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# The influence of road pricing on physical distribution in urban areas

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## Abstract

The Dutch government decided to implement a road pricing system called, ‘paying differently for mobility’. The main idea is that road users have to pay for using the road infrastructure instead of for owning a car. In the future, the price per kilometre will also depend on the time of the day and the location of the travel. Crowded locations and peak hours will be charged at a higher price per kilometre. In this study we examine the expected effect of the proposed road pricing scheme on logistics decisions to supply stores in urban areas based on in-depth interviews with carriers. Based on the revealed logistics reaction to current developments, such as the German LKW Maut, increasing congestion and the high fuel prices in 2008 and the stated reaction to the proposed road pricing scheme, we derive the expected impact of the scheme for urban goods transport in the Netherlands. The expected reactions differ between for-hire carries, shippers and private carriers. In the short term, carriers try to limit logistics changes by passing on extra costs or absorbing the extra costs in their margins. In the longer term, logistics changes are to be expected.

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*Keywords:* Road pricing; city logistics; behaviour; revealed and stated preference; logistics impacts; road user charging

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## 1. Introduction

### 1.1. Road pricing in the Netherlands – ‘Paying different for mobility’

After years of political debate and different proposed schemes, the Dutch government decided in December 2007 to implement a new system in which road users will be charged per kilometre driven on the Dutch road network. This system replaces the current taxation scheme in which car-owners pay a fixed tax for purchasing and owning a vehicle. The proposed system, called ‘Anders Betalen voor Mobiliteit (ABvM)’ which means paying differently for mobility, was planned to be launched in 2011 for road freight transport. In the following years, 2012 – 2016, it was planned to be implemented for passenger transport as well (see Ministerie van Verkeer en Waterstaat, 2008a, 2008b). However, these plans turned out to be too ambitious; the Dutch Minister of Transport decided in April 2009 that the actual launch for freight transport will be only in 2012, after the legislation and technical system tests are finished in

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2011 (Ministerie van Verkeer en Waterstaat, 2009). For passenger cars the scheme will be implemented step by step starting from the end of 2012, to be finished at the end of 2016. The main idea is that road users have to pay for using the road infrastructure instead of for owning a car, as happens in the current taxation scheme. The income from this new system should equal that of the current taxation system, which implies that those vehicle owners that make more than the average amount of kilometres are going to pay more than in the current fixed taxation system and, obviously, those who use their vehicle less than the average are going to be cheaper off in the new system.

Kilometre charging has been a hot topic in Dutch politics for years. Different schemes have been proposed since the eighties, but public support was lacking for most proposals. Eventually, the Nouwen committee advised the government in 2005 that only a system that would answer to the following three demands could reckon on sufficient societal support:

- i. A fair distribution of the costs,
- ii. Contribute to a decrease in congestion and an improvement of the economical climate and social structure in the Netherlands, and
- iii. Contribute to an improvement of environmental quality (including noise) and traffic safety (see National Platform Anders Betalen voor Mobiliteit, 2005).

### *1.2. System architecture of the proposed scheme*

Based on this advice, the main issue in the scheme that is currently proposed is that the road pricing system really means paying differently for mobility, i.e. paying for using roads, and not paying more than in the current taxation system. In the proposed system, all vehicles have to be provided with On Board Equipment (OBE). With this OBE all vehicle movements on the Dutch road network of registered cars can be monitored. This OBE is connected with a Trusted Element (TE) to the vehicle and its owner. The OBE registers the location of the vehicle by means of a GPS receiver. Providing OBE to all vehicles takes some years; it is planned between 2012 and 2016. During this period, the new ABvM scheme and the current fixed taxation scheme are both used, depending on whether a vehicle has the built-in OBE or not. During this period, the kilometre charge will be a fixed amount per kilometre, which varies slightly based on the environmental burden of the vehicle. At the time all vehicles are provided with OBE (in 2017) the kilometre price is planned to vary based on location and time as well. So, from 2017 the level of the price per kilometre in the proposed scheme (called ABvM) depends on:

- The time of the day – with the idea that during peak hours, e.g. congestion, the kilometre price will be higher than during non-peak hours,
- The location – on crowded locations where the roads are often congested the kilometre price will be higher (during peak hours, see previous point) than on quiet locations, and
- The environmental characteristics of the vehicle – vehicles that contribute more to the environmental pollution pay a higher kilometre price than cleaner vehicles.

The Dutch government decided that the road pricing scheme has to satisfy the following conditions:

- The initial costs of the system have to be lower than two billion euro,
- The exploitation costs have to be lower than 5% of the yearly incomes from the system, and
- It is applicable to all vehicles and the complete road network in the Netherlands.

This paper organised as follows: in section 2 we state our research question and present the research model on logistics behaviour as a reaction to road pricing. We also describe the methodology used in this paper in this section, i.e. the case study and data collection. Section 3 reviews the relevant literature on road pricing and changes in logistics behaviour. Results are discussed in section 4: first we show the results on the revealed logistics behaviour on current developments, and next we discuss the expected logistics reaction (the stated reaction) of the different companies in this case-study. Finally, we discuss the implications of the research results and the conclusions of this study in section 5.

## 2. Set-up of This Study

### 2.1. Research question and scope

In this study we answer the following research question:

“What is the expected influence of the implementation of a variable kilometre price on the logistics decisions to supply goods to urban areas?”

This implies that we are focusing on companies that are active in urban freight transport and that have their own logistics organisation or are able to make changes in a logistics organisation, i.e. in case their transport is (partly) outsourced. The chosen scope implies that transport companies that are primarily involved in line-haul transport, e.g. container transport from the harbour of Rotterdam to the Hinterland, are not included in this study. The results of this study can therefore not be generalised to the entire freight transport sector in The Netherlands, but apply to urban goods distribution only. This study does not aim at finding the effects of the proposed kilometre scheme on all freight transport in The Netherlands, but on the physical distribution in, to and from urban areas.

### 2.2. Research model

Figure 1 shows the research model used in this study to answer the research question. This research model is partly based on Vonk Noordegraaf (2007). *Road pricing policy* (see Figure 1) contains two variants in this study:

- In the first variant, introduction, we examine the influence of the implementation of ABvM in 2012. During the introduction not all vehicles have already built-in equipment. In 2012, the fixed taxes for freight transport, i.e. the Eurovignette, is replaced by a fixed charge per kilometre. According to agreements between the government and the freight transport sector, this implementation will be cost-neutral for the freight transport sector. This implies that the gains for the authorities from the kilometre charge paid by the freight sector should be equal to the governmental gains from the Eurovignette at this moment. In this variant the kilometre price already varies based on the Euro-type of the motor.
- In the second variant, ABvM variable price to emissions, time and location (see Figure 1), we examine the situation after 2016. At this time all vehicles, including all passenger cars, have OBE. From this moment on the price charged per kilometre varies depending on the location and time the kilometre is driven. The idea is that at crowded locations during peak hours the kilometre charge is higher, in order to decrease congestion.

For *characteristics* (see Figure 1) we examine the market, company and logistics characteristics of the different companies in this study. These characteristics determine together with *road pricing policy* the *decision possibilities* the companies have. Governmental restrictions, e.g. time-windows (see Quak and De Koster, 2007) and vehicle restrictions (see Quak and De Koster, 2009), limit for example, the decision possibilities of a company to adapt their delivery times, as a reaction to a road price that varies in time. Based on the decision possibilities companies can formulate a *reaction* (see Figure 1) on the proposed road pricing scheme. In this study, the reaction is divided in two possibilities that we compare:

- The *real reaction* to current developments that show parallels to (parts of) road pricing policies. These reactions include the actual logistics changes due to the following developments: the high fuel price (in 2008), the increasing congestion in the Netherlands over recent years, the German toll for heavy vehicles, i.e. LKW Maut, and government regulation in urban areas. The reaction to these developments can be considered as ‘revealed preference’.
- Since ABvM is not yet implemented, we asked for the *expected reaction* of companies on the proposed road pricing scheme (for both variants: introduction and ABvM, see Figure 1). This reaction can be considered as a ‘stated preference’.

Based on the reactions we define the way Dutch companies are likely to adapt their logistics systems to supply goods to urban areas due to the proposed road pricing scheme, both during the introduction (in 2012) and after the implementation of the price per kilometre to emissions, time and location from 2017 on.

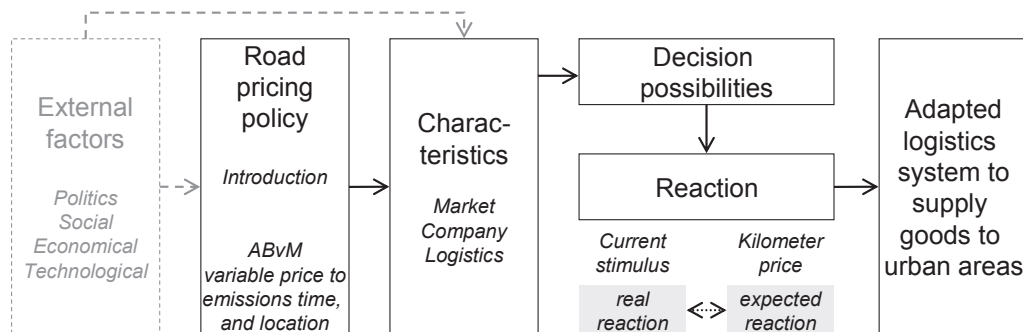


Figure 1 Research model

### 2.3. Research approach

To answer the research question we use a multiple case study. Case research seems appropriate, since this study is explorative in nature. For this study we interviewed 13 logistics managers of companies and 2 road pricing specialists of freight transport interest groups (see Table 1 in the Appendix for the type of company and the industry). Next, we discussed the interview's results at a round table meeting (November 27, 2008) with several logistics managers of companies that were not interviewed in this study. The research approach is based on the steps proposed by Voss et al. (2002) to setup and conduct a case study. After developing the research model (see Figure 1) we selected the cases, based on the following selection criteria:

- i. The company has to be a shipper or carrier (either for-hire or private, see Holguin-Veras et al., 2006).
- ii. The company has to make the majority of its deliveries in urban areas.
- iii. The company itself has to be able to make changes in its logistics system.

To collect information at the companies we used a semi-structured in-depth interview based on a list of questions (see Quak and Van der Moolen, 2009). The list of questions contains five sections:

- Characteristics. In the beginning of the interview we ask for the company characteristics, as well as for the logistics and market characteristics (see also Figure 1).
- Reaction to current developments. In this section we examine the actual reaction of the interviewed companies on:
  - The LKW Maut (only suitable for companies that are also active in Germany) since this provides us with an indication of how companies reacted to the implementation of a toll system and the built-in onboard equipment.
  - The high fuel prices in 2008, since the reaction of the companies on the high fuel prices in 2008 provides us with an indication of how companies deal with a higher variable price per kilometre.
  - The predictable congestion gives us an idea on how companies currently plan roundtrips based on information about 'expensive' times and locations. Locations with predictable congestion are expensive due to the time lost for the delivering vehicles. The way companies currently deal with the predictable congestion gives an indication on how they might deal with a higher price for a certain location at a certain time. Not-predictable congestion due to for example accidents is not considered here.

- Reaction to kilometre charge. We examined the expected reaction using open questions and by letting the logistics managers assess potential reactions between very likely, likely, neutral, unlikely and very unlikely. These questions were asked for both road pricing variants (i.e. introduction and ABvM variable price to emissions, time and location, see Figure 1).
- Determining factors. The questions in this section were intended to give insights in the decision possibilities of companies.
- Expected effects and expected performance.

### 3. Review of Literature and Reactions on Pricing Schemes

The expected effects of road pricing policies depend on the system and the price charged. Although the type of scheme as is proposed in The Netherlands is not comparable to road pricing schemes elsewhere (this is especially true for the second variant AbvM), recently results of several well-known road pricing schemes examples have been published. In order to examine the expected effects of road pricing on physical distribution in urban areas, it is useful to learn from the experiences in other countries and other studies. We limited the review to the influence of road pricing on logistics and on the behavioural reactions of companies, see for a review on different road pricing schemes in Europe for example, McKinnon (2006). The majority of research on road pricing aims at public acceptance and the impacts on passenger transport, see for example, KIM (2008), Hensher and Puckett (2007) and Eliasson et al. (2009).

#### 3.1. Influence of kilometre charging on logistics

The amount of research on the effects of kilometre charging on freight transportation is limited (Holguin-Veras et al., 2006). The Transport for London's annual monitoring reports of the London Congestion Charge show that the congestion charge has a considerable impact on the amount of vehicles entering the charging zone (during the charging period). However, these reports also show a lack of change in the amount of lorries entering the congestion charge (see for example TfL, 2007; 2008). Transport for London's observations correspond with research results shown by Holguin-Veras et al. (2006; 2008). Freight transport might hardly change due to pricing schemes. Link (2007) mentions two reasons (based on the LKW Maut) why the acceptance of these schemes in the freight transport sector is higher than for passenger transport:

- Fairness, a pricing scheme forces all lorries to pay for infrastructure, where fixed taxes only charge local companies, which gives foreign companies a cost advantage, and
- Revenues are used for improvement and maintenance of infrastructure.

A reduction in congestion, due to less passenger cars, and with that a better predictable travel time is also a reason why freight transport companies are sometimes supporting these schemes.

One of the main policy objectives of road pricing is to use the existing infrastructure in a more balanced way. Based on the results mentioned earlier, it is questionable whether pricing is an effective policy instrument to organize freight transport in such a way that it makes more balanced use of the limited infrastructure. Huguin-Veras (2006) mentions reasons that explain why the price signal of pricing schemes does not always (completely) reach the parties paying for transport, i.e. existing market imperfections in the freight transport market, contractual limitations and poor interaction between different actors. The receiver determines usually the conditions, e.g. time or date, for deliveries (see also Quak, 2008). The carrier in its turn has only contact with the receiver at the delivery, because the receiver sets the conditions at the time it orders from the shipper.

Since transport is usually only a very limited part of the price that the receiver pays the shipper for the ordered products, the receiver hardly notices the price signal of the road pricing scheme (i.e. without road pricing transport was already a limited part of the total price, so due to road pricing this limited part increases slightly). Especially for-hire carriers hardly change their behaviour due to road pricing (Holguin-Veras, 2006), because of the just explained relationship with the receivers. Besides, for-hire carriers usually combine several receivers in one roundtrip, which makes it possible to spread the costs of the charge over several receivers. This makes the price signal even lower. An extra problem is that the costs for receiving during off-peak hours are usually far more

expensive for receivers, than paying the toll. Vonk Noordegraaf (2007) explains that the degree in which pricing schemes result in behaviour changes for freight transport companies depends on the available alternatives and the importance of transport to the company, i.e. in case the costs for transport are a considerable part of the company's logistics costs, changes are more likely.

### 3.2. Behavioural changes in freight transport due to road pricing

The possible behavioural reactions of carriers are limited. Vonk Noordegraaf (2007) mentions three possible behavioural reactions of carriers as a response to road pricing:

- Continuing operations the same way as before road pricing,
- Passing on the charge to others in the supply chain, and
- Decreasing cost-increases, for example by avoiding expensive times, using other locations, or cooperating with others.

McKinnon (2006) uses five variables to describe the impact of road pricing on freight transport. Possible behavioural reactions reveal themselves in these variables:

- The logistics system design – the impact of road pricing depends on the following factors:
  - The degree to which carriers are able to pass on the extra costs to their clients. McKinnon (2006) shows that most carriers are able to pass on the extra costs of the LKW Maut, but that these carriers have to pay for the toll themselves in case of empty running (e.g. return trip). Holguin-Veras (2009) shows that it is difficult to pass on all extra costs for urban deliveries. Special transport and time-sensitive deliveries are suitable to pass on costs.
  - The sensitivity of the trade-off decisions on centralization versus decentralization. McKinnon (2006) does not expect that the centralization trend of the last decades will change due to road pricing.
  - The degree in which carriers are able to compensate a cost-increase by improving efficiency.
- The vehicle utilisation – possibilities to improve the vehicle utilisation, for example less empty driving or carry more goods in a vehicle.
- Modal choice – if prices for road transport increase, it might be possible to use other modes, although the possibilities for urban freight transport are limited (see Quak, 2008).
- Vehicle routing – avoid roads that are charged, or in the Dutch context avoid expensive locations.
- Scheduling of deliveries, this reaction depends on two factors:
  - To what degree carriers can absorb higher costs in their margins.
  - To what degree road pricing results in faster travel times due to less congestion.

McKinnon (2006) expects that road pricing is useful to stimulate the improvement of vehicle utilisation and to stimulate the use of other modes than road. However, non-road modalities are usually not convenient for urban goods deliveries. Ecorys and MuConsult (2007) expect that carriers first try to compensate the extra costs by increasing the efficiency of their operations. Next, if this is not possible, the carriers will try to pass on the extra costs.

## 4. Expected Logistics Changes

### 4.1. Revealed logistics changes

#### 4.1.1. LKW Maut

Only a limited number of the interviewed companies have had to deal with the German toll. Five companies in our case selection have or deliver to stores in Germany. The amount of kilometres travelled in Germany is limited in comparison to the distance covered in The Netherlands for all five companies. The five companies that have to deal



with the LKW Maut include three, for-hire carriers and two private carriers. The for-hire carriers are able to pass on the (majority) extra costs to their clients. The private carriers do not pass on costs to their customers by increasing the prices of products in (German) stores. The extra costs are part of the logistics costs and if the company cannot save costs somewhere else in the operations, the toll costs result in lower margins for these companies. The interviewed companies use their cleanest vehicles for transport in Germany, because the toll is lower for cleaner vehicles.

#### 4.1.2. High fuel prices

Fuel prices show an increasing trend over the years; however the increase in the first months of 2008 was enormous. In the beginning of July 2008, the diesel price reached its highest level in The Netherlands at EUR 1.26 per litre (excluding VAT). The price dropped later in the year. In this study we asked the companies how they reacted to the price increase of more than 25% in the first months of 2008. Most for-hire carriers were able to pass on the fuel prices to their customers due to a diesel-clause in their contracts. The fact that the fuel prices increased so much, made it easier to pass on the extra costs, since all carriers had to do so in order to avoid debts. The main condition to be able to pass on extra costs is that all competitors do the same. For the private carriers and the shippers it is not possible to directly pass on all extra costs to the customer. Although the increase was severe, the private carriers and shippers argued that even a 25% rise of diesel-prices are hardly noticeable at the product level. The way to deal with this increase is simple, try to save money in other logistics operations. In case this is not possible, then at the end of the year some product prices might increase. However, the product price in the store is not determined by the cost price (including logistics costs) only, but has also strategically and marketing determinants. For example, a product that costs EUR 1.99 in the store is not expected to be priced at 2.01 due to cost increase. If costs increase and there are no way to cut costs elsewhere, there are two options; either increase the prices of some products or be satisfied with lower margins. These are the reactions mentioned by the private carriers and shippers.

Private carriers and shippers try to find ways to reduce costs, in order to compensate for the higher fuel costs. Ways that were mentioned in the interviews, were: reconsidering the decision to be a private carrier or to outsource transport, reconsider the delivery frequency (which might reduce costs, especially if the carrier faces local authorities' regulations such as time-windows and vehicle restrictions (see Quak and De Koster, 2009), increase vehicle load factor, the use of larger trucks, and training staff to drive more economically. The higher fuel price led three companies to a decision to outsource transport in areas with a low drop density and no strategic customers. Some private carriers said they were able to increase vehicle utilisation and used larger vehicles.

#### 4.1.3. Congestion

The interviewed companies provided us with the following reactions on the predictable congestion on the Dutch roads:

- Avoid the peak period,
- Include congestion in route planning,
- Consider an extra transshipment point (although actually using an extra transshipment point does not happen in practice), and
- Deliver early in the morning or during the night.

#### 4.1.4. Lessons from revealed logistics reactions

The revealed reactions of the interviewed logistics managers give an indication of how they would react on the actual implementation of road pricing in The Netherlands. The most important lessons are that for-hire carriers are able to pass on extra costs to their customers. The degree in which they succeed in passing on these costs depends on the power of the carrier in the carrier – shipper relationship. A cost-increase triggers private carriers and shippers to save money elsewhere in the operations; otherwise they have to absorb the extra costs in their margins. From the interviews we learned some initiatives to decrease logistics costs elsewhere in the operations:

- Use larger trucks to decrease number of roundtrips and kilometres travelled (for high volume deliveries),

- Use empty space in the trucks above the roll containers, one private carrier places boxes on all roll containers to increase the vehicle load factor, and
- Outsource areas with a low drop density (and no strategic clients or suppliers).

#### 4.2. *Expected logistics reaction to the proposed Dutch road pricing scheme*

##### 4.2.1. *Variant 1 Introduction (planned for 2012)*

In this variant the fixed taxes for trucks are made variable per kilometre and the new scheme is cost-neutral for the transport sector. At this moment the majority of the total costs for freight transport are already variable (see NEA, 2007), i.e. drivers' wages (approximately 50%) and fuel costs and writing-off vehicles (approximately 30%). This leaves about 10% of the costs for fixed taxes and 10% for overheads. So only a very limited part of the costs are to be made variable. This implies that the variable kilometre price for trucks will be about EUR 0.015 during the introduction, i.e. a truck (>12 tons) needs a Eurovignette at this moment, this costs about EUR 1200 per year. Now, in case an average truck makes about 80,000 kilometres a year, this implies a variable price per kilometre of EUR 0.015. The interviewed managers do not expect any changes in case of such a low kilometre price. Most managers expect a cost-increase, but only limited. This variable kilometre price is low, e.g. the fuel price increase over 2008 was about EUR 0.04, and is not expected to lead to serious (noticeable) logistics changes.

##### 4.2.2. *Variant 2 Variable price to emissions, time and location*

In this variant the price per kilometre is variable in time and location. The price per kilometre is estimated around EUR 0.50 at crowded locations during busy hours. This price per kilometre is higher in the peak periods, the average price per kilometre is estimated around EUR 0.20. All respondents expect that the implementation of 'paying differently for mobility' (AbvM) will increase their costs, although the idea is that on average the cost equal the current costs for road users. Carriers seem to be more sensitive to an increase of variable costs than to a decrease of the fixed costs.

Most interviewed managers think that, in first instance, almost no changes will occur in the field of urban goods transport organisation. First, they try to pass on the extra costs. In the case that this is not possible, extra costs go at the expense of the margins the companies make. But if the cost increases significantly, and this increase will be lasting, companies argue that they will include the consequences of the road pricing scheme in their periodical reconsiderations of their logistics organisation. Based on the cost-trade offs in these considerations it might be possible that logistics choices are going to change. Most interviewed managers argue that a potential reaction will not follow from the road pricing scheme only, but also on other developments as well. So the kilometre charge is only one of the factors that will contribute to changing the current way of business.

The possible acceptance of the road pricing scheme depends for the logistics managers on the use of the revenue. In general, the respondents are positive about the scheme, if the revenue is invested in infrastructure or improving current bottlenecks. The expectation, however, is that the revenue will be used for other matters. Most managers consider the intention of the Dutch government to start AbvM with trucks strange, since in their opinion trucks do not cause the congestion problems in The Netherlands. Most respondents indicate that they avoid peak hours as much as possible. So, for urban distribution the change to time and location is not expected to change the carriers' behaviour.

Most carriers argue that the only reason they currently plan roundtrips in the morning is due to government time-windows in cities (see Quak and De Koster, 2007) and to satisfy client demands. The complaint most often mentioned by the managers is therefore; they do not have a choice to deliver at times the kilometre price will be lower. In the case where local regulations, and in particular the city time-windows do not change, most carriers feel harmed; on the one hand local authorities force them to travel during the morning rush hours, and on the other hand, the national government makes it really expensive to travel at these times. The private carriers argue that if it was possible they would have changed their delivery times already, to avoid the morning rush hours. Some managers admitted that a high kilometre price would possibly open doors for the logistics department to change the current way of business, but that as long as logistics costs form relatively only a very limited part of the product cost, they are not able to redesign their logistics. At this moment other arguments weight heavier, for example delivering before customers are in the store, or only delivering at times store staff are available to receive the goods. For-hire



carriers argue that they cannot influence the customer's requirements. Based on the interviews we can conclude that as the logistics costs are getting more important for a company, e.g. the main competitive driver is costs, for example in the Dutch supermarket sector or the lower part of the fashion sector, the more likely it is that carriers are already constantly working on decreasing logistics costs and the more likely it is that these carriers will make changes in the logistics choices to deal with the road pricing scheme.

For-hire carriers expect changes due to the implementation of the road pricing scheme. This is especially true for those interviewed for-hire carriers that use a hub-and-spoke network. Their idea is that, since they plan most long distance trips during the night, and start really close to the destination with their distribution roundtrips, on average they will pay a low kilometre price. Besides, their vehicle load factor is high. These carriers expect that more private carriers will decide to outsource transport to their networks. A striking result was that none of the carriers expected that the implementation of AbvM would result in a decrease in congestion. None of the respondents believed their travelled times would be lower after implementation. Basically, the interviewed managers expect that goods transport will simply become more expensive without any behavioural change of carriers. They do not expect passenger cars to change their behaviours due to road pricing either. So the proposed advantages for logistics companies, to enjoy time saving benefits which may be more than the kilometre price, are assumed not to appear.

We also asked the managers to score possible behavioural reactions (based on Holguin-Veras, 2006; McKinnon 2006; and Vonk Noordegraaf, 2007) on a five-point scale, between very likely, likely, neutral, unlikely and very unlikely. Figure 2 shows the average scores on the behavioural changes and the variation in the answers between the different logistics managers. The behavioural reactions are sorted with the highest likely reaction at the left of the graph in Figure 2. All respondents thought that it was very unlikely that they would use other modes to deliver their goods to destinations in urban areas. The only reaction that on average scored 'likely' is to pass on the extra costs. Using a clean vehicle to pay a lower kilometre charge, scores only just likely. Almost all reactions score lower than neutral, which means that the interviewed managers think that most of the reactions are unlikely. This can partly be explained by the fact that some carriers argued that these behavioural responses were not a reaction to the proposed road pricing scheme, but were reactions that they were always considering. For example increasing the vehicle load factor is considered by some companies something that happens constantly, and therefore this is not (only) a reaction to the proposed road pricing scheme. About half of the respondents consider it likely that the delivery times change, but the other half argues that they cannot change the delivery times, so they think it is unlikely that these times will change.

The variation in the answers to the behavioural response 'change origin' is high. Some of the for-hire carriers think it is likely that their network will change; the local hubs in their hub-and-spoke network might change due to kilometre pricing. Most private carriers that distribute their goods from one retail distribution centre consider it really unlikely that they will use another origin to start their roundtrips from. In general, we can say for the other behavioural reactions that those managers that already consider the reactions due to current developments are more likely to answer likely to the reactions. For example, those respondents that currently distribute their goods during the nights answered that it is likely to deliver (more) during the nights due to AbvM, whereas those respondents that do not deliver during the nights consider it very unlikely.

Based on these results and the roundtable discussion the Dutch logistics portal 'Logistiek.nl' put the following poll on the internet: 'What are you going to do when the road pricing scheme is implemented in The Netherlands?'. This poll is not representative, but the results are similar to our interview results. From the 135 respondents (date 17-12-2008) the vast majority (56%) answered that they would pass on the extra costs to their clients. Other answers were planning the transport more efficient (10%), using other modalities (10%), delivering at different times and different routes (8%), increase the vehicle load factor (7%), decrease delivery frequency (5%), and redesign distribution network (5%). This poll's scope is wider than urban freight transport (the scope of this paper), since it is open for all types of transport. This explains the higher percentage of respondents that plan to use other modes in comparison to the reactions of the logistics managers in our interviews (all managers answered that it was very unlikely to use non-road modes for their urban deliveries).

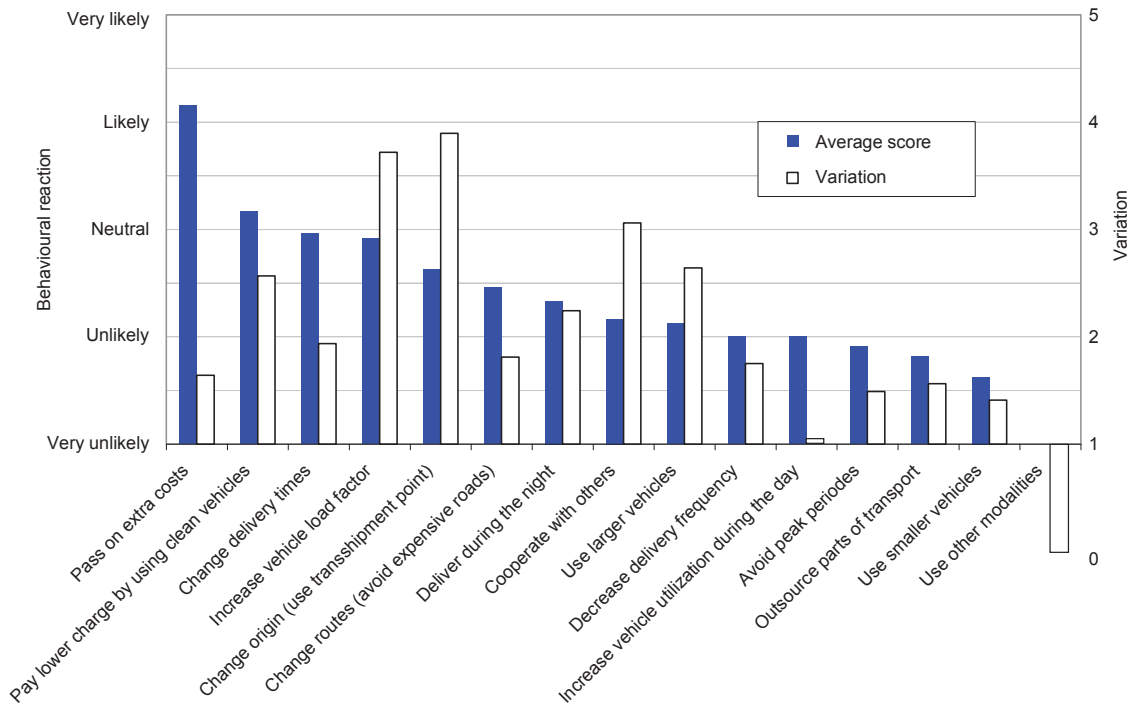


Figure 2 Expected behavioural change (variant 2)

## 5. Conclusion

The implantation of the road pricing scheme, called ‘paying differently for mobility’ (AbvM) seems to be something in the distant future for most Dutch carriers. Most carriers are not familiar with the plans and decisions of the Dutch government about AbvM. The first phase of the proposed road pricing scheme, in this study variant ‘introduction’, in which the fixed taxes (i.e. the Eurovignette) for trucks is replaced by a variable price per kilometre will hardly influence the logistics choices of companies delivering in urban areas. Only after all vehicles, including passenger vehicles (planned for 2017), have the right equipment built in, is it possible to make the kilometre charge variable for different times and locations. Although, the actual height of this variable kilometre price is still unknown, the price might be high enough to change the behaviour of carriers. Most carriers doubt this, and expect the following behavioural reactions:

- No change – since many carriers argue that they do not determine the time and location choices. These decisions are based on demands by receivers (or shippers) and the price signal of the kilometre charge might hardly reach these groups, since transport is only accountable for a limited share in the total product price. Two options are possible:
  - Pass on the costs – especially for-hire carriers expect to be able to pass on the extra costs of a kilometre charge. They argue that these extra costs will occur for all carriers. As long as the vast majority of the carriers pass on the costs, it will not lead to changes. And, according to these carriers, those carriers that do not pass on these costs will make severe losses and go either bankrupt or pass on the costs later.
  - Absorb extra costs in profit margins – especially private carriers argue that product prices in the stores won’t be raised automatically due to increasing logistics costs. So, as long as competitors do not raise product prices (in high competitive markets) the extra road pricing costs go at expense of the profit margins. These carriers aim at finding ways to reduce logistics cost, in order to balance the cost increase due to road pricing. The logistics managers also agree that this is not a reaction for the long run; some form of passing on costs is

expected in the case it is not possible to save (logistics) costs elsewhere in the operations (see next bullet-point).

- Extra focus on efficiency and lower logistics costs – although the reaction in the beginning might be not to change, both options passing on costs and absorbing costs are not long term strategies. In the longer term passing on costs still does not pay back the extra costs for the times the truck runs empty and absorbing costs reduces long term profitability. So in the longer term, we expect to see other choices, such as reconsidering outsourcing (parts of) the transport, for example in regions with a low drop density or increasing the vehicle load factor. In case the kilometre price in some urban areas becomes really high, carriers do expect that it becomes more likely that they deliver goods to a point nearby the city (e.g. an urban consolidation centre (see for example Van Rooijen and Quak, 2009) or to a carrier specialized in deliveries in that city) during the (cheap) night, from which goods only have to make a minimum number of expensive kilometres during the day.

Private carriers expect that a serious price signal might make it possible in their organizations to supply stores at other times or less frequently. For-hire carriers have less decision-making power and do not expect this. This is especially so for goods with a low value density or in highly competitive markets the impact of the proposed road pricing scheme might be higher than companies expect at this moment; road pricing won't stop at one company. Even if the price increases only by 0.5% or 1% per link in the supply chain, in case every link passes on these costs, the effect can run up to 4% of a company's turnover at the end of the chain. For low-value products this might even be a very conservative estimate.

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**Appendix A. Interviews**

Table 1 Persons interviewed in this study and type of company and industry

Company name	Contact name	Date	Carrier type	Industry
EVO	Rink Jan Slotema	05-08-'08		interest group
TLN	Paul Poppink	11-08-'08		interest group
Gordijn Transporten	Danny van der Meer	06-10-'08	for-hire	all
Paul Klarenbeek Fashion Forwarding	Pieter Klarenbeek	07-10-'08	for-hire	fashion
TransMission bv	Peter Tjalma	08-10-'08	for-hire	all
Etam Retail Services	Marcel Balkestein	14-10-'08	private	fashion
Kruidenier Foodservices	Marten van der Laan	14-10-'08	private	food
Zeeman	Frank Keijzer	14-10-'08	private	fashion
Hoogvliet	Johan Berkheij	15-10-'08	private/shipper	food
TNT Fashion Group	Geert Zomer Dolf Lohuis	16-10-'08	for-hire /shipper	fashion
Deli XL	Hans van der Ster Tom Berk	17-10-'08	private	food
Hema	Willem Zandvliet Bas Gepkens	21-10-'08	private	department store
Centraal Boekhuis	Egbert Guis	23-10-'08	private	books
Vroom en Dreesman	Olav Vissers	29-10-'08	private	department store
Heijmans	Jan van Elderen Miel van Hutten	03-11-'08	private	build