / polluter pays* principle
- Interventionist second-best policies
  1. Excessive subsidies for alternative modes
  2. Prohibiting/limiting car use in sensitive areas
  3. Moral pressure against car use
- The case of Budapest: congestion charging as a *punishment* for funding

Limited success in the last two decades

## CONCLUSION

1. Road pricing should function as an **autonomous demand management tool**, ensuring efficiency
2. Congestion-related externalities are by far the **most damaging effects** of car use
3. General **misunderstanding** of the economics of road pricing in policy making
4. Promising **new payment technologies**
5. The advent of **electric & autonomous vehicles** could make congestion charging indispensable