CEPS Task Force on "transport and climate change"
Second Meeting

The economics if transport pricing: what do we know? (25 years research and debate)

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Initial outline and structure provided by Arie Bleijenberg are gratefully acknowledged.

Brussels, 27 April 2011

Pricing

- Marginal social cost (MSC) ('efficient')
- Internalisation of external costs ('full costs')
- Revenue raising ('fair')

Focus in 'efficiency' but in reality all three matter; tensions between the objectives

Efficiency

Marginal social cost pricing

Marginal social cost (MSC) pricing is widely accepted as *economic* principle for transport pricing (→ efficiency)

- **Marginal: … each additional (marginal) vehicle should pay the costs that it imposes to society.**
- **Social: … all costs, including the so-called external costs, should be paid.**

Marginal social cost pricing

Costs:

- Management and maintenance of infrastructure
- Accidents *
- Air pollution *
- Noise pollution *
- New: climate change *
- New: security of energy supply (oil dependence – Typically in US) *

* Shadow price (based on robust economic valuation tools)

MSC pricing

Range of MSCs robust enough to inform transport policy making (especially taxing and charging).

Example (GER, POL, SWE)

Table: Summary of average and marginal cost for road *infrastructure* (in €/vehicle-km)

	AC	MC	Output variable
	€/vkm	€/vkm	Q
Renewal (R)			
Germany R	1.590	1.390	HGV
Poland R	0.210	0.120	All veh
Sweden R paved	0.036	0.032	HGV
Sweden R gravel	0.415	0.236	HGV
Sweden duration model	-	0.0013	HGV
Renewal (R) and Maintenance (M)			
Sweden R+M	0.059	0.040	HGV
Poland R+M	0.270	0.130	All veh
Maintenance (M)/Operation (O)			
Poland M	Na	na	All veh
Sweden O	0.024	(0.002)	All veh
Sweden O winter	0.015	(0.001)	All veh
Sweden O paved	0.003	(0.001)	All veh
Sweden O gravel	0.066	(0.010)	All veh

Source: Lindberg (2006), p.28 (GRACE project)

Example (GER)

Table: Road transport (urban excerpt): exemplary unit values per cost component reflecting marginal *external costs*, in €cent/vehicle-km for Germany (€2000)

Cost component		*Passenger car*	*Heavy duty vehicle (HDV)*
€ct/vkm		*Unit costs (bandwidths)*	*Unit costs (bandwidths)*
Noise	Urban, day	0.76 (0.76 - 1.85)	7.01 (7.01 - 17.01)
	Urban, night	1.39 (1.39 - 3.37)	12.8 (12.8 - 31)
Congestion	Urban, peak	30 (5 - 50)	75 (13 - 125)
	Urban, off-peak	0 (-)	0 (-)
Accidents	Urban	4.12 (0 - 6.47)	10.5 (0 - 13.9)
Air pollution	Urban, petrol	0.17 (0.17 - 0.24)	(-)
	Urban, diesel	1.53 (1.53 - 2.65)	10.6 (10.6 - 23.4)
Climate change	Urban, petrol	0.67 (0.19 - 1.2)	(-)
	Urban, diesel	0.52 (0.14 - 0.93)	2.6 (0.7 - 4.7)
Up- and downstream processes	Urban, petrol	0.97 (0.97 - 1.32)	(-)
	Urban, diesel	0.61 (0.61 - 1.05)	3.1 (3.1 - 6.9)
Soil & water pollution	Urban/Interurban	0.06 (0.06 - 0.06)	1.05 (1.05 - 1.05)
Total urban	**Day, peak**	**36.7 (7.1 - 61.1)**	**109.8 (35.5 - 192)**
	Day, off-peak	**6.7 (2.1 - 11.1)**	**34.8 (22.5 - 67)**
	Night, off-peak	**7.4 (2.8 - 12.7)**	**40.6 (28.2 - 80.9)**

Source: Maibach et al. (2008), p. 103 (IMPACT project)

Example (US)

Table: Central values for marginal external costs for road transport (US)

External cost	*€ cents/km* [1)]	*Studies reviewed*
Air pollution	*0.880*	*Small and Kazimi (1995), McCubbin and Delucchi (1999), US Federal Highway Administration (FHWA)(2000)*
Accidents	*1.150*	*US FHWA (1997), Miller et al (1998), Parry (2004)*
Climate Change	*0.150*	*Nordhaus and Boyer (2000), Tol (2005), Pearce (2005)*
Oil dependency	*0.230*	*Leiby et al (1997), NRC (2002), CEC (2003)*
Noise	*0.023*	*Delucchi and Shi-Lang (2005à, US FHWA (1997)*
Congestion	*1.350*	*Small and Parry (2005), US FHWA (1997, 2005)*

Source: Parry et al. 2007, cited in Safirova, Houde and Harrington (2007)
1) Calculated from US cents/mile: USD = 0.70 € cent

Climate change

- **Fuel charge based on carbon content (Energy Tax directive or ETS)**
- **At what level? Damage costs ?**
  - **Uncertainty**
  - **local differences (some countries may have positive impacts)**
  - **depending on adaptive capacity**

Equity

Infrastructure

- User of infrastructure should pay full (*not:* marginal) infrastructure costs including fixed (sunk) costs: i.e. *public funds* to be used for fixed infrastructure costs, *not* user charges (→ taxes, e.g. car registration taxes not depending on mileage of vehicle)

Exception:

- Regular congestion in rush hours: additional infrastructure is private benefit (of few) → user/congestion charges are justified) *[Building/maintaining: € 0.20 to 0.25 per km in densely populated areas]*
- Alternative 1: allow congestion *[congestions costs are internalised by users but not socially optimal]*
- Alternative 2: set user/congestion charge so high that congestion disappears *[socially not optimal]*

Combining the efficiency and equity principle: variabilization and differentiation

Variabilization:

- **shift from fixed to variable taxes, including fuel taxes, kilometre charge, parking charges and congestion pricing**
- **total tax receipts generally remain at the same level**

Ubbels, Rietveld and Peeters (2001) estimate the likely effects of introducing a **kilometre charge** in the Netherlands:

- 20% to 70% less pollution from cars and a significant decrease in congestion
- the average costs for consumers will not rise in most cases
- can be combined with removing the tax on car ownership and new cars
- reduction of: 30% in emissions and energy use, 15% in noise nuisance and 20% in the number of traffic accidents

ECMT (2000): To achieve efficiency and avoid international competitiveness problems

- **differentiate** charges on territorial basis through instruments such as kilometre charges and road tolls
- move partially away from national taxes and charges, such as vehicle excise duties, fuel taxes and the Eurovignette

Bringing it all together : Efficient taxes (efficiency, equity, revenue raising)

- Revenue (generation for public expenditure)
- Income distribution
- Correction of market failure
- Distortions of economic activities/efficiency

General rules:

1. **Use taxes that correct market failure (taxing externalities)**
2. **Use non-distorting taxes (e.g. sales and vehicle taxes); this may lead to the desired income distribution and net contribution of motorists**
3. **Use distorting taxes (VAT, income or profit taxes) in a balanced way to minimise distortions**

Bringing it all together : Efficient taxes (efficiency, equity, revenue raising)

Examples of what lies ahead:

European Conference of Ministers of Transport - ECMT (2000): for efficient taxation that fully reflects MSC pricing, the mean rates of freight transport charges per kilometre at the time in nine European countries would have had to double (see Table).

CE Delft (2008): on the whole, current fixed and variable taxes and charges may be covering as little as 70% of the total social costs (infrastructure and external) when congestion is included (see Table).

Table: Net taxes in t-km in relation to full coverage of capital infrastructure costs and in relation to efficient taxation taking into account external costs

(€ cents per t-km)

	Current net taxes	Hypothetical level of net taxes that would raise revenues equal to capital infrastructure costs	Hypothetical level of net taxes that, in a context of optimum pricing, would raise revenues equal to full social cost coverage
Basis of calculation	Chargeable expenditure	130% of chargeable expenditure	150% of capital infrastructure costs
Mean for Austria, Belgium, Czech Republic, France, Germany, Netherlands, Spain, Switzerland and United Kingdom	0.39	0.51	0.76

Source: ECMT 2000, p. 95

Table: Comparison of revenues from existing and marginal costs based taxes and charges for road transport, excluding congestion costs (EU-19 for 2005 in billion €-2000)

[1] EU19: AT, BE, CZ, DE, DK, ES, FI, FR, GR, HU, IE, IT, LU, NL, PL, PT, SE, SI and UK

Billion Euro	Cars	LDV	HGV	Bus	Motorcycles	All road vehicles
Marginal kilometre-related costs	**91**	**14**	**50**	**20**	**9**	**184**
Variable infrastructure	6	0.5	25	16	0.1	47
Air pollution	18	5	16	2	0.4	41
Noise	8	3	3	0.4	0.3	14
Accidents	61	6	6	1.2	8	81
Congestion (rough estimate)						(100)
Kilometre charges/tolls	**5**	**3**	**15**	**0.1**	**1**	**24**
Cost coverage. excl. congestion	**5%**	**22%**	**31%**	**0%**	**6%**	**13%**
Marginal fuel-related costs	**24**	**3**	**8**	**0.9**	**0.3**	**42**
Climate change	10	1.2	4	0.4	0.1	22
Well to tank emissions	14	1.4	4	0.5	0.2	20
Security of supply						Pm
Fuel taxes	176	20	32	3	2	**250**
Cost coverage	**726%**	**752%**	**418%**	**384%**	**517%**	**599%**
Fixed costs	**132**	**13**	**21**	**3**	**2**	**172**
Fixed infrastructure costs	119	12	15	2	2	151
Other external costs	13.1	1.4	6	0.7	0.4	22
Fixed taxes/charges	**58**	**3**	**5**	**1.4**	**6**	**73**
Cost coverage	**44%**	**25%**	**24%**	**45%**	**242%**	**42%**
Total costs. excl. congestion	**248**	**30**	**79**	**24**	**11**	**398**
Total costs. incl. congestion (rough estimate)						**498**
Total taxes and charges	**238**	**27**	**52**	**5**	**8**	**348**
Cost coverage excl. congestion	**96%**	**89%**	**66%**	**20%**	**71%**	**87%**
Cost coverage incl. congestion estimate						**70%**

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Source: CE Delft 2008, p. 69