

Road Pricing and the competitiveness of bus & coach

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Outline & Motivation

- The 3 or 4 competitors for short to medium distance trips: car, bus, rail, (e-bike)
 - What is best choice and how does road pricing affect the choice?
 - What will happen?
- Rail and bus competition
 - Destructive competition?
 - How to select?
- Car and Bus competition
 - Stockholm corridor example
- Car, (Bus) and Rail competition
 - Brugge – Ghent - Brussels

4 modes compete

	access	parking	Speed w/wo road pricing	cost
Car	++	-	- becomes +	- becomes --
Bus	+	+	- becomes +	+ remains +
Rail	-	+	+	+ remains +
(E-bike)	++	+	+	+ remains +

EFFECTS

1. Good road pricing makes the congested car trips faster but more expensive, bus trips will be faster and not more expensive because savings in operation costs (driver+bus) > toll


High value car consumers will continue to use the car

Low value car consumers will either reduce number of trips, or move to bus and rail

BUT the increase of bus and rail use could be only 25%? of the reduction of car use

2. Rail users may move to bus because bus becomes faster

Outline & Motivation

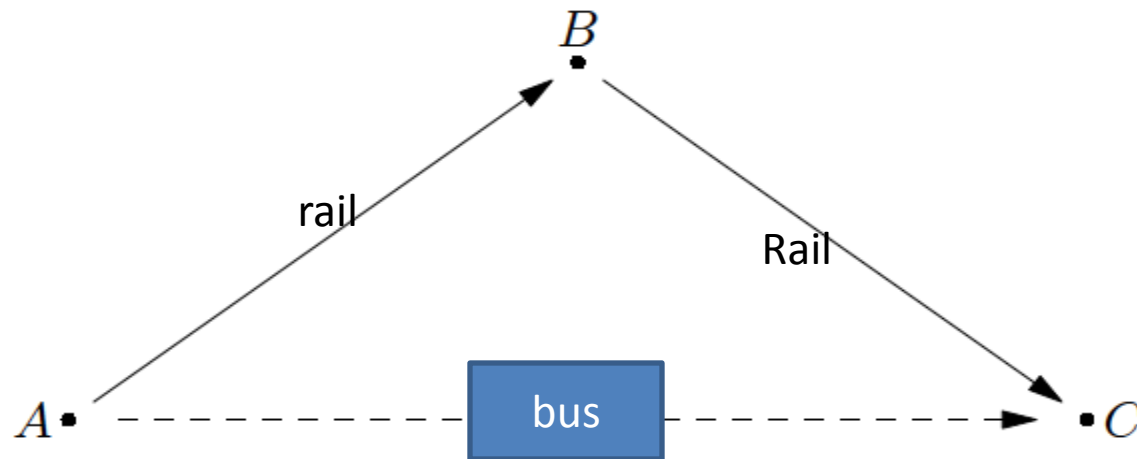
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Bus & Rail competition 1

- Liberalisation of bus services means that bus lines will start to compete with rail services
- 2 types of effects are expected
 - Overall a denser public transport network but less frequent and more expensive?
 - Along one line, only either bus or rail should subsist

Bus & Rail competition 2

- Liberalisation of bus services means that bus lines will start to compete with rail services
 - Overall a denser public transport network but less frequent and more expensive?
 - Bus can offer a more direct link from A to C
 - This will force rail to decrease frequency on AB and on BC, the corresponding passengers will lose, AC passengers will gain
 - The end result can be that total costs for passengers increase (Braess-paradox)



The existing transit system AB,BC and the new entry AC -

Bus & Rail competition 3

- Along one line, either bus or rail should subsist because there are economies of scale in both – how to decide?
 - Rail has much higher fixed cost (stations, tracks and vehicles) than a bus, so it is better justified for high densities
 - Bus can offer much higher frequency because cost of extra bus is much smaller
 - If you offer them both, frequency of both decreases
 - Optimal frequencies:

Cost of extra bus(train) = saved schedule delay or waiting time + saved crowding cost within the vehicle


- in Belgium several low density lines will sooner or later be substituted by bus lines
- If high density, competition may result in high value consumers taking rail and low value consumers using bus service (examples: Stockholm Arlanda airport to city center)

Bus and rail competition 4

- Illustration for Arlanda-airport to Stockholm city center (road pricing in Stockholm, congestion limited, 9 Skr=1 Euro)
 - Lower fixed costs per vehicle means bus has higher frequency
 - Lower fixed costs bus also means price discrimination is smaller
 - Longer journey of bus implies lower price, but for values of $\text{time} < 40 \text{ Euro} (= (280-119)/(60/25))$ people would take the bus, so the train has a hard time to compete

	Frequency In peak	Journey time	Adult fare	Student fare	Environment
Bus (flygb)	6/hour	45 min	119 Skr	99 skr	Biodiesel
Rail	3/hour	20 min	280 Skr	150 skr	Electricity

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Car and bus competition


for a commuting corridor in Stockholm of 14km with some 10000 trips per day –no metro or rail

In Euro's	Toll p	Toll op	Bus fare p	Bus fare op	Bus Freq p	Bus Freq op	Subsidy %	Welfare gain
Baseline	1.8	1.0	2.2	2.2	68	48	37%	
Car tolls	2.9	3.4	2.2	2.2	68	48	34%	small
Bus freq.	1.8	1.0	2.2	2.2	92	13	25%	Large
Full optimum	4.3	3.3	4.9	1	83	20	- 5% (surplus)	Large

Important:

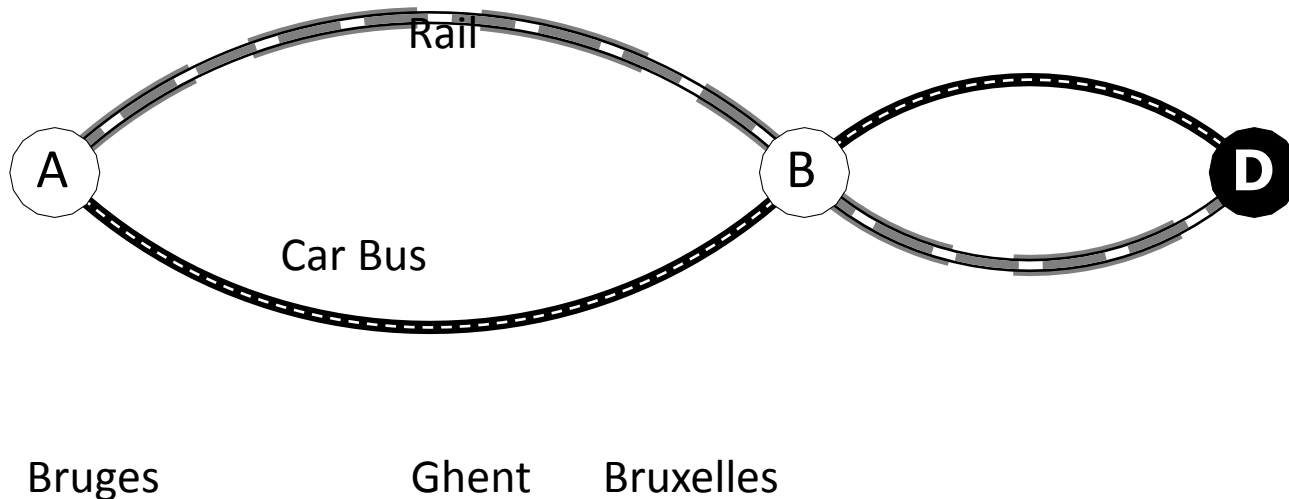
- 1) optimal car tolls have only limited effect on bus use
- 2) optimal bus fare for peak is higher than off peak to account for crowding (and/or capacity costs)
- 3) getting the frequencies right is most important for welfare (lower in off peak and higher in peak)

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simple network

Two origin cities A and B, one destination D



2 periods: peak & off-peak

4 population groups:

rich & poor commuters, students, retired

People travel to D, not from A to B or vice versa

Train has fixed composition for the whole day (600

Results Bruges & Ghent to Bxl – FIRST BEST

		BASELINE		SECOND BEST		FIRST BEST	
		Peak	Off -p	Peak	Off -p	Peak	Off-p
RAIL FARES (Euro/							
BRUGES to BXL	Euro	8.6	8.6			3.8	2.4
		Part of optimal fare due to					
Crowding B to G	Euro					1	0.5
G to BXL	Euro					2.8	1.7
Substitution car	Euro					0	0
<i>ROAD TOLLS (Euro/trip)</i>		<i>0</i>	<i>0</i>			<i>0.7</i>	<i>0</i>
GHENT to BXL	Euro	6.3	6.3			2.6	1.5
		Part of optimal fare due to					
Crowding G to BXL	Euro					2.8	1.7
Substitution car	Euro					-0.1	-0.1
<i>ROAD TOLLS (Euro/trip)</i>		<i>0</i>	<i>0</i>			<i>5.1</i>	<i>0</i>
RAIL FREQUENCIES	<i>run/h</i>	4	2			6.7	2.2

FARES: (with road tolls mainly between Ghent and BXL): higher fares for peak and for more congested part (Ghent to BXL)

FREQUENCIES: Higher than in Baseline in the peak period but prices are lower

RIDERSHIP of Rail in peak: +8 to +11% and in off peak +17 %

Results Bruges & Ghent to Bxl – Second Best

		BASELINE		SECOND BEST		FIRST BEST	
		Peak	Off -p	Peak	Off-p	Peak	Off-p
RAIL FARES (Euro/ one way trip)							
BRUGES to BXL	Euro	8.6	8.6	1.9	1.9	3.8	2.4
Part of optimal fare due to							
Crowding B to G	Euro			1.0	0.5	1	0.5
G to BXL	Euro			2.8	1.7	2.8	1.7
Substitution car	Euro			-1.9	-0.4	0	0
<i>ROAD TOLLS (Euro/trip)</i>		0	0	0	0	0.7	0
GHENT to BXL	Euro	6.3	6.3	1.1	0.9	2.6	1.5
Part of optimal fare due to							
Crowding G to BXL	Euro			2.8	1.7	2.8	1.7
Substitution car	Euro			-1.7	-0.8	-0.1	-0.1
<i>ROAD TOLLS (Euro/trip)</i>		0	0	0	0	5.1	0
RAIL FREQUENCIES	<i>run/ h</i>	4	2	6.7	2.2	6.7	2.2

FARES: As road tolls are absent, the substitution of cars is important and this is main driver for fares < crowding externality

Introducing Road Tolls means that Rail Fares should go up

These are uniform second best fares – it is better to differentiate them as effect on car substitution is different

FREQUENCIES: Second best = First Best as more or less same patronage

RIDERSHIP: Rail peak +8 to 12% and Rail off peak +17% to +36%

Summing up (for short to medium distance)

- Road pricing will make bus use more competitive
- Liberalisation of bus supply will lead to competition with rail
 - Can be suboptimal
 - For low densities best that rail is substituted by bus
- Road pricing for cars
 - Will not send many customers to bus (or rail)
 - Once you correct prices for cars, also bus (and rail) prices and freq need to change

Papers used

Bus – car paper Stockholm (with Borjesson, Chau Man Fung) at

<http://feb.kuleuven.be/drc/Economics/research/dps-papers/dps15/dps1531.pdf>

Bus – rail paper (with Kilani, de Palma) at

<http://feb.kuleuven.be/drc/Economics/research/dps-papers/dps15/dps1515.pdf>

Car- rail paper (with Monchambert) still in draft status