Subsidies in public transport

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Abstract

The pricing of public transport may range from charging the full price to supplying it for free. The present situation in most European countries is between the two extremes implying a partial cost recovery. In this paper we will explore both extremes on the axis of cost recovery: free public transport, and public transport without subsidies.

We start with a discussion of free public transport, and give a short survey of the intentions governments may have with its introduction. After this short survey we discuss in more detail the experiences with free public transport in four real world cases, two from Belgium and two from the Netherlands: the city of Hasselt, the Brussels region (for students), the Leiden-The Hague bus corridor, and free public transport for students in The Netherlands.

Then we discuss the other extreme: public transport without subsidies. We start with a short overview of the financial performance of the Dutch public transport systems and an analysis of the impacts of measures to improve the benefit-cost ratios. Then the effects of subsidy suspension in the Netherlands are estimated by developing two scenarios that describe opposite extremes in the hypothetical situation that no subsidies are granted to public transport operators and comparing the outcomes with a reference scenario where continuation of subsidies is assumed.

The paper concludes with a discussion of the merits and problems of both pricing policies: free public transport and public transport without subsidies.

Keywords: Subsidies; Free of charge; Profitable; Public transport.

Introduction

The pricing of public transport may range from charging the full price to supplying it for free. The present situation in most European countries is between the two extremes implying a partial cost recovery. In this paper we will explore both extremes on the axis of cost recovery: free public transport, and public transport without subsidies.

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Large scale public transport developed in the 19th century. At that time it was an economic activity that did not need subsidies. In most countries the subsidy issue only emerged during the second half of the 20th century, when ownership and use of the car grew rapidly and the cost of public transport developed in an unfavourable way due to the relative increase of labour costs. In most countries governments decided to cover the deficits by some kind of subsidy scheme.

There are various motivations for such a policy (Button, 1993). First, subsidies may be motivated because of the 'social function' of public transport. Vulnerable groups such as low income households, persons without a driver licence, elderly and persons with a handicap, need public transport to avoid problems of social exclusion. Second, public transport subsidies may be motivated as a second best instrument to address urban transport problems caused by car use when the possibilities of directly addressing these problems are restricted. These problems relate to noise, pollution, parking externalities and congestion. By subsidising public transport it is expected that a modal shift will take place away from the private car. A third argument for subsidies may be that public transport is characterised by economies of scale, so that marginal costs are below average costs. Hence, marginal cost pricing –being welfare optimising– would lead to deficits to be covered by subsidies. A fourth argument would be that there are positive externalities in public transport: an increase in travel volumes leads to a supply response in terms of higher frequencies and this leads to a decrease of scheduling costs of new and existing travellers.

These motivations for subsidies have been criticised for various reasons. For example, the 'social function' argument would call for selectivity in subsidisation so that only the groups that really need it pay reduced fares (see for example, Small, 1992). In stead, most countries have implemented subsidy schemes where all users benefit from the subsidy, even when they would not need it. The positioning of public transport subsidies as a second best tool depends to a considerable extent on their effectiveness to address the urban transport problems mentioned above. This effectiveness is questioned since the environmental performance of public transport is not as superior as is often thought, and besides, subsidies do not only lead to a modal shift away from the car, but will also generate 'new' demand that may aggravate the urban problems mentioned above (Rietveld, 2005). Further, whether or not subsidies are welfare improving depends on the question whether market distortions due to cost coverage reasons in transport are larger than market distortions due to taxation (McCarthy, 2001). Besides, it is argued that increasing returns to scale and density are not as large in public transport as is sometimes thought (Quinet and Vickerman, 2004). Finally, there is evidence that subsidies to public transport reduce its efficiency, so that the potential benefits do not materialise (De Borger and Kerstens, 2000).

The present developments in the public transport sector are twofold. On the one hand there is a tendency to reduce subsidies and improve cost coverage in many countries. On the other hand, in several countries far going subsidy schemes, including entirely free public transport schemes have been introduced. Both extremes will be addressed in this paper. Next section starts with a review of free public transport cases in Belgium and The Netherlands. We try to be as explicit as possible to describe the consequences of these cases in order to give a fair judgement and avoid wishful thinking. Then we explore the consequences of the opposite case: public transport without subsidies. The final section concludes.

Experiences with free public transport

Forms of free public transport

When taking a closer look at the fares public transport providers charge for their service, in general three types of *reduced* fares can be distinguished. The first group is the most extreme one: it consists of public transport that is free for all the passengers during every time of the day. An example of this is ‘vertical traffic’, such as elevators and escalators. ‘Horizontal traffic’ can be free as well, for example the moving paths at Amsterdam Airport Schiphol (Van Hulten, 2004). Another example could be found in Leiden-The Hague region where in 2004 two bus lines were free for all passengers.

The second group consists of public transport that is free for some passengers or that is free during certain periods of the day. This is the case in Belgium, where local and regional transport by bus, tram and metro is ‘free’ for all senior citizens, disabled persons and children. There is one constraint: passengers pay for their journey at working days before 09.00 a.m.

The third and last group of reduced fares is dependent of place, time or category of passengers. Examples of these for train transport are the reduction card with which passengers can get a discount of 40% after 09.00 a.m. and the senior citizen’s pass. For bus transport an example can be found in Apeldoorn, The Netherlands. Passengers pay a special fare of €1 for their ticket, independent of the length of the trip. In the present paper we will focus on examples in the first and second category.

There is a great variety in the motivations for different experiments with free or reduced public transport (whether they be short- or long-term).

The following elements are mentioned in the book ‘Gratis Openbaar Vervoer’ by Michel van Hulten (2004), one of the advocates of free public transport:

- Costs that are associated with the cashing and administration of the payments will disappear. The safety of the conductor or driver is enhanced because no longer cash is available. Another effect of the disappearance of payment is that passengers can get on and off quicker, which in turn will lead to a higher velocity of circulation of the public transport vehicles.
- The attractiveness of a city will increase for tourists, because they do not have to pay for their journeys either. Free public transport can become a sales pitch to attract more tourists.
- Some motorists will switch from using the car to using public transport. Even when these are a few people, less space for the car users is required. This change of travel mode can be expected when the free public transport is permanent, because it is then considered in the decision about where to live and work. Temporary experiments do not lead to such a structural change.

Other positive consequences of free public transport can be found in social aspects. One striking outcome of the introduction of free public transport in Hasselt was that the number of visits to patients in the hospitals was reported to increase enormously. Free public transport might in this way be a means to prevent elderly people of becoming lonely.

These arguments for free public transport are to a considerable extent in line with the motivations for subsidies given in chapter 1. Of a different nature is the tourist promotion argument, which is debatable from an economic perspective, because it is not clear why in particular this industry should be supported by subsidies. The first point in favour of free public transport mentioned above is a valid point, however. When cost coverage is already very low and transaction costs of paying tickets are high, providing a service at zero price may indeed make sense. However, rebound effects have to be considered such as a large demand response leading to a higher tax burden when supply follows demand and quality is increased or a decline in the quality of the service when supply does not follow.

After this short overview of the different forms of free public transport and the motivations for introducing it has been given, the discussion will go more in-depth. Four real-world cases will be analysed and compared to see what the effects of free public transport are under different circumstances.

Four cases regarding free public transport

In practice, numerous examples can be found regarding free public transport. For the purpose of this paper, four cases were selected to investigate the effects of free public transport. Two cases concern free public bus transport: one in The Netherlands and one in Belgium. The other two cases concern free public transport for students, also one in The Netherlands and one in Belgium. These cases will be analysed according to the following aspects: location, initiator, time span, size of experiment, time of day, effects on modal choice and congestion and so on. These points are shortly summarised in fact sheets. After this analysis, a comparison of the four cases will be made to find out in what situations free public transport contributes to the purposes that have been formulated. The four cases that will be discussed are:

- Free public transport on the Leiden-The Hague bus corridor.
- Free public transport in the city of Hasselt.
- Free public transport for all students in the Netherlands.
- Free public transport for students in the Brussels region.

For each case some background information will be provided. This information will regard the aim and nature of the project, the effects on modal choice and congestion and possible other changes in the network.

Free public transport on the Leiden-The Hague bus corridor

In January 2004 an experiment was started with free public bus transport. This experiment took one year. The aim was to test in practice whether free public transport can contribute to a reduction in congestion (Egeter & Versteegt, 2004). Because the aim of the experiment was to offer an alternative mode of transport for commuters, the busses were free only on Mondays till Fridays. The total costs of the experiment were €1,000,000. The Province paid half of this amount to Connexxion as a compensation for missed income, €200,000 was reserved for extra busses and €300,000 was used for education and research about the results of the experiment. On average, six extra bus rides were made per workday. When taking holidays in account, this means that on annual basis, 1150 extra bus rides were made [1]. The results of this experiment were as follows: bus use on the free bus routes increased from 1,000 to 3,000 passengers a day. From this new passengers 45% made the transfer formerly by car, 10% used the moped or bike, 20-30% switched from other public transport services (other bus routes or train) and 16% did not make the transfer at all. The reduction in car use has probably led to a small reduction in congestion on the motorways between Leiden and The Hague, but this was so small that it could not be measured. Note that part of the traffic that shifted from car to bus took place outside the peak periods. In Table 1, a summary of the results can be found.

Table 1: The case of free busses between Leiden and The Hague.

Aspect	***Assessment***
Location	The Hague, Katwijk, Noordwijk, Leiden.
Initiator	The Province of South Holland in co-operation with the public transport company Connexxion.
Time span	January – December 2004.
Size of experiment	Two existing bus lines: route 88 and 95 and one new one: route 89.
Who can use the free bus?	Everybody.
Time of day	Monday till Friday; entire day.
Fare	Zero.
Aim	Main objective: To test in practice the ability of free public transport to contribute to a reduction of congestion on the A44/N44. Sub objectives: • Increase in the use of public transport: at least 40%. • Former motorists should account for at least 20% of this increase. • Increase in occupancy rate transferium: at least 50%.
Effects	• Congestion did not decrease. • Bus use on the two routes has increased from 1000 to 3000 passengers per day. • 45% of the new passengers made the transfer formerly by car. • 10% of the increase in passengers consists of passengers who formerly travelled by moped or bike. • 20-30% of the new passengers switched from other public transport services (other bus routes or train). • About 16% of the new bus trips are made by passengers who formerly would not make such a trip. • The occupancy rate of 'Transferium' 't Schouw/ A44 near Leiden is more than doubled.
Goal achieved?	The beneficial effects on congestion could not be measured because of the small size of the pilot. Therefore it is difficult to say whether a larger scale pilot would have the desired result. The sub objectives are achieved.
Costs	Total costs are €1 million, all paid by the Province of South Holland. • €500.000 is paid to Connexxion as a compensation for lost incomes. • €200.000 is reserved for extra busses. • €300.000 is used for education and research on the results of the experiment.
Other changes in transport network	Number of daily bus rides increases (from 85 to 87). One new bus line is introduced. All in all the increase in bus rides per day is 6.

[1] Information provided electronically by drs.ing. Lars Jansen.

Free public bus transport in the city of Hasselt

Information regarding the mobility policy of Hasselt can be found in Lambrechts (2004). Before free busses were introduced, public transport was badly available in Hasselt. The two main lines had an hour-frequency (both during peak- and off-peak periods), which implied that public transport was not very popular. After improving the network it consists of nine urban lines with a higher frequency. Making the bus free (next to the improvement of the network) was regarded as an extra measure to increase the number of bus passengers. With the introduction of the improved network, transport operator De Lijn aimed at multiplying the number of passengers times four in three years after the introduction.

The urban busses are free for everybody (not only inhabitants of Hasselt). For the regional busses, only the rides within the boundaries of Hasselt for inhabitants of the city are free.

In 1998 the costs for free public transport are €22.64 per household.

Table 2: The case of Hasselt.

Aspect	***Assessment***
Location	Hasselt, Belgium.
Initiator	The Hasselt Municipality in co-operation with public transport company De Lijn.
Time span	Introduced in 1996 and still operational.
Size of experiment	The urban bus network consists of nine bus lines.
Who can use the free bus?	Urban bus: free for everybody (including non-inhabitants). Regional bus: free for every inhabitant of Hasselt, only for rides within the boundaries of Hasselt.
Time of day	Monday till Sunday; entire day.
Fare	Zero.
Aim	For the urban bus: to multiply the number of passengers times four after the introduction of the new system (within three years). Another aim was to increase the number of passengers who use the regional bus to go to Hasselt.
Effects	• The number of bus passengers increased tenfold. • Of all the bus users, 37% consists of new users and 63% of former users. Hence former bus users started to make much more intensive use of the bus system. • The origin of the 37% new bus users is: car: 16%, bicycle: 12%; pedestrian: 9%. • 48.8% of the bus users lives in Hasselt, the other 52.2% does not live in Hasselt. • Visits to the hospital were more often made by public transport than before.
Goal achieved?	The number of passengers who use the urban bus increased tenfold (from 331,551 in the old situation to 3,200,000 in the new situation). The number of passengers who use the regional bus to travel to and from Hasselt has not increased.
Costs	The most recent numbers regarding the costs and benefits are those of 2001. In that year, the costs for the urban net were estimated at €526,296. The costs for the regional net in that year were €347,505.
Other changes in transport network	The urban bus network was strongly improved before it became free. The number of busses increased from 8 in the old situation to 40 in the new situation. The number of bus lines increased from four to nine and the frequency was increased to 15 minutes in the peak and 30 minutes off-peak.

The number of bus passengers per year increased tenfold. This was however not the case for the regional network; here the number of passengers decreased. An explanation for this can be that the regional rides were not free, but only (marginally) cheaper and that the network of the regional busses has not been improved (as was the case for the urban busses). Most of the additional trips (63%) are made by former bus users. About 37% are made by passengers who switched from other modes of transport to the bus, 16% used the car, 12% used the bicycle, 9% walked before. The results of the introduction of free busses in Hasselt are summarised in Table 2.

Free public transport for all students in the Netherlands

In January 1991, the ‘OV-Studentenkaart’ was introduced in The Netherlands. This card replaced the travel cost allowance for students, included in their scholarship, and entitles them to freely use public transport unlimitedly throughout the year (HCG, 1995).

Table 3: The case of free public transport for students in The Netherlands.

Aspect	***Assessment***
Location	The Netherlands.
Initiator	Ministry of education, in co-operation with public transport operators.
Time span	Free public transport for students was introduced on the 1st of January 1991 and is still applicable today.
Size of experiment	All forms of public transport: train, bus, metro and tram.
Who can use the free bus?	All students who receive student grants.
Time of day	Students were entitled to use of public transport throughout the year for free.
Fare	Zero.
Aim	The ‘OV-Studentenkaart’ was aimed at replacing the – in the study grant included – amount for travelling expenses between the living address and the study address.
Effects	• Share of public transport in total number of movements of students changed from 11% to 21% after the introduction of the OV-Studentenkaart. • Per day students use public transport 0.81 times, before the introduction of the card this was 0.45 times. • Average number of kilometres travelled by students increased with 15% to 46 kilometres a day. • Car use of students decreased with 34%. • Bicycle use of students decreased with 52%. • Increase in the number of train movements of students is the largest on Sunday and Friday. • Increase in the number of bus/ tram/ metro movements of students is the largest on Tuesday and Wednesday. • Before the introduction of the OV-Studentenkaart in 1990 the number of passenger train kilometres in The Netherlands was 11,000 million. In 1991 this increased to 15,000 million.
Goal achieved?	Not applicable.
Costs	Information not available.
Other changes in transport network	NS increased the supply of trains on important sections in response to the increase in total train kilometres. On the sections Arnhem-Den Haag and Zwolle-Eindhoven 40 intercity trains are added. In the peak periods of a number of sections the frequency of trains increased.

From November 1994 onward, the pass was replaced by two different public transport passes. Students can choose one of these two passes. However, only the results of the initial OV-Studentenkaart will be taken in account. The ‘new’ situation will be left out of this analysis. The introduction of free public transport led to a large increase in public transport use in The Netherlands. For example, the number of passenger kms on rail increased by almost 50% and the share of public transport in the trips of students increased from 11 to 21%. The average number of kilometres that students travelled increased with 15% to 46 kilometres a day. This growth is for 60% accountable to bus, tram and metro use. The largest change in the modal split was due to students switching from bicycle to public transport (52%). A smaller part of the students switched from car to public transport (34%). In table 3 an overview can be found. The introduction of free public transport for students had two main effects on the other travellers. First, it leads to crowding; second, on a number of lines frequencies increased. As a result of the last point, some of the other travellers benefited.

Free public transport for students in the Brussels region

The following information can be found in Witte *et al.* (2005). In 2003-2004 students from Dutch-speaking universities and colleges had the opportunity to obtain a free annual subscription on Brussels public transport (bus, tram and metro).

Table 4: The case of free public transport for students in Brussels.

Aspect	***Assessment***
Location	Brussels, Belgium.
Initiator	Flemish government.
Time span	Introduced in the 2003-2004 academic year and continued next year.
Size of experiment	Bus, tram, metro.
Who can use the free public transport?	Students younger than 26 studying at Dutch speaking Flemish colleges or universities in Brussels.
Time of day	Public transport is free during a full year, 24 hours a day.
Fare	In the first year: Students buy a season ticket and then ask for repayment. In order to cover administrational costs, a fee of €10 was charged (normally a season ticket costs €200). In the second year: Fee has been raised to €25. Students pay for one month and travel for free during the other eleven months. In the third year the system of refunding has been abolished. Students just pay €25 at a special sales point.
Aim	<u>Main objective:</u> To promote the mobility of Dutch speaking students to and in Brussels and to stimulate inscriptions at colleges and universities in Brussels. <u>Sub objectives:</u> • Stimulate Flemish students to participate in social, cultural, sport and other activities in Brussels. • Attract Dutch-speaking students to Brussels. • Create a positive image towards public transport and induce habit forming, contributing to more sustainable transport.
Effects	• 47% of the students applied for the season ticket. • 89% regularly used the tram, bus or metro (at least once a week). • 11% applied for the free season ticket, without fully exploiting their free access to public transport. • Of the students that applied 13% were new public transport users, 35% used public transport before but became more intensive users. The rest had equal use (43%) or less use (6%).
Goal achieved?	Information not available. Students from Dutch speaking universities still use the train more often than bus, tram or metro, even after the introduction of free public transport.
Costs	The Commission of the Flemish Community (VGC) provided €1,200,000. An additional subsidy of €246,293 was needed to cover all costs.
Other changes in public transport network	No changes in the public transport network or frequencies.

The main objectives of the 'free' public transport initiative were to promote the mobility of Dutch speaking students to and in Brussels and to stimulate inscriptions at colleges and universities in Brussels. About 47% of the target group participated in the initiative. Within this group about 13% were new public transport users, 35% became more intensive public transport users. The rest had equal use (43%) or less use (6%). In Table 4 the main results are summarized.

Comparing the four 'free public transport' cases

Table 5: The four cases compared.

Aspect	*Den Haag*	*Hasselt*	*'OV-studentenkaart'*	*Students Brussels*
Time span	January-December 2004.	Introduced in 1996, still operational.	Introduced in January 1991, still operational.	Introduced in the 2003-2004 academic year and continued next year.
Size	Two existing bus lines: route 88 and 95 and one new one: route 89.	Nine urban bus lines.	All forms of public transport: train, bus, metro and tram.	Bus, tram, metro.
Passengers	Not restricted.	Urban bus: free for everybody (including non-inhabitants). Regional bus: free for every inhabitant of Hasselt, only for rides within the boundaries of Hasselt.	All students who receive student grants.	Students younger than 26 studying at Dutch speaking Flemish colleges or universities in Brussels.
Main objective	To test in practice the ability of free public transport to contribute to a reduction of congestion on the A44/N44.	To multiply the number of passengers times four after the introduction of the new system (within three years).	The 'OV-Studentenkaart' was aimed at replacing the – in the study grant included – amount for travelling expenses between the living address and the study address.	To promote the mobility of Dutch speaking students to and in Brussels and to stimulate inscriptions at colleges and universities in Brussels.
Increase in public transport use	Bus use on the two routes has increased from 1000 to 3000 passengers per day.	The number of bus passengers increased tenfold.	Share of public transport in total number of movements of students changed from 11% to 21% after the introduction of the OV-Studentenkaart.	Of the students that applied 13% were new public transport users, 35% used public transport before but became more intensive users. The rest had equal use (43%) or less use (6%).
Origins of additional users: Modal shift and new or longer trips	*Modal shift:* Car: 45% Bike: 10% Other public transport services: 30% *New trips:* 16%	*Modal shift:* Car: 16% Bike: 12% Pedestrian: 9% *New trips:* 63%	*Modal shift:* Car: 34% Bike/moped 52% Walking: 9% Other: 5% *Trip length:* +15%	*Modal shift:* Car: 60% Bike: 5% Pedestrian: 19% Other public transport: 15% *New trips:* PM

The four cases can be compared according to their time span, size, type of passengers, increase in public transport use and modal shift. All of the four examples had different objectives. Whether a free public transport project can be regarded as a success or a failure depends on the way in which these objectives are formulated. When the main aim is to reduce congestion (like the The Hague experiment) but the scale of the pilot is small so that the reduction of congestion cannot be measured, the achievement of the main objective cannot be evaluated. However, the sub objectives (e.g. the increase in the use of public transport should be at least 40%) are achieved in this project. In some cases the introduction of free public transport goes with other changes in the public transport system, as is the case in Hasselt. Before free transport was introduced, the public transport system was improved, which could explain why more passengers use public transport. Making it free was only an extra measure to attract even more passengers. In all of the four examples, public transport use increased. This increase is caused mainly by passengers who switched from car to public transport. A brief summary of the comparison can be found in Table 5.

Conclusions regarding free public transport

We conclude that in some cases free public transport does contribute to the purposes that have been formulated, but in other cases the plan failed (see for example the Leiden-the Hague pilot). In the case of Hasselt there is a very large response from the demand side, but here the initial supply of transport services was poor. The effect observed is not only the consequence of free public transport, but also of the increase in frequency and network size. In the case of the Leiden-The Hague pilot on the other hand the supply remained almost stable and additional demand was limited. Thus, the issue whether free public transport will lead to a large increase in travel demand depends strongly on the context. The cases studied here demonstrate that for many persons the overall quality of public transport remains low compared with that of other modes, so that they will not shift transport mode even when public transport would become free.

From the perspective of environmental effects it is important to consider the modal shift from the car to public transport. In the case of Leiden-The Hague the largest effect was indeed on car use. However, in the cases of the Dutch free public transport pass for students and of Hasselt the effect on non-motorised transport modes dominated the effect on car use. It is important to distinguish short distance and long distance public transport in this respect. Modal shift in the case of short distance public transport mainly takes place at the disadvantage of non-motorised transport modes and hence has adverse environmental effects.

With longer distance transport the opposite occurs. Thus the spatial context is important: for example the Leiden-The Hague bus service takes place at distances where non-motorised transport modes are relatively unimportant.

Transport models have their limitations when they are used to simulate the effects of free public transport. This would entail the use of model equations in a domain where they have not been tested. Therefore real world pilots with free public transport are useful in this context. When we try to infer from these case studies what would be the consequence of entirely free public transport in the whole country, we would conclude that this will lead to a large increase in demand implying more trips in urban areas and longer trips, in particular in the rail sector. Given the response to the introduction of free public transport for students in 1990 we expect substantial bottlenecks for rail transport. The quality and reliability would deteriorate unless massive investments would be made here. This obviously implies a large financial burden for the public sector. Where free public transport for targeted groups like students may be attractive since these can to a certain extent be accommodated on empty seats in trains and busses, this is no longer the case when all passengers will travel without paying.

Public transport without subsidies

Now we discuss the opposite: What would happen if subsidies for public transport are suspended and the user is charged the full price? This question is investigated for the Netherlands. The study is reported in Dutch by Peeters et al., 2000 and, into more detail, by van Goeverden and Schoemaker, 2000, Bruinsma and Rietveld, 2000 and Claassen and Katteler, 2000. The results are summarized in this paper. The study concerns only suspension of subsidies that are used to eliminate the operating deficits; infrastructure is assumed to be used for free. An exception is made for train operators who will be charged for usage of the railway infrastructure, thus reflecting political reality. It should be stressed that the current Dutch governmental policy does not aim at full suspension of subsidies, though it is directed at reducing these substantially (Ministry of Transport, 2004).

The main theoretical argument for withdrawing subsidies for public transport is that the sector would be fully subjected to the market forces. Assuming no market imperfections, the invisible hand of the market could produce the optimal public transport supply. In practice, the main reason for reducing subsidies in the Netherlands is political dissatisfaction with the high amount of subsidies. The annual subsidies amounted to 1.5 billion Euros in the early nineties, about 0.5% of GNP.

The study starts with an evaluation of the financial performance of the Dutch public transport system. This uncovers the main financial weaknesses and gives some understanding about how to improve these. Then the effects of suspension of subsidies are investigated by adopting a scenario analysis. Two scenarios are developed that describe opposite extremes in the hypothetical situation that no subsidies are granted to public transport operators. Both scenarios are compared to a reference scenario where continuation of subsidies is assumed.

Financial performance of public transport in the Netherlands

The evaluation of the financial performance refers to the situation before the new policy to introduce tendering, decentralization and reduction of subsidies started (second half of the nineties). We define this as the base situation. The base situation will differ from the current situation in 2006, because the new policy had a significant impact on public transport supply. For reasons of data availability, the year 1993 is selected to represent the base situation. Due to the new policy the commercial consciousness of the transport companies increased and the power of governmental bodies reduced, effecting that (sensitive) financial data are no longer in the public domain. The 1993 data were gathered from the Ministry of Transport (1995), Central

Bureau of Statistics (1 and 2) and annual reports of the Dutch railways and the public transport companies of Amsterdam, Rotterdam and The Hague. Because there was no charge for railway infrastructure use in 1993, the cost figures in this section relate only to the operating costs.

In 1993 the passenger revenues covered 59% of the operating costs of Dutch public transport. This was the result of the average cost of 2.9-3.4 eurocents per seat km (the range is caused by different assumptions on standing densities), the average revenue of 5.6 eurocents per person kilometre (pkm) and the average occupancy of 31-34%. As can be seen in Table 6, these figures vary a lot over the different PT-systems.

Table 6: Financial performance of Dutch public transport in 1993.

	Costs per seat[1] km (Eurocent)	*Revenues per pkm (Eurocent)*	*Revenue-cost ratio*	*Average occupancy*	*Travel volume (million pkm)*
Urban bus	4.6-5.8	7.9	0.29	0.17-0.21	1300
Urban tram	4.2-5.6	7.9	0.33	0.18-0.24	710
Underground	1.9-3.2	7.9	0.65	0.16-0.26	675
Regional bus	2.7-3.3	6.0	0.42	0.19-0.23	3670
Local train in rural areas	3.3	5.1	0.38	0.25	560
Local train in non-rural areas	3.0	5.1	0.63	0.36	4875
Express train	2.2	5.1	1.20	0.52	9330
Total PT	2.9-3.3	5.6	0.59	0.31-0.34	21120

[1] including standing places in bus, tram and underground.

The benefit-cost ratios range from nearly 30% (urban bus) to 120% (express train). Generally, fast systems perform better than slow systems. This gives rise to the assumption that slow local transport will be more affected by suspension of subsidies than fast long distance transport.

The most important cost components are the costs of the vehicle crew and the costs of fleet ownership and maintenance. In the bus systems the driver's wages count for 50-60% of the operating costs, while another 20-25% relate to ownership and maintenance of the vehicles. In the rail systems vehicle costs are highest with shares between 30 and 50%, those of vehicle crew range from 20 to 25% for heavy rail, going up to 40% for the urban tram. The heavy rail systems employ station staff, responsible for 10-15% of the costs. Energy and overhead still play a significant role, ranging from 10-20% and 5-10% respectively.

A demand-related factor that enlarges the operating deficits is the high fluctuation of demand over time and space. The morning peak shows the highest demand at about 280,000 persons travelling at the same time by PT, which is 30% more than the evening peak and about 3 times the period between the peaks. It is interesting that the fluctuation over time is less articulated for the other modes. For these modes there is no difference between the two peaks, while the peak demand is about twice the off-peak demand. Therefore, measures that are directed to a large increase of the share of public transport may result in a more uniform distribution, so raising the average occupancies and increasing the cost coverage.

Estimation of the effects of subsidy suspension

The estimation of the effects of suspension of subsidies is based on a scenario analysis. To find out which measures the public transport operators probably would take for eliminating the deficits, the effectiveness of both cost reducing and revenue increasing measures is analysed. The results are used for developing scenarios that are helpful in finding the effects of suspension of subsidies.

Measures for improving the revenue-cost ratios

Promising cost reducing measures are measures that tackle the costs of the two largest cost components: vehicle crew and fleet ownership + maintenance. Increasing revenues can be realised by raising the level of service or increasing the fares.

Van Goeverden et al. (2005) found that the most effective cost reducing measure is lowering the wages. Halving the wages will reduce the operating costs by 30-40%. Second best is increasing stop spacing. This raises the operating speed of the vehicles, effecting a more efficient employment of vehicles and personnel. Doubling the distance between stops will reduce the costs by 20-30%. Producing cheaper vehicles is also effective for the rail modes. Halving the price of vehicles will reduce the operational costs by 10-20%.

Measures that aim at raising the revenues by making public transport more attractive have only significant effect in non-urban transport. The most effective measure is increasing the operational speed. A speed increase by 50% will increase patronage by 30-35%. However, if the speed increase is effectuated by increasing stop spacing, the longer access and egress distances will soften the increase in demand, approximately by 50%. Doubling the frequency of the services will increase patronage by 10-30%, where the higher the initial frequency the smaller the effects.

Fare increase is most effective in urban transport. Doubling the fares is expected to reduce patronage with about 25%. In regional transport the estimated fall in demand is 40%, in long distance transport 50%. In the latter case total revenues will just remain constant, so that the only beneficial effect would be a decrease in costs.

Scenario development

Three scenarios are developed for 2010 based on the ‘Trend scenario’ defined in the Scenario Explorer (Heyma et al., 1999). One scenario is a reference scenario describing the situation that granting of subsidies to public transport companies will be continued. The two other scenarios define two extremes of the probable development of public transport supply and demand if subsidies are suspended. The scenarios differ only with respect to the designs of the public transport systems and related factors like modal travel volumes.

The Reference scenario is a projection of the base situation to 2010. In this scenario it is assumed that a) operating losses will be covered by the government, b) public transport operators have to pay nothing for utilization of infrastructure, c) there is some political dissatisfaction regarding the large subsidies causing pressure from the government to operate cost efficient, and d) the real fares will not change.

Starting-point in the two subsidy-free scenarios is that a) subsidies for public transport operation are suspended and b) train operators have to pay an annual levy for utilization of the Dutch railway infrastructure. The main difference between the two scenarios is the basic attitude of the public transport operators that determines their main strategy for eliminating the deficits.

Basically two strategies are available to increase the benefit/cost ratio: increasing revenues and reducing costs. In the first scenario, the strategy is primarily directed at attracting more customers and thus increasing the revenues. Therefore, measures are taken that raise the level of service. The operators do not aim at a profit and they have an open eye for social and community interests. The government supports their strategy by providing adequate infrastructure. This is the so-called 'User scenario'.

In the second scenario, the strategy of the operators is primarily focused on cost reduction to satisfy the investors by aiming at a high profit. The new independence of governmental rules that were connected with granting subsidies is used to cut the most uneconomic services without considering the social and community interests. There is no infrastructural support from the government. This is the so-called 'Yield scenario'.

The User and Yield scenarios are developed stepwise. After defining base variants that improve the financial performance of public transport but do not make it financially self-supporting, adapted variants are developed until a situation is found with zero loss for the User scenario and about 10% profit margin for the Yield scenario. The definition of the base variants is in full accordance with the respective strategies. The adaptations are strictly directed at improving the revenue/cost ratios and are sometimes contrary to the basic strategy of a scenario.

The effects of subsidy suspension

Impacts of subsidy suspension on the public transport system

Table 7 demonstrates the financial performance of public transport in the scenarios. It shows the revenue-cost ratios for the three scenarios as well as costs per seat km and revenues per person km for the User and Yield scenarios relative to the Reference scenario.

Table 7: Financial performance of public transport in the scenarios.

	Revenue-cost ratio			*Operating costs/seat km (RS=100)*		*Revenues/person km (RS=100)*		*Average occupancy (RS=100)*	
	US	YS	RS	US	YS	US	YS	US	YS
Urban bus	0.90	0.93	0.29	66	95	213	212	93	141
Urban tram	0.91	1.01	0.37	65	98	213	212	75	125
Underground	1.44	1.50	0.69	117	125	213	212	115	128
Regional bus	0.92	1.22	0.42	73	88	170	170	93	149
Local train in rural areas	0.77	1.16	0.62	90	93	110	150	102	117
Local train in non-rural areas	0.72	1.03	0.61	93	90	110	150	99	101
Express train	1.46	1.59	1.08	98	122	110	150	120	121
High-speed train	1.90	2.36	1.58	97	101	110	150	106	101
Total PT	1.00	1.12	0.71	86	101	125	162	107	118

The latter are represented by index numbers. The charge for use of rail infrastructure in the two subsidy-free scenarios is included only in their revenue-cost ratios for total PT. The User, Yield and Reference scenarios are indicated by "US", "YS" and "RS" respectively.

In the User scenario the total revenues just cover the costs, while in the Yield scenario the operators gain a profit of 12%. The Reference scenario still shows a large deficit, though the revenue-cost ratio is higher than in the base year 1993. In the two subsidy-free scenarios the separate PT-systems sometimes still have deficits, especially in the User scenario. In urban transport, in both scenarios the deficits of the bus are fully compensated by the profits of the rail modes, especially the underground. The deficits in regional transport in the User scenario demand some cross subsidy from the profitable long distance train services to the regional transport services. If long distance train services and regional bus/train services are operated by different companies, the national government could actualise cross subsidy by passing on tax revenues from long distance operators to regional operators.

The relatively high costs per seat km for some rail services in the User and Yield scenarios can be explained by the deployment of relatively short trains. It is interesting to see that the overall cost-effectiveness in the Yield scenario is much lower than in the User scenario.

The revenues per person km increase significantly in both the User and Yield scenarios, especially in urban transport and regional bus transport. The increase reflects the rise in fares. In the Yield scenario the occupancies also increase substantially, with the vehicles becoming more crowded.

The impacts on some level of service variables are presented in Table 8. Again, the impacts are indicated by index numbers, where the Reference scenario values are fixed at 100. The frequency variable is the number of services per week, so it indicates changes in periods of operation and interval times simultaneously. Another relevant variable, crowding in vehicles, was indicated in Table 7 by the changes in occupancy rates.

Table 8: Level of service impacts of the subsidy-free scenarios (RS=100).

	Access/egress distance		*Frequency*		*Operating speed*	
	US	YS	US	YS	US	YS
Urban bus	184	223	132	62	138	101
Urban tram	101	124	87	40	142	100
Underground	104	107	82	48	100	100
Regional bus	151	212	129	55	122	110
Local train in rural areas	100	170	104	50	100	110
Local train in non-rural areas	100	105[1] 166[2]	101	41[1] 67[2]	100	109
Express train	100	107	87	37	100	97
High-speed train	98	100	93	58	107	100

[1] urbanized areas [2] non-urbanized areas.

In the Yield scenario a large overall decline of the level of service will result from the measures. Bus and tram stops as well as the railway stations are at much larger distances and frequencies fall. The only positive changes are the moderate speed increases of the regional bus and train systems.

The results for the User scenario are less detrimental. It is true, that in urban transport the access distance to the bus stops greatly increases and the frequencies on the urban rail transport decrease, but there is a substantial increase in speed of the bus and tram systems. In regional bus transport again a larger access distance to the stops is accompanied by a higher operating speed.

The impacts on the demand are shown in Figure 1. The figure indicates the estimated demand for public transport in the User and Yield scenarios, relative to the Reference scenario.

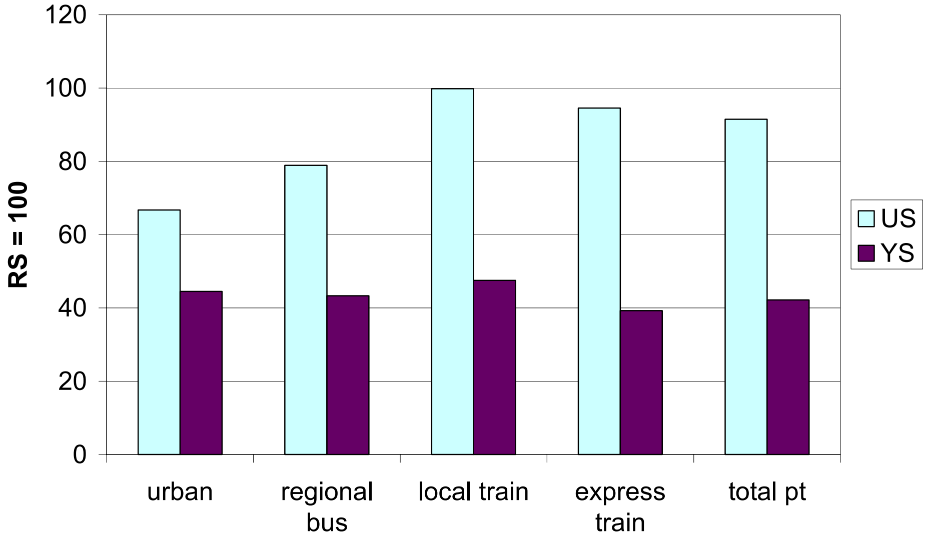

Figure 1: Demand for public transport in the scenarios.

In the User scenario the overall public transport demand is slightly less than in the Reference scenario. The difference is mainly caused by a substantially lower demand for urban and regional transport. The demand for train travel is similar in both scenarios.

In the Yield scenario the impact on demand is much larger. In each sub market the demand falls to about 40% of the Reference scenario demand. Even the introduction of the high-speed train does not prevent the demand for long distance trains being severely cut.

A remarkable side result is a growth in demand of about 50% at the current subsidy level in the first (not self-supporting) variant that was defined in the stepwise development of the User scenario. Measures in this variant were all directed to increase both service level and efficiency in order to attract more passengers and reduce unit costs. So, a significant improvement of current public transport is possible without increasing subsidies.

Impacts on other modes

The estimated effects on the other modes are small. Car use will increase by 0.4% in the User scenario and by 1.1% in the Yield scenario. Still in some (congested) corridors the effects can be substantial. Bicycle use will increase by 1.7% and 4.0% in the User and Yield scenarios respectively.

Social and economic impacts

The social impacts of both scenarios have been evaluated in a qualitative way. Four groups of PT-users have been distinguished: those who have a car available, temporal-emergency users, consciously non-car users and forced car-less. In both scenarios mainly negative impacts are expected, though these are much more severe in YS than in US. For the first group the impacts will be limited and partly positive as these people have in principle an alternative, get a faster PT system and may often be able to pay the higher fares for it. The second group, using PT only in case of emergencies will have larger problems at those moments, but this happens only incidentally. The third group will theoretically be able to switch to alternatives though this may cause ethical distress. Nevertheless, people may be able to pay the higher prices and enjoy the higher speeds. The last group is the most affected one, as this group has no alternative and often people are unable to drive a car due to disabilities, high age or low income. On all these aspects the system is deteriorating in both scenarios because of increasing access and egress distances, more crowded vehicles and much higher fares.

The main conclusion is that the social function, serving the fourth group of travellers, is deteriorating much stronger in the Yield scenario than in the User scenario. Notably in the Yield scenario less and less places will be accessible by PT and at less hours of day and night and less days of the week.

From an economic perspective the complete suspension of subsidies would yield about 800 million Euro per year in the form of a tax reduction for the Dutch taxpayers. This is about 0.3% of GDP. Jobs in public transport would decrease with an estimated 26% in the case of the User scenario and 63% in the Yield scenario. A countervailing effect is that the increase in disposable income owing to the tax reduction will lead to an increase in demand for goods and services produced in other sectors. Much depends on the flexibility of the labour markets so that persons who would loose their job in public transport can find a new job in another sector.

Experiences in the UK after deregulation of bus services

In the UK the 1985 Transport Act exposed local bus services outside London to market forces. The Act introduced deregulation for commercial services, competitive tendering for subsidised services and privatisation. One of the intents was subsidy reduction (Gwilliam, 1990). It would be interesting to compare the observed effects in the UK with the estimated effects of subsidy suspension in the Netherlands. One should keep in mind that the former were induced by deregulation and competitive tendering, while the latter are induced by withdrawing subsidies in a regulated market.

Financial performance

The largest effects in the UK are observed for the metropolitan areas (except for London). In these areas the subsidy per passenger journey was reduced by 50-55% (Matthews et al., 2001). This is the result of a large decrease in operating costs per vehicle km and higher fares. On the cost side, productivity of personnel increased significantly. Based on staff input per vehicle km, in the metropolitan areas 16%

productivity increase of platform staff is estimated in 1987/88 and even 37% productivity increase of non-platform staff (Heseltine et al., 1990). Additionally, the wages of bus drivers lagged behind other wages; in 1998 the wage fall amounted to 30% relative to the average wage rate (Matthews et al.). The fall in wages is partly the result of deployment of minibuses on lightly used routes. Drivers of minibuses earn much lower wages than their colleagues on the large buses. Replacing large buses by minibuses also reduces maintenance costs, because minibuses do not need heavy maintenance facilities (Heseltine et al.). Apart from cost reduction, a real fare increase was observed in the metropolitan areas. Directly after introduction of deregulation the fares increased by 20-25%, in the years after they continued to increase at a higher rate than they did before 1985 (Fairhurst et al., 1996). Outside the metropolitan areas fares increased only slightly.

Generally, the British outcomes support the Dutch result that urban transport will be more affected than regional transport. However, in more detail, they show many differences from the Dutch estimates. Looking at the cost side, the differences can be explained by assumptions that are made in the Dutch study. First, in the latter a constant number of bus drivers per vehicle hour is assumed as well as a constant ratio between drivers and non-platform staff. Productivity can only be raised by increasing operating speed. Substantial speed increases have been achieved in particular in the User scenario. Second, a maximum real wage reduction of 10% was assumed. Third, no analyses are performed with varying bus capacity. One could wonder, whether minibuses would have been introduced in the assumed Dutch situation where a) a large wage cut cannot be achieved and b) there are no services subsidised by the government. Finally, the fare increase is much higher in the Dutch estimations. This can partly be explained by the assumed restraints for cost reduction and partly by a much lower initial fare level in the Netherlands (Commission for integrated transport, 2001).

Level of service

The new policy had different impacts on the service quality in the UK. Bus kilometres increased substantially. In 1988/89 the increase was 11% in the metropolitan areas and even 24% in the English shires (White, 1990). However, timetable co-ordination between companies serving the same route to even out frequencies stopped; this might have reduced the contribution of more bus kilometres to service quality. Similarly, the integration with rail was converted into competition. Bus companies refrained from performing a feeder role to the local rail network and started services parallel to the rail routes (Tyson, 1990).

The observed increase in bus kilometres is opposite to the Dutch outcomes. In both scenarios substantial decreases in both urban and regional bus km are foreseen, ranging from 15% for the regional services in the User scenario to 70% for both bus systems in the Yield scenario. Presumably, the main explanation for the differences is that the observed increase in the UK is induced by on-road competition, not assumed in the Dutch analyses. Other possible explanations are the added services parallel to rail routes in the UK and the ignored deployment of minibuses in the Dutch case. Suspension of co-ordination between bus operators and integration with the rail network are not assumed in the Dutch analyses as well. They may also be related to the deregulation policy.

Demand

The impact on demand in the UK seems to be negative. Demand for bus transport was declining in the 1970's, but the decline was converted into a small increase in the early 80's. After introduction of the new policy again a long term decline of demand has been observed. In the metropolitan areas the reduction in bus patronage was 16% three years after deregulation, 25% five years after, 38% ten years after and 45% 16 years after. The figures for the English shires are a 7% fall in demand three years after deregulation and 23% 16 years after (White, 1990, Matthews et al., 2001, Balcombe et al., 2004). Estimates of travel demand assuming continuation of the old policy produced substantial higher figures. White (1990) predicted a 6% higher demand outside London in 1988/89 (12% in the metropolitan areas), Fairhurst et al. (1996) predicted a 25% higher demand outside London in 1994/95. Taking into account the effect of increased bus mileage, assuming a positive contribution to service quality, the predicted demand by Fairhurst et al. exceeded the observed demand even by nearly 60%.

Despite differences between results regarding fares and service level, the estimated impacts on demand are similar if the UK case is compared to the Dutch User scenario. The Yield scenario features a larger fall in demand. This is close to the UK outcome that includes the effect of increased bus mileage.

Conclusions regarding subsidy suspension

Suspension of subsidies for public transport operation would have strong negative effects on the urban and regional transport supply. The level of service would decline and the fares would increase substantially. As a consequence demand would decrease. The decline of the level of service is the result of much lower network and stop densities, lower frequencies, and more crowded vehicles. The extent of the effects depends on the strategy of the operators for eliminating the deficits. If they focus on offering a high level of service in order to attract more customers, the estimated fall in demand is about 30%. If they focus on cost reduction and earning the highest possible profit, the demand might fall up to 60%. The effects on long distance transport can either be negative or positive, depending on the strategy of the operators. Focusing on profits might lower the level of service seriously. The demand can fall up to 50%. On the other hand, focusing on the attractiveness of public transport might have small positive effects and result in an increase in demand that equals the estimated increase for the situation that granting of subsidies will be continued. The outcomes for the bus systems differ from British experiences after deregulation of local bus services, especially regarding the supply side. The British observations display considerably lower impacts on service level and fares. Nevertheless, the impacts on demand could be similar. A common result is a larger impact on urban transport than on regional/rural transport.

Conclusions/Discussion

The choice for the level of subsidies in public transport is of course a political one and hence cannot be made on the basis of scientific research only. It is clear, that the introduction of entirely free public transport for everybody may score well according to the equity argument to prevent social exclusion, but that it has considerable disadvantages because of rebound effects that make the environmental effects less attractive than anticipated. Also the burden imposed on the tax payer obviously is a negative effect.

There are, however, good arguments for free public transport (or strongly reduced fares) for specific groups such as students and the elderly, especially when this is restricted to off-peak periods when marginal costs are low.

Full suspension of subsidies may have serious impacts on service quality of public transport. In particular in urban and regional transport a considerable decline of services may be expected. Moreover, fares will increase. Subsidy suspension contributes to the social exclusion of low income groups that have no car.

In long distance transport the effects may be moderate. Operation of long distance services is already profitable.

Generally, the impacts of subsidy suspension depend on the strategy of the PT-operators in achieving full cost recovery. If they focus on cost reduction and earning a high profit, the negative consequences are expected to be significantly larger then if they focus on providing a high service level in order to attract more customers and so increase the revenues.

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