Ministry of Infrastructure and Water Management

Pricing tools: better as a package?

How pricing and other tools influence the choice for public transport

KiM | Netherlands Institute for Transport Policy Analysis

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Summary

Lowering public transport fares is not an effective measure for encouraging people to switch from car to public transport. Lower fares mainly lead to new trips and only to a limited extent encourage the switch from car to public transport. In addition, lower fares lead to less cycling and walking.

Introducing a flat rate fare reduction, whereby fares are reduced for everyone at any time, does increase the use of public transport. However, around 78% of that rise in public transport use is the result of extra mobility. If a pricing tool is introduced, that is differentiated according to time or focused on specific target groups, this share rises to 87%. In the most favourable scenario (with a flat rate reduction), 12% of the growth in public transport mobility comes from trips by car drivers and 6% from car passengers. Furthermore, the effect on car use is less significant, in relative terms, than on public transport use, because the scale of car mobility in the Netherlands is around five times that of public transport mobility. If public transport use were to increase by 25% as a result of fare reductions, the resultant fall in car use would be just 1%.

Irrespective of the tools employed, it is not possible to make the switch to public transport for many car trips. There are various situations in which public transport is not an alternative for the car. These include some car trips in non-urban areas and trips at night. On the other hand, there are situations in which a shift might work, such as car trips within urban areas or relatively long trips (>50 km) between urban areas.

A study of literature reveals that a combination of measures is more effective in bringing about a shift from car use to public transport use than focusing exclusively on pricing tools. Such measures might include making car use less attractive by means of a parking policy or a km charge and making public transport more attractive by reducing fares or by improving service and quality.

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1 Achievable shifts from car to public transport

Cheaper public transport results in more public transport use, but only to a limited extent helps reduce car use. This is due to the relatively limited scale of public transport use as compared with car use, because for a large proportion of car users, public transport is currently not an option and because cheaper public transport mainly results in new mobility.

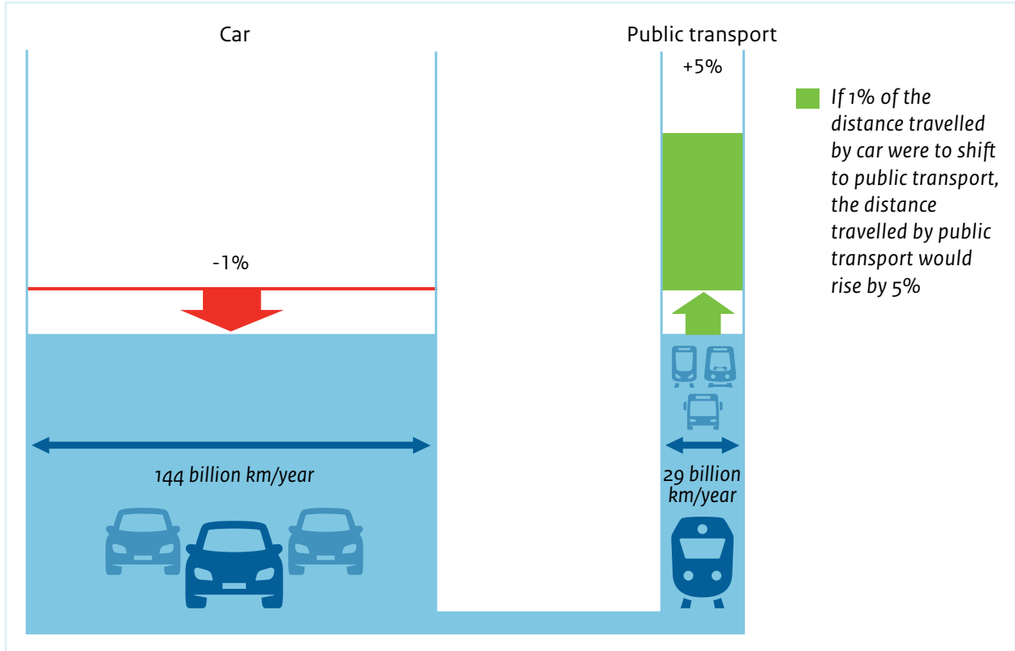


Figure 1 *Comparison of distance travelled by car and public transport in the Netherlands (Source: ODiN 2019)*

25% more public transport use due to lower fares would result in just 1% less car use

In 2019, Dutch people travelled five times further by car than by public transport. This means that if we were able to encourage car drivers to use public transport for 1% of their car kilometres by introducing lower fares, in theory public transport would have to facilitate 5% more use (see Figure 1). If those travellers were partly to travel during rush hour, the capacity of public transport would soon have to be expanded. Additional capacity will also have to be created because as already suggested, lower public transport fares not only result in a shift from car to public transport use but also to a considerable volume of new public transport mobility. Moreover, lower fares encourage people to shift from walking or cycling to using public transport. As a consequence, a pricing measure that causes a 1% shift from car use to public transport would not result in 5% more public transport use but an estimated 25% more public transport use (see Figure 2). The extent to which public transport can contribute to less car use is therefore limited. In chapter 2, we will discuss these shifts between modes of transport as a result of pricing measures, in more detail.

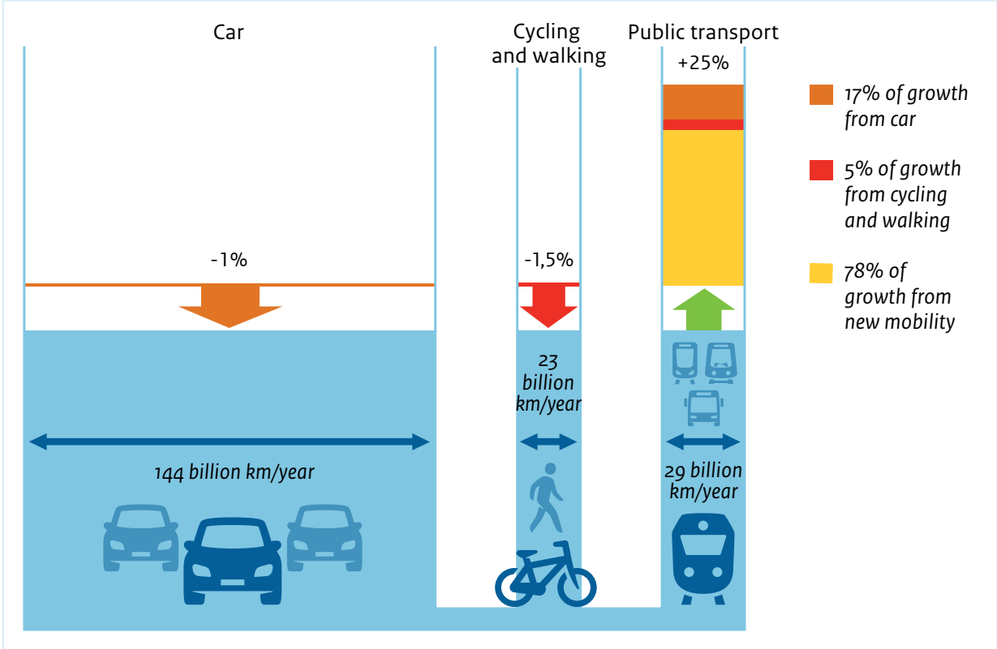


Figure 2 *Effect of pricing measure that generates 25% growth in the distance travelled by public transport (Source: ODiN 2019)*

Public transport is not an alternative for all car drivers

Public transport is only a viable alternative for the car at specific locations and for specific traveller segments. Around one third of Dutch people have access to frequent city or local transport services and a station near to their home environment. If the trip destination is also accessible by public transport, it becomes possible to use public transport instead of the car. However, for the majority of these trips, travel times by public transport are substantially longer than by car (generally more than twice as long).

For 12% of all car trips, the travel time by public transport would be less than twice as long. For just 2% of all car trips this would be less than 1.5 times longer. The longer the distance, the greater the likelihood that public transport offers a relatively acceptable travel time. There is a public transport alternative available for around half of car trips over a distance of at least 50 km, whereby the traveller's travel time would not be more than 2 times as long. For 8% of those car trips, the travel time by public transport would be less than 1.5 times as long. For people travelling late in the evening or at night, the relative travel time by public transport can be even longer than during the daytime. In many cases there is no alternative travel option. Moreover, relatively busy public transport connections (in particular during rush hour) and connections with one or more transfers are less attractive compared with car travel.

In addition to travel time, travel costs is another important factor. If we consider the total cost for the traveller, public transport is often cheaper than the car, even without lower fares. However, car users often ignore the fixed costs of car ownership so that in their perception, there is little difference between the price of public transport and the car, and in certain cases, public transport in fact appears more expensive. If car users travel together, and share the costs, the car is often cheaper than public transport. A passenger is carried on almost one quarter of all car trips. Approximately 10% of car trips involve two or more passengers. For employees with a company lease car, public transport will not quickly become cheaper.

Public transport is not an alternative for people who have difficulty walking/limited mobility. In the Netherlands, 5.7% of women and 3.3% of men aged 12 years and older are unable or barely able to walk 400 m, uninterrupted. This is approximately the distance that as a rule has to be covered by foot for a public transport trip from home, or at the destination. There are also people with a strong preference for the car. They are less likely to switch to public transport. This may be a case of 'unknown makes unloved': people with little experience of public transport generally have a negative view of it.

2% of car trips, 10% of travel distance promising for a shift to public transport

According to our estimates, it is likely that travellers will view public transport as a viable alternative for around 2% of car trips. Because the trips in question are relatively long, this represents 10% of the distance travelled by car (see Figure 3). In these figures, as far as possible, we take account of the already mentioned factors (car trip within or between urban municipalities, a distance of at least 50 km, travel outside rush hour but not at night, no lease car available and a maximum of 1 passenger on board). There will of course be other car trips where public transport is still conceivably an alternative, even if the trip does not fulfil all these factors (for example shorter car trips within cities).

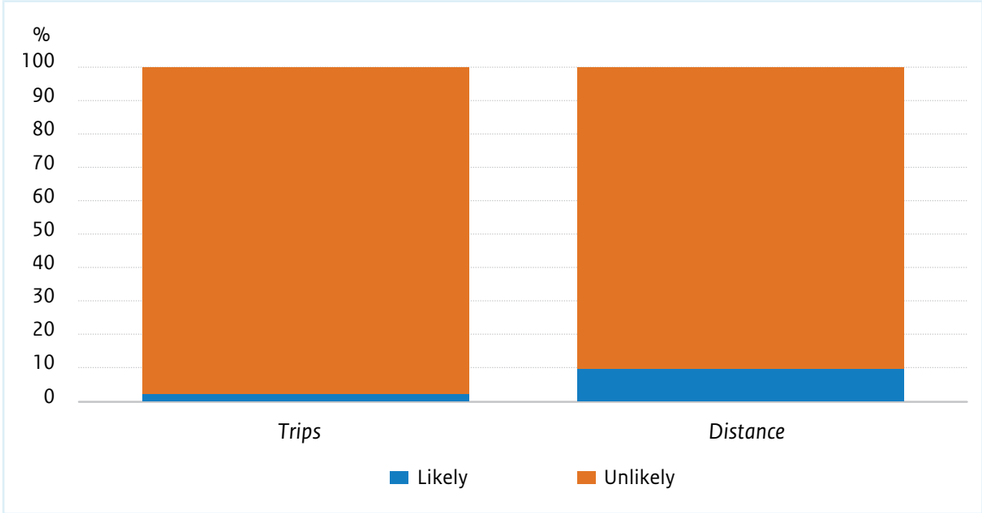


Figure 3 *Proportion of annual trips and distance travelled by car drivers whereby a switch to public transport is or is not likely on the basis of the parameters outlined above (Source: ODiN 2018/2019)*

2 From car to public transport through lower fares?

Lowering the fares for public transport is not the most effective measure for encouraging people to abandon their car. A literature study and an estimate of effects conducted by KiM reveals that lowering public transport fares will only result in a limited shift from car to public transport, while at the same time, trips by bicycle and on foot will be replaced by public transport travel. The greatest effect of lowering public transport fares is an increase in public transport mobility, in the form of additional trips.

Background to the study

In 2022, promoting the use of public transport by reducing fares is a subject of much discussion, both in the Netherlands and abroad. In a response to the motion submitted by members Boulakjar and De Hoop, the State Secretary of Infrastructure and Water Management promised the Dutch House of Representatives to analyse which pricing and other tools could be deployed to bring about a switch from car to public transport. KiM conducted this analysis into pricing tools in public transport, to determine whether such tools could be effective in the Netherlands in promoting the use of public transport. The central focus of our study is a shift from car to public transport and not simply generating new mobility by public transport, or a rise in public transport use at the expense of cycling or walking.

Lower fares will mainly encourage new mobility

Following the introduction of a flat rate fare reduction whereby fares are reduced for everyone at all times, around 78% of the increase in public transport use will be generated by additional mobility (see Table 1). In the event of differentiated price tools according to time, or for the specific target groups for which we conducted the necessary calculations, this share in fact increases to 87%.

Table 1 *Effects on public transport use of various pricing tools (estimate on the basis of ODiN 2018/2019 and LMS elasticities)*

Type of pricing tool	Applicable for whom	Applicable when	Fare reduction	Growth in public transport use due to new trips	Change in mode of transport (relative change in distance travelled in %)							Impact on CO_2 emissions
					Train	Bus	Tram/metro	Car (driver)	Car (passenger)	Bicycle	Walking	
Flat rate	Everyone	Always	Zero rate VAT	78%	4%	2.5%	3%	-0.1%	-0.2%	-0.2%	-0.2%	-0.01 Mtonnes
	Everyone	Always	-40%	78%	21%	12%	13%	-0.6%	-0.8%	-1.2%	-1.0%	-0.05 Mtonnes
Peak and off-peak	Everyone	Off-peak	-40%	79%	14%	8%	9%	-0.4%	-0.7%	-0.7%	-0.7%	-0.02 Mtonnes
	Everyone	Peak/ off-peak	-20% peak, -40% off-peak	78%	18%	10%	11%	-0.5%	-0.8%	-1.0%	-0.9%	-0.03 Mtonnes
Target groups	≤ 25 year	Always	-40%	85%	7%	6%	4%	-0.1%	-0.3%	-0.4%	-0.2%	+0.02 Mtonnes
	≥ 65 year	Always	-40%	81%	3%	1%	2%	-0.1%	-0.1%	-0.1%	-0.2%	-0.003 Mtonnes
	Low income	Always	-40%	87%	1%	1%	2%	-0.0%	-0.0%	-0.1%	-0.1%	-0.003 Mtonnes

In relative terms, the greatest shift from car to public transport is achieved in the event of a flat rate fare reduction. Although in that situation around 78% of the growth in public transport use is generated by new mobility, more than 17% is attributable to car travellers. For effects on congestion and sustainability, a shift from car drivers to public transport is particularly relevant, and amounts to around 12% (see Figure 4). It is essential to realise that these results are subject to uncertainty. This is an estimate on the basis of elasticities[1] from the National Model System (LMS). This approach has a number of limitations, which are discussed in the background report. Despite these limitations, however, we assume that these results give a sound indication of the expected effects, because the relevant literature and experiences with fare reductions in the Netherlands and abroad also show similar effects.

With these results, it is also important to realise that a considerable growth in public transport use could also have negative effects. If the current public transport system is unable to accommodate the growth in demand, it is probable that the additional traveller numbers will cause a proportion of public transport travellers to go in search of alternatives. A number of them may well opt for the car as an alternative, for example because as a result of increased traveller numbers they no longer have (or are unable to secure) a seat and are no longer able to work while travelling by public transport. Because these capacity problems are likely to first manifest themselves in peak hours, it could be meaningful to introduce tools that result in a better traveller spread, across the day. Possibilities include fare differentiation according to time and space, whereby avoiding busy routes during peak hours is encouraged.

1 *An elasticity expresses the sensitivity of one quantity (for example public transport use) to changes in another quantity (for example the level of public transport fares).*

Limited impact on CO_2 emissions

Due to the limited substitution of car use (by drivers), the impact on CO_2 emissions will also be very limited. Although the train, tram and metro in the Netherlands are powered by green electricity, the increased use of buses will at present result in an increase in CO_2 emissions. Estimates suggest that the impact on CO_2 emissions of the various pricing tools from Table 1 will range from a fall of 0.05 Mtonnes per year with a flat rate fare reduction of 40%, to an increase of 0.02 Mtonnes in the event of a price reduction of 40% for travellers up to the age of 25 years. By way of illustration, in 2019, total CO_2 emissions from passenger cars amounted to around 17.9 Mtonnes.

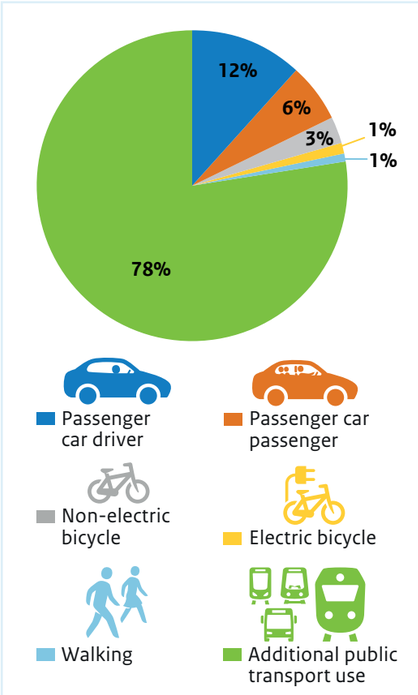


Figure 4 *Origin of increased public transport use in the event of a flat rate reduction in public transport fares*

Experiences in the Netherlands and abroad all point in the same direction

On the basis of past experience of the introduction of cheaper or free public transport in the Netherlands and abroad, we conclude that these tools primarily result in a rise in public transport use due to new mobility. A recent example of this phenomenon can be found in Germany, where in the months June through to August 2022, travellers were offered the opportunity of unlimited travel by public transport for €9 per month (with the exception of long-distance trains). During these months, public transport use rose considerably but the effect on car use appeared limited (see block).

On the basis of the literature, it appears that a combination of measures is more effective in bringing about a shift from car to public transport, whereby on the one hand the car is made less attractive and public transport more attractive. We discuss this in more detail in chapter 3.

Illustrative case: public transport for 9 euros per month in Germany

By way of compensation for rising energy costs as a result of the Ukraine war, on 1 June 2022, the German government introduced a scheme according to which everyone (not just German residents) could make unlimited use of public transport for the symbolic amount of 9 euros per month (for 3 months), with the exception of intercity trains and long-distance buses. The scheme proved extremely popular: between June and September, 52 million tickets were sold. The scheme cost the German government around 2.5 billion euros.

The German trial with almost free public transport resulted in the first month in 42% more train travel than in June 2019. There was also a small reduction in car traffic, in particular for trips of more than 100 km.

However, there is no consensus on the precise effect on car use in the currently available evaluations of this scheme. The German association of public transport companies VDV concludes that around 10% of ticket holders undertook 1 fewer car trip per day. Research by the University of Berlin, however, suggests that the substitution of the car was of an order of magnitude of around 3%. Local studies among travellers in Munich revealed that 35% of travellers had opted more frequently to travel by bus, but that just 3% of them made less use of their car as a consequence. Although the outcomes of these evaluations do not match precisely, it is clear that the measure in Germany did lead to a large volume of new mobility.

Since the scheme was halted on 1 September, public transport use has declined considerably. There appears also to be no further decline in car use. It appears therefore that the scheme did not result in any structural switch from car to public transport. Real clarity will however be achieved following a definitive evaluation of the scheme.

3 Other tools besides lower fares

Pricing tools influence the direct cost (paid by the traveller) for a trip. However, the actual choice for a mode of transport is the result of a combination of factors. Because other factors besides cost also play a role, pricing tools need not be the most effective choice when it comes to shifting from car use to public transport use. Various tools could be deployed to make public transport more attractive (pull measures) or to make car use less attractive (push measures).

Cost and travel time but also comfort determine the choice

The choice of mode of transport is the result of a combination of factors. For example personal characteristics (income, work situation, etc.), ownership of modes of transport, cost (of public transport and alternative modes of transport) and the spatial environment. Subjective factors also play a role, such as the specific preference for a particular mode of transport (for example for the mode of transport with which the traveller is most familiar) or the value the traveller attaches to a particular travel characteristic. For example, not everyone considers travel time to be equally important, because people can work as they travel, on condition they have a seat. Not every mode of transport has the same travel characteristics: with public transport, for example, generally speaking, transport to and from the public transport departure point is required, while with car travel it is sometimes necessary to pay for parking or to search for a parking space. Roughly speaking, these factors can be classified as out-of-pocket (direct) costs, public transport travel time, public transport comfort, travel to and from the public transport departure point and the out-of-pocket costs, travel time and comfort of alternatives.

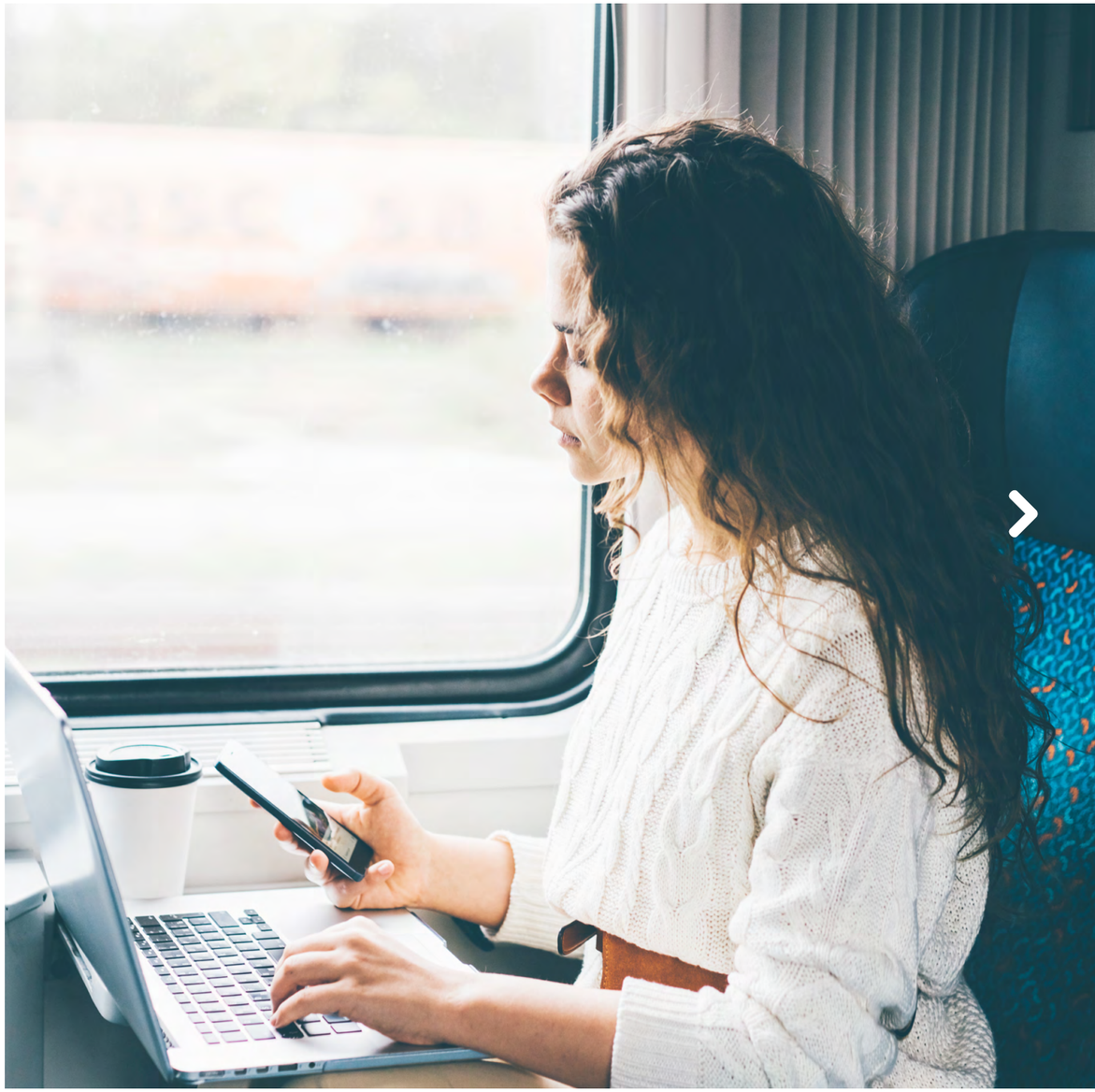


Table 2 provides an overview of a number of pull and push tools, and the travel characteristics that they influence. It must be noted that a large proportion of our daily mobility can be classified as habitual behaviour. This means that for a large proportion of their trips, people do not make a conscious decision for a particular mode of transport, but instead opt for the mode of transport they always use. In addition, certain decisions regarding travel behaviour are not taken from one day to the next, for example car ownership. As a consequence, changing travel behaviour can prove difficult, particularly in the shorter term.

Push and pull measures to influence the choice

A number of the factors that help determine our choice for a particular mode of transport can be influenced by policy-based measures. A distinction can be made between factors that can be influenced in the short term (such as parking charges or public transport fares) and longer-term factors (such as the layout of the spatial environment).

It is important to realise that making car use less attractive will not necessarily immediately result in a switch from car to public transport. After all, car users may start to travel less often, decide to travel together or opt for a different mode of transport, such as cycling or walking.

Table 2 *Overview of tools and effects on travel characteristics*

	Out-of-pocket costs public transport	Travel time public transport	Comfort public transport	Access and egress public transport	Out-of-pocket costs alternative	Travel time alternative	Comfort alternative
Free public transport	√			√			
Cheaper public transport	√			√			
Public transport incentive programmes	√		√				
Better quality public transport		√	√	√			
Tax incentives for public transport use	√				√		
Kilometre charge passenger cars					√		
Congestion and peak time charges					√		
Urban cordon charges					√		
Parking policy					√	√	√
Fuel excise duties					√		
Car taxes (motor vehicle tax, bpm tax)					√		
Reducing/scrapping car commuting allowance					√		

Effects of other tools

In a literature study, we examined the effects of other tools besides pricing tools employed currently or in the past in the Netherlands and abroad.

Pull measures such as organising incentive programmes (rewarding travellers for demonstrating particular behaviour) and improving the quality of public transport could result in increased public transport use, but there has not yet been sufficient research into the specific effects on public transport use and car use.

A national, flat rate kilometre charge for car use (Pay per Use) could result in a decline in car use and limited growth in public transport use. If Pay per Use only applies at set times, as with a rush hour or congestion charge, no effect on public transport use is expected. Raising the level of fuel excise duties will result in a decline in car use and limited growth in public transport use, as will the scrapping of the commuting allowance, for the car.

Without further research, it is not possible to determine the effects of other push measures on car use and public transport use. Possible examples are an urban cordon charge, parking policy measures and higher motor vehicle tax.

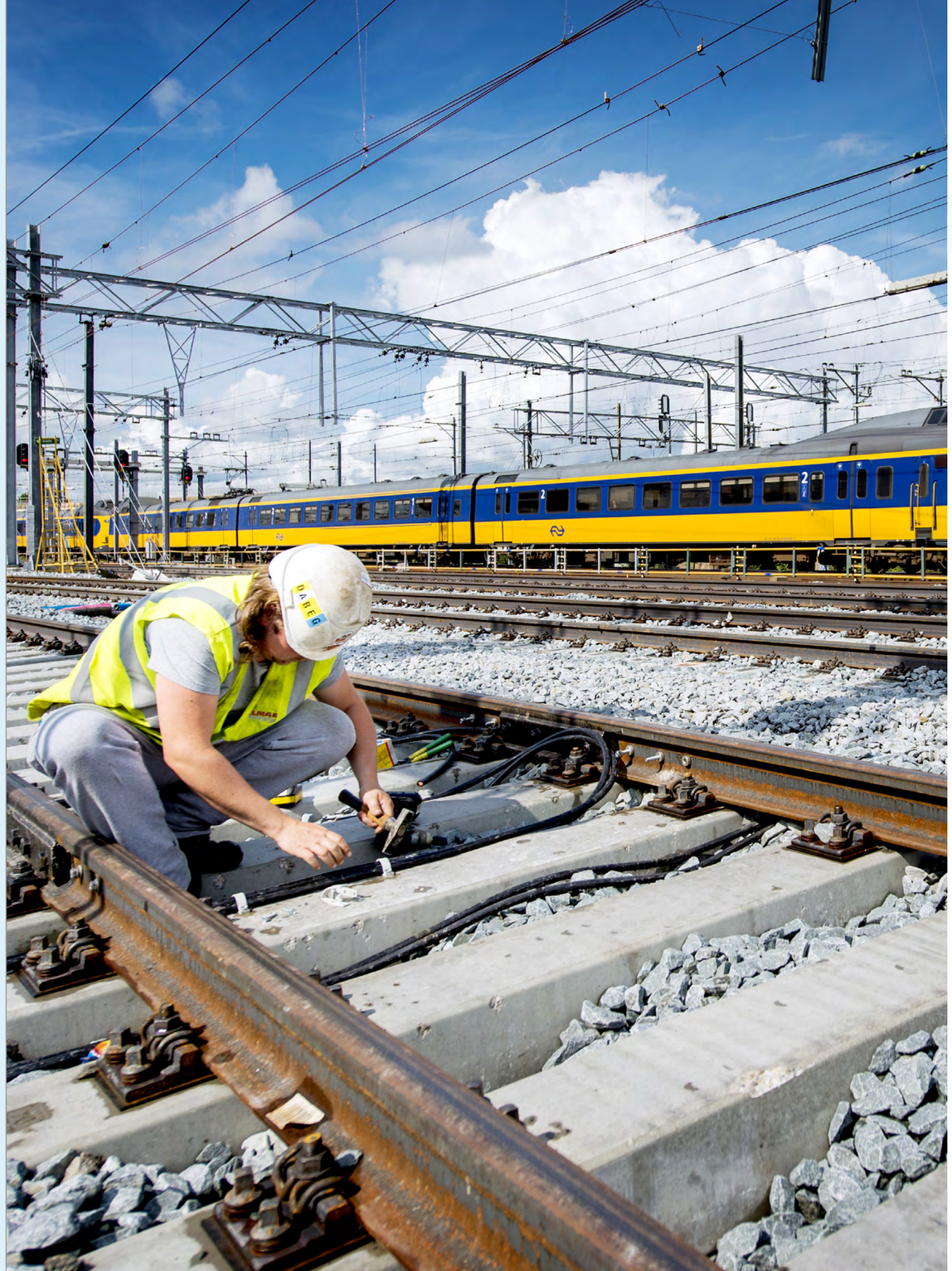
Combination of measures is more effective than individual measures

Based on our literature study, a combination of measures appears more effective than individual measures in bringing about a shift from car use to public transport use, as in the example of Tallinn (see block). By making the car less attractive (for example through parking policy, higher taxes and a kilometre charge) and making public transport more attractive (possibly not only by reducing fares but also by improving service and quality), a greater effect on car use is expected, than if the only measure introduced is lower public transport fares.

Illustrative case: Tallinn, Estonia

Since 1 January 2013, Tallinn has been offering free public transport as a means of encouraging more sustainable mobility and to improve the mobility of jobseekers and people with low incomes. Before the introduction of the measure, 60% of travellers were already exempt from paying charges (the elderly and children) or enjoyed reduced fares (students and people with low incomes). In addition to free public transport, the space for cars on the road was reduced and parking charges increased. In other words, a combination of push and pull measures.

Studies suggest that 1 year following the introduction of free public transport, public transport use had risen by 14% and that mobility among residents with low incomes had risen. The number of trips by foot fell by 40%, while the average distance of pedestrian trips remained the same. This suggests that more people had replaced their pedestrian trips by public transport travel. At the same time, the number of car trips fell by 5%. The policy in Tallinn also meant that car drivers in fact changed their destination, resulting in a net increase in the distance travelled by car of 31%. Unexpected side effects like these show that influencing travel behaviour by (a combination of) push and pull measures can be effective, but remains extremely complex.



4 Who has to take initiative?

In this study, we have discussed a large number of tools aimed at bringing about a shift from car to public transport. If the decision is taken to actually start implementation, the question is who is responsible for doing so. The answer varies depending on the tool in question and relates closely to the question whether the tool is a matter of public transport pricing, national legislation and regulations or local policy. The way in which public transport is organised and who is authorised to do what also varies widely from country to country. As a consequence, measures taken abroad with the aim of shifting more travellers onto public transport are not always automatically transferrable to the Netherlands.

Within Dutch public transport, local governments have a degree of pricing freedom, which they in turn sometimes delegate to the transport operators. However, local governments do establish agreements on a number of fares within the National Pricing Framework (LTK), such as the basic fare and national season tickets for urban and regional transport. Local trains and buses, trams and underground trains are already partially subsidised by government. The average subsidy rate per traveller kilometre is currently highest for buses at 45%. In many cases, free or cheaper public transport would probably have to be financed by governments. If the transport operators themselves were required to bear the fall in income, it could have negative consequences for the quality or coverage of the public transport network.

PRICING TOOLS: BETTER AS A PACKAGE?

The responsibility for other pull measures can vary. The quality of public transport could be improved through various measures. For example improved service or better facilities at stations and in the vehicle. Grantors could arrange improved services in a new concession or by introducing a degree of open access. Improving facilities on stations and in the vehicle will probably have to be initiated by the infrastructure manager, and the transport operator. When it comes to expanding the infrastructure, the infrastructure manager is responsible. Making public transport use more fiscally attractive is typically a task for the national government. On the other hand, transport operators themselves often introduce incentive programmes, as was the case with Arriva's MyOV app (an application for public transport).

The responsibility for introducing push measures is with various levels of government. Parking policy, for example, in terms of rates or scarcity, lies with local governments. Other measures, such as lowering the car commuting allowance, introducing Pay per Use or increasing fuel excise duties and other taxes, are tasks for the national government. In the case of introducing an urban cordon charge, there will have to be cooperation between national and local governments.

5 Aspects not investigated

This study gives an indication of the expected effects of pricing tools aimed at encouraging a switch from car use to public transport use, on the basis of literature and an estimate on the basis of existing data. It is clear that the mere deployment of pricing tools is not the most effective means of achieving the objective, as it will mainly result in new mobility.

Although we do provide an estimate in this study of the expected effects of lower fares in public transport, we do so only on an aggregated, national level. As a consequence, we do not know exactly how the growth in public transport use is spread, in terms of time and place. This makes it impossible to determine to what extent any such additional public transport use can be accommodated by the existing system. If greater insight is required on this issue, we will have to study the effects at a lower aggregation level.

Deploying only pricing tools will result only in a limited switch from car use to public transport use. If the need arises, in a follow-up study, the effects of a broader set of measures could be investigated.

Reducing car use by means of push measures, such as parking policy or a kilometre charge would appear to be more effective. However, to what extent such measures will actually result in a shift to public transport cannot be ascertained from the literature.

It is also important to understand the costs of the different tools. Our study shows that although public transport use will rise following the introduction of pricing tools, total revenue will fall. This is because the relative growth in public transport use is smaller than the relative reduction in fares. Furthermore, the costs for rolling stock and personnel may even rise, in order to accommodate the growth.

If new mobility is generated by reducing public transport fares, this will not help reduce car use. However, this new mobility could have social value, for example because specific groups are better able to participate in society. A follow-up study will be needed to determine the relationship between the benefits of such new mobility and the costs.

6 Acknowledgement

Method

In this research project, we have made use of the available literature to acquire an understanding of the various tools (and their effects) that could be introduced to bring about a shift from car to public transport. Based on data from the Dutch National Travel Survey (ODiN), we have estimated the scale of car trips in respect of which a switch to public transport is more or less likely.

To provide a clear picture of the effects of pricing tools in public transport on mobility, we made use of the elasticities from the National Model System (LMS). We then applied those elasticities to the data from ODiN.

For more information about the literature, a description of the applied research methods and the limits of the analyses, please see the background report to this brochure.

Background report

For more information on the method used and the results, consult the background report (only available in Dutch) that can be downloaded via the website www.kimnet.nl

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