

# External effects in transport

# Externe Effekte im Verkehr

What is that,  
and why should it be of essential interest to you?  
Was ist das,  
und warum sollte Sie das wirklich interessieren?

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# Is transport too cheap or too expensive?

- **transport users (buyers) decide**
- **depending on their costs and their benefits !?**

But what if part of the costs or benefits or paid by others?

Assume I want to have a Porsche, personal benefit: 1000 €  
But the government gives me 1 570 000 €: Yes or No?

Individuals & society: Two perspectives.



## Individual perspective:

There is scientific and popular consensus on that:

### **The benefits of transport are very large:**

- Access to spare parts, products, workers, ...
- Access to shops, jobs, doctors, restaurants, relatives ...

1) Each transport user knows his/her benefits

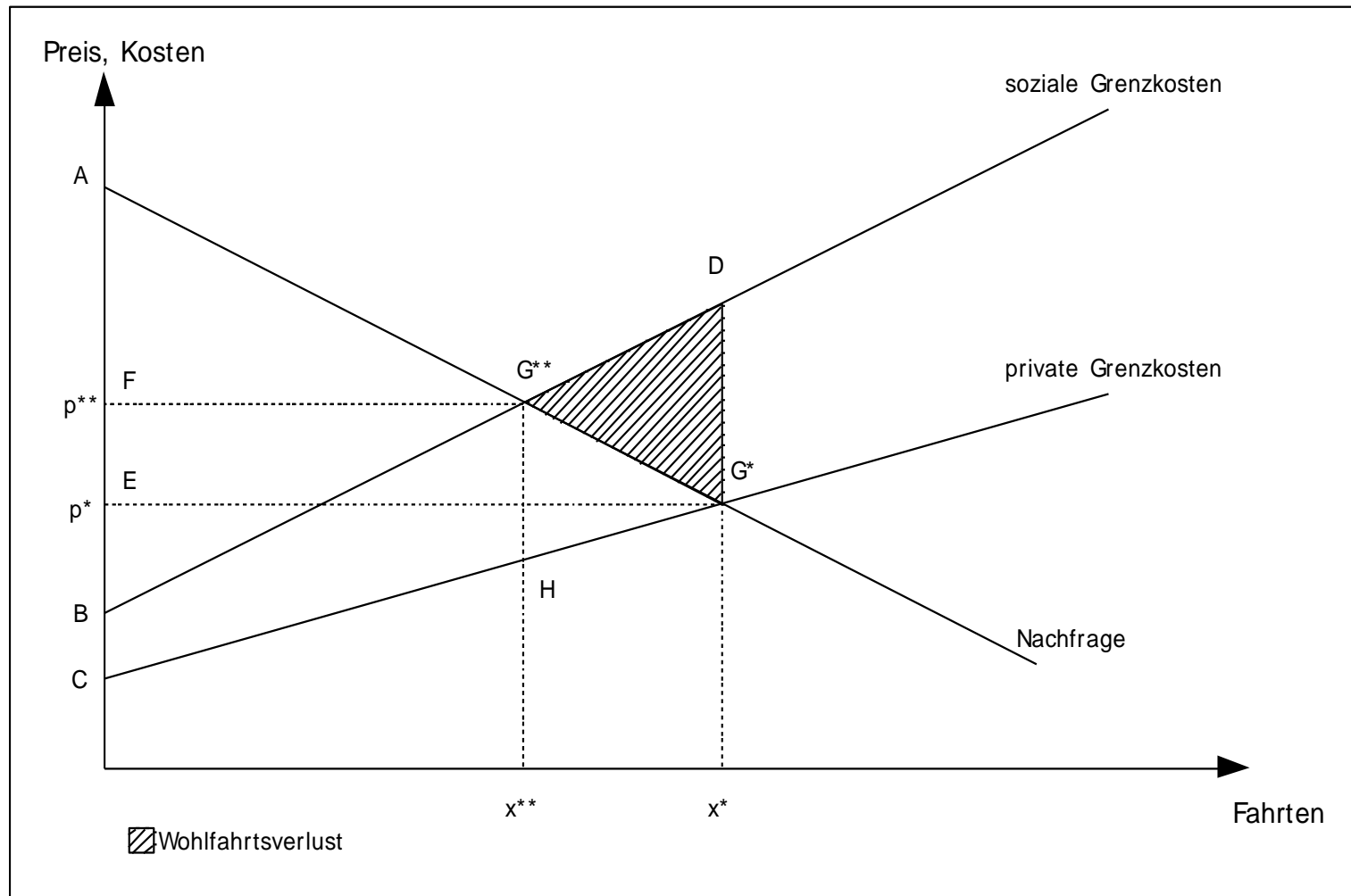
2) Each transport user knows his/her costs: ticket prices, trip times, fuel prices, highway charges, parking fees, congestion charges, vehicle taxes, VAT, ....

Users do get a service in exchange

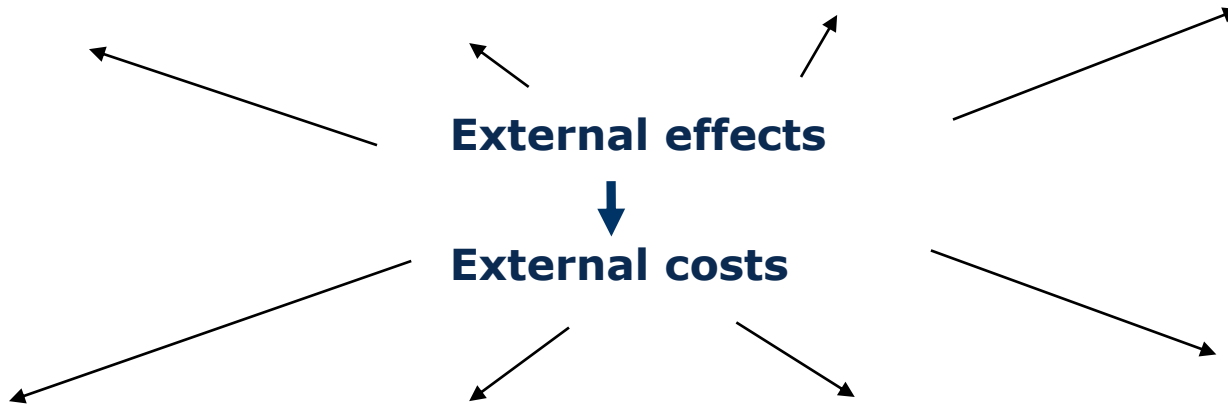
Efficient allocations: Trips are made if  $\text{benefits} > \text{costs}$ .



# External costs and inefficiencies



# External (environmental) costs



# Who pays? Distributional effects

## Costs externalised onto ...

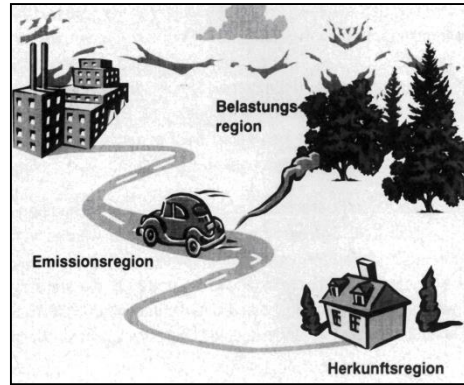
Other people

Other regions

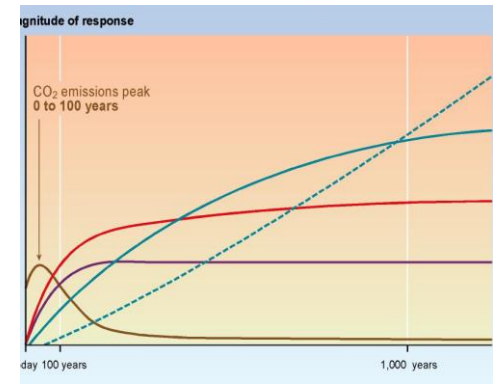
Other times



Interpersonal



Interregional



Intertemporal



## Perspective of society:

In individual decisions, **external effects** are not included.

External costs are significant:

- part of infrastructure costs are paid by society
- noise costs are carried by residents/society
- some accident costs are covered by society
- pollution costs are carried by residents/society
- costs of climate change are not paid by today's users
- up- and downstream effects are not covered by users
- other costs (soil, water, habitat losses ...) exist
- ...



## Perspective of society:

Significant parts of total costs are externalized  
- onto other people, regions, generations

There are trips where total costs for society exceed benefits:  
Inefficient allocations are generated

As long as external costs are not included, we generate  
*inefficiencies, wasted resources, misleading price signals*

There is scientific and growing popular consensus on that:  
**The prices have to give the right signals**

Arthur Cecil Pigou: *Wealth and Welfare (1912), Economics of Welfare (1920)*





## EU White Paper 2011 (p. 29):

### **3.3. Getting prices right and avoiding distortions**

#### **Phase I (up to 2016)**

*Transport charges and taxes should be restructured. They should underpin transport's role in promoting European competitiveness, while the overall burden for the sector should reflect the total costs of transport in terms of infrastructure and external costs.*

...

*Proceed with the internalisation of external costs for all modes of transport applying common principles while taking into account the specificity of each mode.*

#### **Phase II (2016 to 2020)**

*Building on Phase I, proceed to the full and mandatory internalisation of external costs ....*



# EU Handbook on estimation of external costs

M. Maibach, C. Schreyer, D. Sutter (INFRAS)

H.P. van Essen, B.H. Boon, R. Smokers, A. Schroten (CE Delft)

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## Handbook on estimation of external costs in the transport sector

Produced within the study  
Internalisation Measures and Policies  
for All external Cost of Transport  
(IMPACT)

**Wide scientific consensus on the order of magnitude!**

[http://ec.europa.eu/transport/themes/sustainable/doc/2008\\_costs\\_handbook.pdf](http://ec.europa.eu/transport/themes/sustainable/doc/2008_costs_handbook.pdf)



Several times updated (CE Delft, Sept. 2011):



Huib van Essen, Arno Schroten, Matthijs Otten (CE Delft)  
Daniel Sutter, Christoph Schreyer, Remo Zandonella,  
Markus Maibach (INFRAS Zürich)  
Claus Doll (Fraunhofer ISI Karlsruhe)

External Costs of Transport in Europe  
Update Study for 2008

results: 514 billion € (transport), 314 billion € (cars)

[http://www.cedelft.eu/publicatie/external\\_costs\\_of\\_transport\\_in\\_europe/1258](http://www.cedelft.eu/publicatie/external_costs_of_transport_in_europe/1258)



Thilo Becker, Julia Gerlach, Udo Becker

# External costs of cars in EU-27

- overview on existing studies and methods
- sums of uncovered externalized costs

Brussels, December 6<sup>th</sup>, 2012

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## Methodology, e. g. for cars

- Methodology based on „handbook“ and „update study“
- „Cars“ only, 2008 prices
- Scope: EU-27: CE Delft –(NO/CH) + (Malta+Cyprus)
- No new data basis, only using available figures

### Included external effects:

- Accidents
- Air pollution
- Noise
- Climate Change (high/low estimate)
- Upstream and downstream effects (high/low estimates)
- Other effects (land use, separational effects, etc.)



## First best: Damage Costs

Accidents: traffic data, accident rates per country (CE Delft), value of statistical life (VSL) = 1,67 M€, country adjusted

Air pollution: PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>x</sub>, SO<sub>2</sub>, VOC, O<sub>3</sub> : tons emitted from cars, times damage estimates [€/t] (CE Delft)

Noise: Number people affected (acc. to 2002/49/EC) times annoyance and health costs (CE Delft):

32% of total costs for cars, 68% for all other vehicles

Upstream and downstream effects: Including energy production, vehicle production, infrastructure: 14,3 billion € for pollution plus ca. 16,7% of climate costs added

Other effects (land use, separation, etc.): +3,4%



# Climate costs

A) Damage costs for climate change are not really feasible

B) Avoidance costs: Depending on assumptions:

- Target? Time to reach the target?
- total of emissions up to base year?
- only technical improvements? Self supporting?
- changes in land use and individual behaviour?
- measures in all sectors/only transport specific?

Meta-Study by Kuik, Brander, Tol: Energy policy 37 (2009):

- 450 ppm CO<sub>2</sub>-eq
- Marginal Avoidance Costs for 2025: 69 €<sub>2005</sub> (low)  
241 €<sub>2005</sub> (high)
- our discount rate 2005 to 2008: 1,5% p.a.
- values used in this study: 72 €<sub>2005</sub> (low)  
252 €<sub>2005</sub> (high)



# Total costs of cars by country and category

	Accidents	Air Pollution	Noise	Climate (low)	Climate (high)	Up + Down (high)	Up + Down (low)	Other	Total
	Mio €/a	Mio €/a	Mio €/a	Mio €/a	Mio €/a	Mio €/a	Mio €/a	Mio €/a	Mio €/a
Austria	5,811	0,674	0,177	0,683	2,384	0,646	0,362	0,296	9,988
Belgium	4,790	0,851	0,174	0,928	3,240	0,877	0,492	0,290	10,222
Bulgaria	1,647	0,078	0,085	0,224	0,782	0,212	0,119	0,084	2,888
Cyprus	0,185	0,032	0,010	0,017	0,101	0,027	0,009	0,012	0,368
Czech Republic	2,416	0,394	0,174	0,446	1,559	0,422	0,237	0,146	5,112
Denmark	1,504	0,250	0,073	0,510	1,780	0,482	0,270	0,112	4,200
Estonia	0,191	0,019	0,004	0,052	0,183	0,049	0,028	0,012	0,459
Finland	1,331	0,347	0,037	0,704	2,460	0,666	0,373	0,126	4,968
France	16,756	5,402	1,093	5,832	20,369	5,516	3,091	1,362	50,498
Germany	38,366	6,351	0,621	9,121	31,856	8,628	4,834	2,442	88,263
Greece	2,234	0,111	0,239	0,388	1,354	0,367	0,206	0,127	4,432
Hungary	2,128	0,345	0,122	0,366	1,280	0,347	0,194	0,125	4,346
Ireland	1,221	0,142	0,148	0,300	1,050	0,284	0,159	0,045	2,890
Italy	19,977	2,578	0,685	3,634	12,694	3,438	1,926	1,153	40,525
Latvia	0,392	0,038	0,041	0,103	0,360	0,098	0,055	0,026	0,955
Lithuania	0,679	0,055	0,022	0,106	0,372	0,101	0,056	0,036	1,265
Luxembourg	0,447	0,098	0,006	0,070	0,245	0,066	0,037	0,026	0,889
Malta	0,069	0,012	0,004	0,006	0,038	0,010	0,003	0,005	0,137
Netherlands	4,620	1,038	0,220	1,613	5,634	1,526	0,855	0,357	13,396
Poland	7,180	0,775	0,259	1,405	4,908	1,329	0,745	0,419	14,870
Portugal	1,828	0,192	0,125	0,597	2,085	0,565	0,316	0,131	4,925
Romania	2,766	0,171	0,189	0,389	1,360	0,368	0,206	0,146	5,000
Slovakia	0,857	0,174	0,092	0,180	0,628	0,170	0,095	0,056	1,978
Slovenia	0,943	0,106	0,017	0,146	0,508	0,138	0,077	0,051	1,764
Spain	10,695	2,035	0,987	3,868	13,509	3,659	2,050	0,844	31,728
Sweden	2,610	0,320	0,080	1,085	3,789	1,026	0,575	0,208	8,032
United Kingdom	22,396	3,174	2,222	6,712	23,443	6,349	3,558	1,603	59,188
<b>Total EU-27</b>	<b>153,003</b>	<b>25,762</b>	<b>7,905</b>	<b>39,486</b>	<b>137,969</b>	<b>37,366</b>	<b>20,930</b>	<b>10,240</b>	<b>373,284</b>



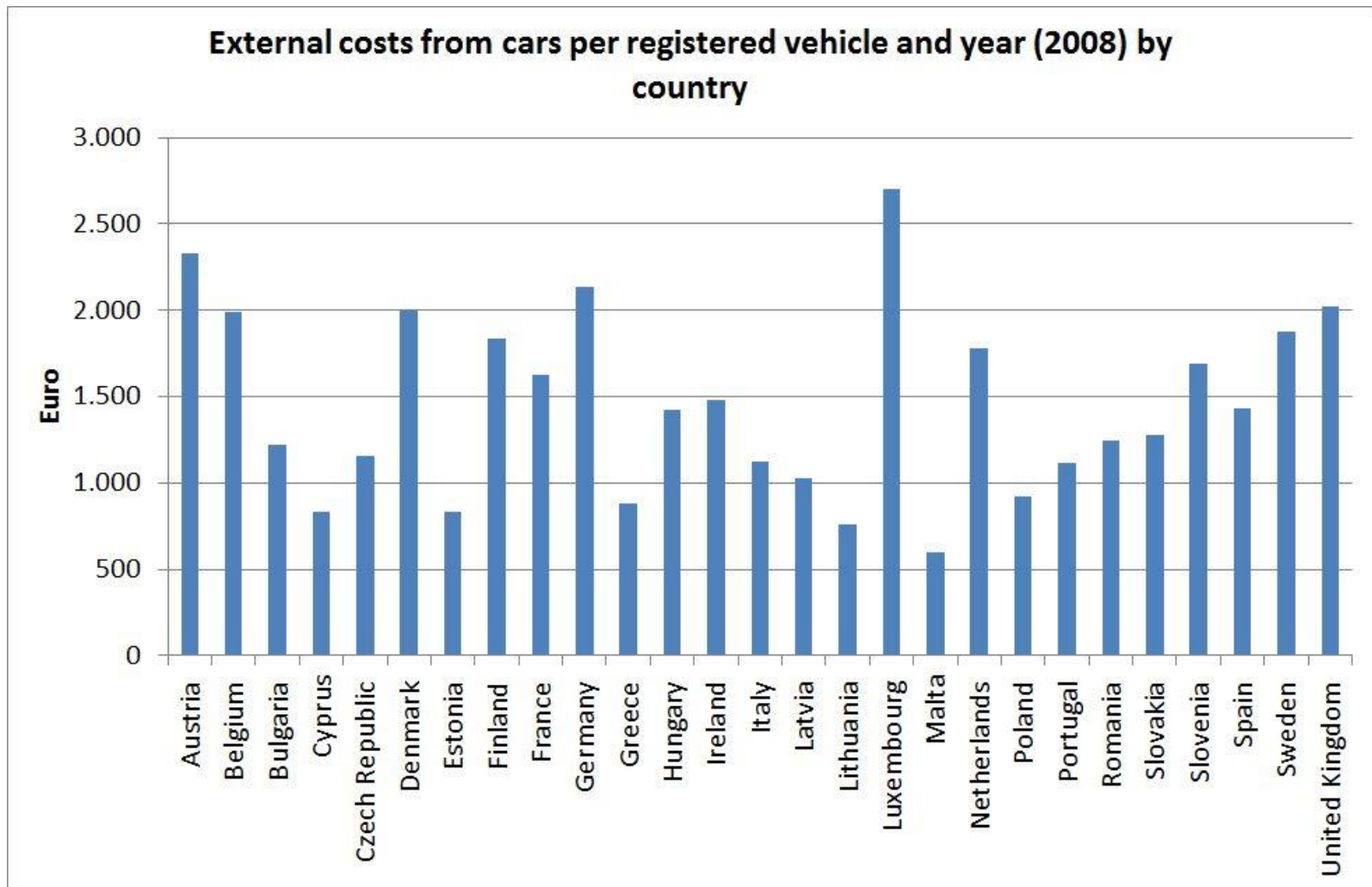


## Results for EU-27 (high estimates)

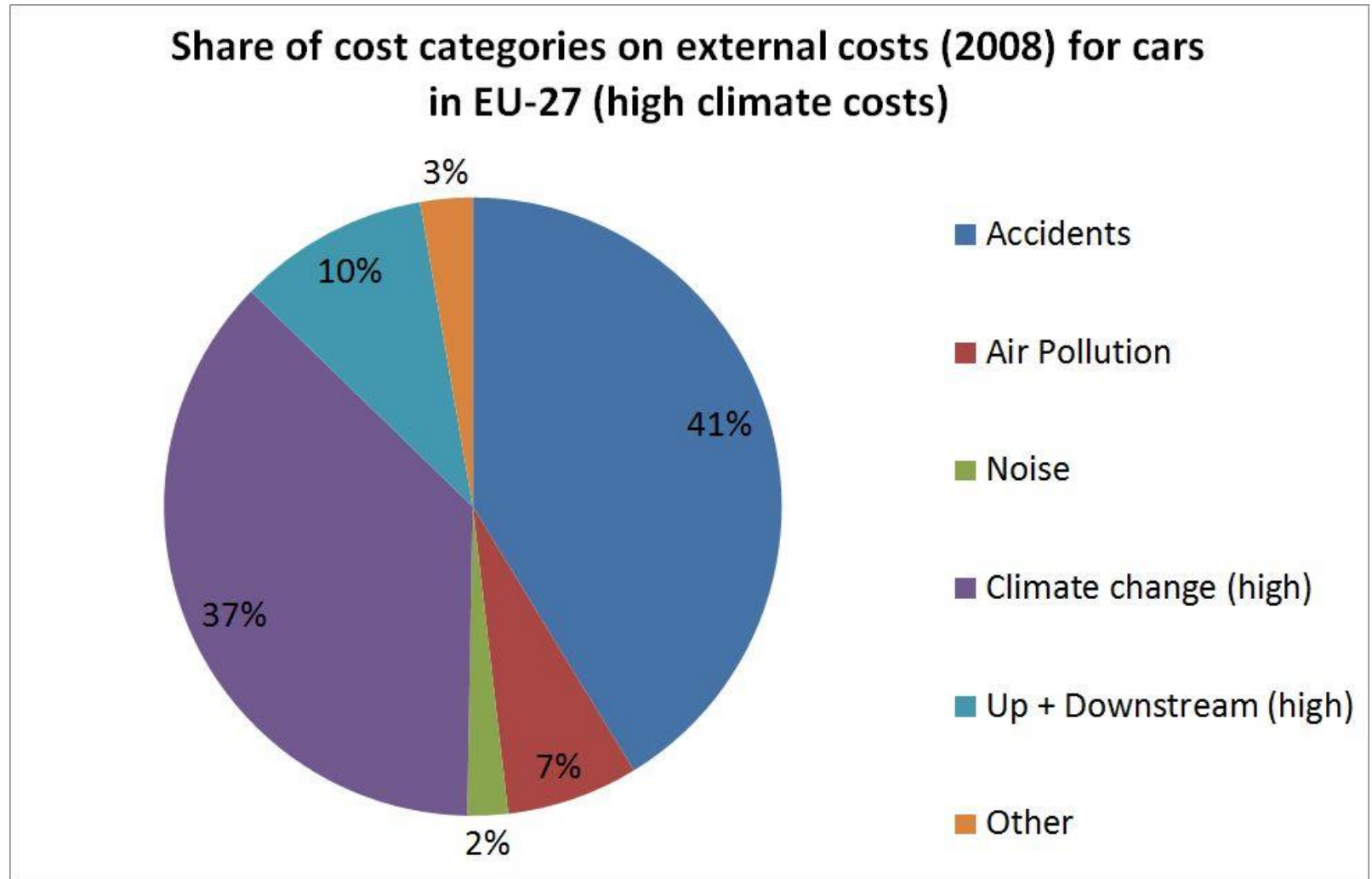
- 1) Uncovered external costs of cars per year in EU-27: 350 to 400 billion € (i.e. 373284000000 €)
- 2) Ca. 750 € per person (EU 27)
- 3) 234 million cars in EU-27 (2008): Uncovered external costs per [car\*year] ca. 1600 €/year (high: 1596.24)
- 4) In Germany: Between 1900 € and 2400 € per year
- 5) Do not compare figures among countries: different purchasing parities, transit vehicles, urban/regional
- 6) Costs per 100 [veh\*km] from 9.40€ to 19.80€
- 7) Thus, a charge of 9-20 cts/km results.
- 8) Internalisation is extremely powerful: Everybody wants to (and should) do everything to avoid paying the costs



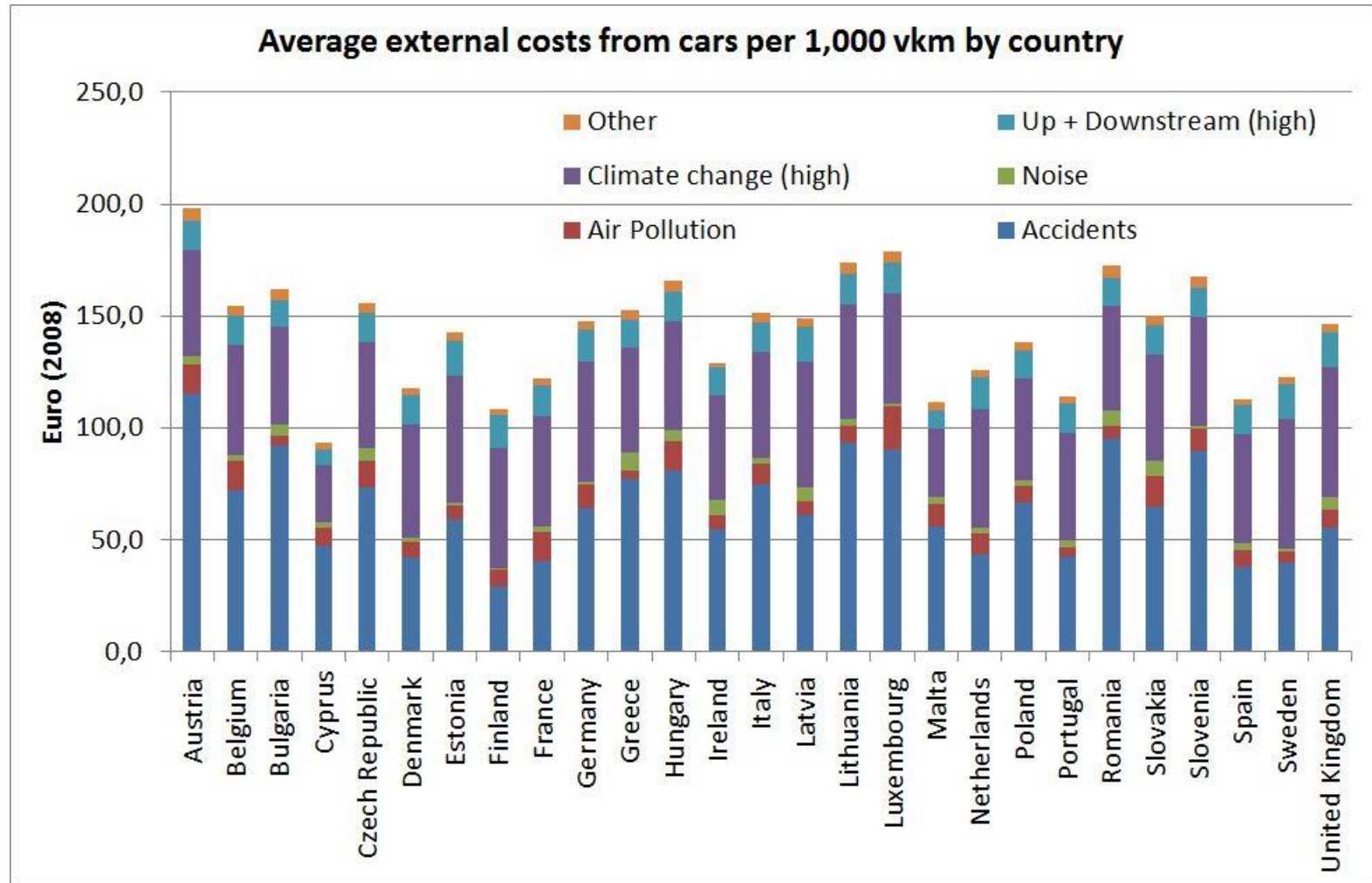
# Results - External costs per vehicle



# Results - Share of cost categories (high)



# Results - average external costs per 1,000 vkm



## Concerning these values:

External costs will never be known “by the cent”: Bandwidth!

Cautious estimates: are the higher ones (accounting!)

All cost rates are open for discussion: But they are not Zero!  
Somebody, somewhere, somewhen will pay these costs.

External costs can not be balanced against paid taxes: Taxes go into the general budget („Nonaffektationsprinzip“).

External costs must be balanced against special charges,  
fees, earmarked taxes (hypothecated, ring fenced)

Create a process of constant monitoring and updating



# Internalising external effects

- is **not** to „punish people“ or to generate revenues
- is especially important in times of economic crises
- is setting price signals instead of prohibitive laws
- is in the long term interest of the industry
- is in the interest of the population (damage is avoided)
- is stimulating innovation and competitiveness
- is supporting the poorer parts of population (DIKE)

The earlier we start with internalization,  
the more we support the economy,  
the more we reduce environmental damage,  
the more we help poorer parts of the society!



# Selected references

## Methods and data:

- A. C. Pigou (1912/1920): Scientific problem solved
- Numerous EU-Projekts (ExternE, Unite, GRACE, IMPACT ...)
- Numerous national studies (Schweiz, Deutschland, UK, FR ...)
- Unite-case studies 2002 for 1998, EU-Projekt
- Transport totals: Infras 2007 für 2005
- Sachsen, Verkehrsökologie, für 1999-2001 (Auftrag LfULG), 2012

## Reports/Regulations:

- Methodenkonvention zur Schätzung externer Umweltkosten (UBA 2007)
- Handbook on the Estimation of External Cost (EU 2008)
- CE Delft: External Costs of Transport in Europe: 514 billion € transport
- Ricardo-AEA: Update of the Handbook on External Costs of Transport, Final Report (DG MOVE), Januar 2014,  
[http://ec.europa.eu/transport/themes/sustainable/studies/sustainable\\_en.htm](http://ec.europa.eu/transport/themes/sustainable/studies/sustainable_en.htm)

