PUBLIC FINANCE AND PUBLIC TRANSPORT

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INTRODUCTION

As in most European countries the public transport system in the Netherlands is in need of large governmental grants. These grants accumulate substantially in periods of public transport growth. In exchange for these grants the government has a substantial influence on the performance of public transport companies. The companies have to cope with rather detailed standards of service frequencies, which they have to supply in certain regions at certain times. The national fare structure for city and regional companies is defined on a central governmental level. The national railway company is the only company that has some freedom to differentiate its fares, within a specified range.

As in many other European countries there is a tendency in the Netherlands to a higher level of autonomy in the public transport sector. In order to control public expenditure governments tend to decrease governmental grants. Furthermore, the opinion exists that public transport companies do not get enough incentives to optimalize their effectiveness and efficiency. An important cause for this lack of incentives is the actual grant system. The amount of grants are based on the subsidy of the previous year, adjusted for external changes such as inflation. In this way the (lack of) efficiency of the past is in fact projected into the future. In order to control the grants, the Dutch government decreases the overall public transport budget. All firms have to contribute pro rata, wether efficient or not. This is not satisfactory. An alternative grant formula that meets the disadvantages of the actual system, is developed in this paper.

First we describe the reasons for governmental interference in the public transport system and the different ways to interfere (section 1). The elements that should theoretically be part of an alternative grant system are given in section 2. Section 3 deals with the cost structure of public transport companies. In section 4 the elements are integrated into one grant formula. The effects of an introduction of this grant system on passenger kilometres and on the costs and revenues of public transport companies as well as on the governmental grants (absolute and per passenger kilometre), are described in section 5. Finally, in section 6 the alternative grant system is evaluated and its practical consequences are discussed.

1. Reasons for governmental interference in the public transport system and different ways of interference

1.1. Reasons for governmental interference

There are two important reasons for the government to interfere with the public transport system by the government. The first is the demand for specific infrastructure for some kinds of public transport. Investments in huge infrastructural networks do involve great risks. These risks are caused by the long life of these networks, combined with the fact that only in the long run the revenues will be high enough to pay back the costs of investments. Private companies will be very prudent in investing in these projects, so the (socially) desired infrastructure will not be achieved if the government does not take part in these risks. Specific infrastructure calls for a monopolistic way of exploitation, which has disadvantages for consumers. This can be a reason for the government to interfere with, for example, the fixing of price and with the standards of performance.

A second reason for governmental interference is the 'social interest' of public transport. This 'social interest' consists of three elements:

a. The 'merit good'-character of mobility. Both to social and economic considerations the government is likely to stimulate public transport. Economic considerations are, for example, a better working of the labour market and improved efficiency of city and regional centres. An example of a social reason is mobility for everybody, also for those people that are not able to use private transport.

b. Distributional reasons. In addition to the first element, this one points to equal mobility rights for everybody at reasonable prices.

c. A reduction of negative externalities caused by private transport like car use. Examples are relief of traffic congestion, reduction of accidental costs and reduction of pollution.

1.2. Different ways of governmental interference

In order to stimulate the use of public transport the government can subsidize public transport, levy taxes on the competitive transport modes, i.e. private car use, or imply fiscal measures (the real overall costs of public transport can be compensated by tax-reductions for the users). In this paper we will focus on subsidies to the public transport system.

Thinking of manners in which the government can subsidize public transport we distinguish two main directions:

- give a grant to reduce the costs of public transport;
- give a grant to increase the income of public transport systems.

In both systems an ex-ante and an ex-post application is possible. In an ex-ante

situation a grant agreement is stated in advance, in an ex-post application the grant is fixed depending on the annual earnings. In general one could state that an ex-ante grant gives more incentives than an ex-post grant, but on the other hand an ex-post grant makes it possible to consider special events or circumstances. Another important decision is wether a general grant or a grant differentiated to specific input or output elements will be chosen. A differentiated subsidy generates a more fine tuned control system, but is on the other hand more complicated and expensive.

The selection between cost- and output grants depends on optimal allocation and price setting. Granting at the input side, combined with (more) freedom of the transport companies in fare policy is an incentive for a more market-oriented performance of the transport firms. The problem with granting at the input-side, thus at the means of production, is that it can disturb the market's invisible hand. This might lead to a reduced cost- or efficiency-awareness. When labour or energy are not priced at a normal market level they might be abused.

Granting at the output side, on the other hand, can disturb the fare setting. The reasons for governmental influence on public transport as discussed in the previous section, are output oriented. The main goal is not to make public transport profitable but to increase the performance (output) of this beneficial system up to an agreable social quality and cost level. In section 5 we will indicate how the government can control the price setting of monopolistic public transport companies.

2. ELEMENTS OF AN ALTERNATIVE GRANT FORMULA

As described in section 1, the main reasons for the government to stimulate public transport are to reduce the externalities and to offer transport possibilities to people who are not able to use private transport. Furthermore, the government wants to stimulate the efficiency and the effectiveness of the transport system. However, a major constraint is the public expenditure control.

The reasons for stimulating public transport, the governmental constraint and disadvantages of the actual grant system, as described in section 1, lead to the development of an alternative grant system. This grant system should be simple and easily applicable. A too complicated formula could easily lead to decreased freedom for transport companies.

The grant formula will be described in section 4. Theoretically the grant system should consist of the following elements:

a. The first element of the grant system is a compensation for the economic disadvantages of the by the central or local government desired level of supply of public transport . This compensation should be dependent on local or regional circumstances such as the population rate, the service area, the ratio between passenger kilometres in peak and in non-peak hours etc. This compensation isneede

because the market mechanism does not necessarily lead to a socially adequate supply of public transport. In a small rural village with a low population density a bus company can not compete with private car use like a bus company in an urban area with much congestion.

b. The second element of the grant system is an incentive to raise the performance of public transport companies. The grant is dependent on a performance unit, like passenger kilometres. Because of a difference in social valuation of a passenger kilometre in for example peak and non-peak hours or in more and less populated areas, the compensation per kilometre can be differentiated (for example a higher compensation per passenger kilometre in peak-hours than in non-peak hours).

c. The third element is an incentive to raise efficiency. Efficiency indicators are the occupancy degree (see also d.) or the velocity of circulation.

d. The fourth element is an incentive to raise quality. The occupancy degree is not only an efficiency but also a quality indicator. Therefore, a desired occupancy degree can be fixed, low enough to guarantee an adequate quality and high enough to meet efficiency requirements. The desired occupancy degree can be differentiated for peak and non-peak hours.

e. The fifth element is a maximum grant (absolute or per passenger kilometre), in order to meet the government's constraint to control public expenditures.

The grant system should disturb the internal account structure of the public transport companies as little as possible. This implicates that we have to consider the production and cost structure before implementing the elements of the grant formula mentioned above.

3. THE COST STRUCTURE OF A PUBLIC TRANSPORT FIRM

An essential point for the construction of a grant formula is knowledge of the cost structure of public transport firms. The rate of fixed and variable costs is the most important factor for changing costs in situations of increasing or decreasing production. In a situation of slight growth of the performance within the existing infrastructural and rolling stock capacity, fixed costs do not have to increase. A substantial increasing demand, however, will need a large investment to adjust capacity. In this case not only the variable costs but also the fixed costs will rise. On the other hand, in situations of diminishing demand it is not possible to reduce the fixed costs quickly. In general, used transport technic (bus, trolley, tramway, lightrail, heavy rail) determines the degree of fixed costs. The heavier and more specific the infrastructure and rolling stock, the larger the investments in infrastructure and subsequently the fixed costs.

An additional and important factor that determines the dynamics of costs is the way demand for public transport is spread over periods of the day, days of the week and months of the year. The less equal the demand the higher the costs per passenger kilometre.

In this section we will illustrate the cost structure of transport firms by a fictive example of a public transport firm. The productional and financial data are in a sense simplified but not unrealistic. In table 1 we present the underlying assumptions for a basic year.

Table 1: The production and cost structure of a public transport firm

VARIABLE	AMOUNT	UNIT	CAUSES OF CHANGES
peak production (a)	5,500	seatkm	(c/a) and (L/H) last year
off peak production (b)	25,000	seatkm	(a)
peak demand (c)	4,000	passenger km	(E)
off peak demand (d)	6,000	passenger km	(F)
peak rate (c/(c+d))	0.40		
occupancy rate p (c/a)	0.73		
occupancy rate op (d/b)	0.24		
id. average (c+d)/(a+b)	0.33		
peak fare (E)	18.0	cents/km	price policy
off peak fare (F)	10.0	cents/km	price policy
total fare box (G)	1,320	money	fare and demand
production costs (H)	3,575	money	production and demand
negative result (I)	2,255	money	
covering rate (J)	0.369		
GRANT (K)	2,325	money	see next section
net result (L)	70	money	
average grant (K)/(c+d)	23.3	cents/km	

The capacity needed in peak hours is essential for the production and cost

structure is. Even in this period the demand is not equally spreaded over the network, so a theoretical occupancy rate of 100% is not feasible without the possibility of some overcrowded lines. A growing demand in the peak period at an occupancy rate of for example 70 or 80 percent makes an increase of capacity necessary. Marginal costs of additional seat kilometres in peak hours are so high that peak demand is the major determinant of the total cost level. The marginal costs in the off-peak hour are only a fraction of the marginal peak hour costs. The firm will therefore try to provide a high level of service in off-peak hours as long as fare revenues cover marginal costs. The frequency levels in periods between peak hours and during evenings are only slightly lower than in peak hours. In our example we have assumed that growth of the peak production is dependent on the net result of the previous year (the ability to invest) and the occupancy rate in the same year (the need to invest). The production in the off-peak hours is thereupon dependent on increased capacity during peak hours.

In our example the marginal costs in the peak hours are about 7 times higher than during off-peak hours. To cover these high marginal costs the firm is able to collect substantial higher fares in peak hours than in off-peak periods. This is possible for the reason that demand in peak hours is not very price-elastic due to a lack of alternatives. Congestion problems make private car use not very attractive. However a 7 times higher fare level is not possible. Postponement of capacity growth is not a real option too, because when the occupancy rate gets too high, the perception of the service will decrease, and this might be a more decisive cause of decreasing demand than the fare level.

In our firm the fares in peak hour are assumed to be 80% higher than off-peak hour fares. In the off-peak hours the fares can not compensate the marginal losses of the peak production because the competition of private car use is stronger and the target groups of this service (scholars, aged people) do have less purchasing power.

Thus although the off peak fares can cover the marginal costs of the off peak production, they can by far not compensate the losses of the peak hours. A governmental grant is needed to maintain the public transport service on the existing level, in reference to the social benefits mentioned in section 1. In the next section we will suggest a grant formula based on the cost structure of transport firms and governmental policy on public transport use instead of private car use.

4. TOWARDS A DIFFERENTIAL GOVERNMENTAL GRANT

An alternative grant formula is developed based on a simple model for a specific public transport company. This model is subsequently based on the so-called FINOV-model (Financial forecasting model on public transport), developed at the Institute for Research on Public Expenditure in the Netherlands. In the

FINOV-model demographic and economic developments, changes in traffic policy, efficiency developments and the influence of different grant systems determine mobility changes in three transport modes (rail transport, regional bus service and urban transport) and the financial results of the public transport companies.

The first element of the grant formula mentioned in section 3 is a general amount, in which local circumstances are compensated. In our example we have used population density as a parameter. The higher the density, the better public transport can compete with private transport, thus the lower the governmental grant can be.

If the second element of the governmental grant to the transport firm would be general, the firm would not get internal incentives to extend peak hour production as long as marginal income does not cover marginal costs. In order to stimulate specifically the peak hour production of public transport firms, for instance because of the huge congestion problems of private car use during those hours, the grant should be differentiated to peak- and off-peak performance. The peak hour grant should be just just as high as to compensate to the gap between the marginal costs and the marginal fare income of the firm, in order to stimulate peak production at a competitive price.

Although in the off-peak hours marginal fares can cover marginal costs, granting the performance of this service is also interesting for the government. Stimulating public transport in off peak hours can lead to a more efficient use of the total transport system. The mobility of groups with less purchasing power such as students, unemployed and aged people can for instance be stimulated. And although congestion in the off peak hours might be less problematic, the externalities of car use can also be reduced in the off-peak hours by providing a frequent, high levelled service at attractive fares. All this all can justify a passenger kilometre premium which should however be at a much lower level than for transport during peak hours.

A possible risk of grants is that the firm considers the governmental grants too much as an easy way to get money. A lack of incentives can lead to less cost awareness and efficiency losses. If this happens it is not the production (provision of service) that should be subsidized but the performance in passenger kilometres instead. This will lead to a much more customer friendly behaviour of the firm and gives in a kind of quality-guarantee as well.

A standard occupancy rate embodies both an efficiency incentive (element 3) and a quality incentive (element 4). A certain occupancy rate is assumed to be a reasonable average between a level where the occupancy gets so high, that customers are pushed back to their cars, and a level that is so low that one can speak of waste of capacity. This standard occupancy rate should be higher at peak hours, because of the less elastic demand for quality during this hours. The risk of spillover capacity during off-peak hours is much lower for off-peak production can be seen as a profitable use of overcapacity. set by the neceessary peak capacity.

Control of the total amount of grants (element 5) is very important for the government but unfortunately hard to combine with the wish to give real incentives. Fixing an absolute grant ceiling is not preferable, because this undermines the policy of transport firms to reach the optimum of grants, fares and costs. Therefore, the government has to bear a certain risk. In the long run the government is of course free to change the amount per (extra) passenger kilometre (one could see this as a 'public fare' per kilometre, dependent on the quality and efficiency performance). Similarly, the transport firms have to decide every year about the price fixing to their (other) consumers. By changing the kilometre premium periodically, the government is able to stimulate transport firms to choose a more market-oriented fare-structure or to reduce the costs of public transport service and the government can control its own expenditures on public transport.

The grant formula composed above can be described by:

$$K = X (1 - pd) + @ * c * (c/a)/Y + \# * d * (d/b)/Z$$

X = basic amount depending on local circumstances such as population density (pd)
@ = premium per passenger kilometre in peak hours
Y = standard occupancy rate in peak hours (0.70)
# = premium per passenger kilometre in off peak hours
Z = standard occupancy rate in off peak hours (0.40)

In the next section we will illustrate how this grant formula works and how the government is able to acts upon the fare setting of public transport firms.

5. THE EFFECTS OF THE GRANT FORMULA IN PRACTICE

In table 1 we have presented the data in basic year 0. In that year the occupancy rate in peak hours is higher than the standard. The peak hour grant per kilometre is thus about 4% lower than it would be at the standard level. The net result is however positive, so the firm is able to invest in capacity in order to reduce the occupancy degree. To raise its result, the firm also decides to increase the peak fares. As the demand is rather inelastic only a slight decreasing demand is expected, and the service level will increase. The off-peak demand should be stimulated because the occupancy degree is rather low
compared with the standard. Therefore the governmental premium does not operate at its maximum. The firm decides to lower its off-peak fares in order to attract new passengers to occupy overcapacity.

This policy leads to a better result in the next year as we can see in figure 1. Because of this and also because of the still too high occupancy degree during peak hours and too low occupancy degree off peak hours, the firm decides to continue this policy. Until year 3 this will be profitable. The net results and the total demand

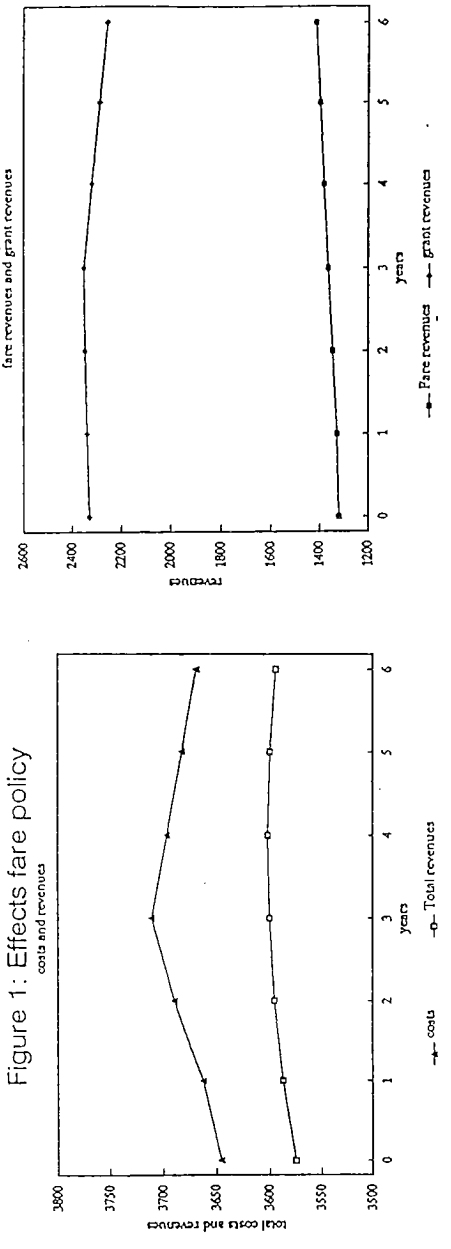
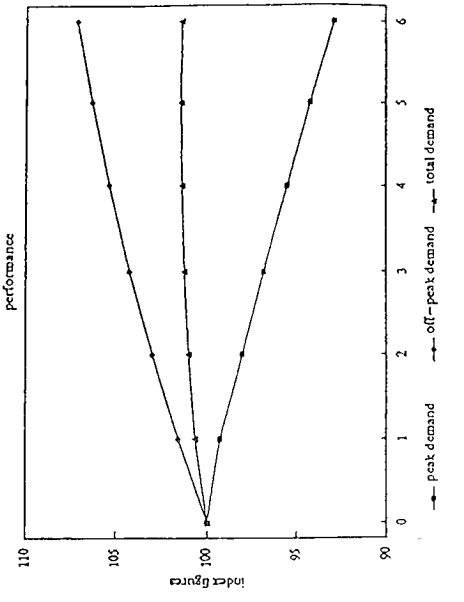
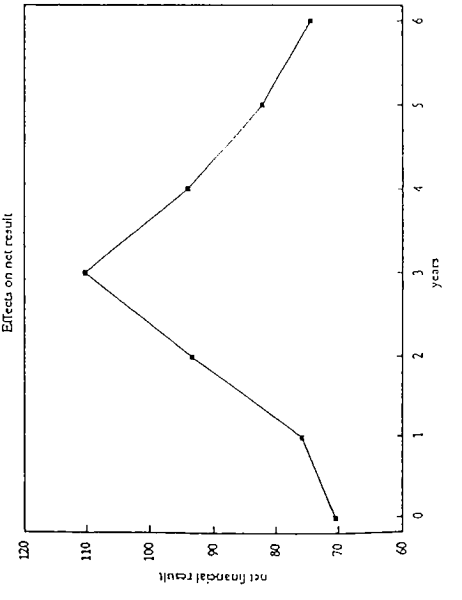


Figure 1: Effects fare policy





both will increase. However, after year the peak occupancy rate will fall below the standard. The fare increase for peak hours now would cause a further decreasing demand and thus a further decline of the occupancy rate. The extra fare revenues per passenger kilometre cannot compensate for the decreasing grant per passenger kilometre. An optimum result and an optimum governmental grant are reached at the same time. In fact the transport firm has to deal with the government as an ordinary customer with his own preferences at a certain price.
The government notices that the covering rate has increased (a higher efficiency level is reached) and that total performance has also increased. The peak hour performance however has decreased. This does not coordinate with a important goal of the government. Although the efficiency has increased, the contribution to the solution of congestion in peak hours of this particular firm is negative. The incentives to the peak hour production should thus be intensified. The peak passenger kilometres have to become relatively more profitable, even in a situation of growing demand. The firm is able to attract passengers by lower fares and growing supply (quantitative and/or qualitative). The government can try to influence the firm's price fixing by increasing its premium on peak performance. In order to prevent an overall increase of the governmental expenses on public transport, the basic amount can be cut or the premium on the off-peak production can be reduced comparably. The choice between those two options depends on whether the government wants to stimulate the off peak performance or not.

6. EVALUATION OF THE ALTERNATIVE GRANT SYSTEM

The example shows that in this alternative grant system the government acts in a way as a market party who expresses his preferences and willingness to pay for public services. The difference with the actual situation in for instance the Netherlands is, that efficiency and actual performance that are in accordance with social targets are rewarded instead of shortages in the past.

The system has its difficulties too. First off all there is the necessity of rather detailed data on the performance of public transport firms. The actual registration system does not provide data like occupancy degrees. It is however possible to collect these data by taking samples at random or, in the future, by more advanced ticket systems like chip cards.
Another problem that is not to avoide, is the tension between transportation goals and financial goals. The government is continually able to change its priorities and is therefore a not always reliable. This is, however, also the case for the other market parties (the passengers). The transport companies are only able to reduce these kinds of risk by trying to decrease there relative dependence of one dominant client. A qualitative and quantitative good level of service is the best option for that purpose.
Another problem might be the introduction of a differentiated grant system as

described above. The public transport firms are accustomed to the actual system and might be confrontated with substantial changes in the amount of grant in the new system. A possible solution for this temporary problem could be an introduction in stages. In the first stage the share of the first element of the grant (determined by the local circumstances) could be relatively high. In the following stages the share of the grant that depends on the quantitative and qualitative performance could be increased step by step, in order to give the companies a chance to get accustomed to the new system.

Finally it is worthwhile to consider that not only risks but also new oppotunities are involved with the alternative system. One of these opportunities is the larger degree of freedom for the companies, compared to the present situation.