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Incentives to encourage shared mobility

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1. Introduction

Shared mobility is seen as a promising way to reduce traffic congestion and CO_2 emissions (Rabbitt and Ghosh, 2016; Taylor et al, 2015, p. 42, p. 98; Shaheen et al, 2015; Martin and Shaheen, 2010), although the extent of these reductions would depend on the type of shared mobility. For example, trips made by one person or a driver and a passenger, will yield lower benefits than public transport on demand in terms of congestion and CO_2 emissions (Viegas and Martinez, 2017, p. 9).

Given the potential benefits of shared mobility, a comparison can be made with electric vehicles, which are also seen as a promising option for reducing CO_2 emissions (Andwari et al., 2017; Hao et al., 2017; Newbery and Strbac, 2016). Indeed, governments at local and national level have implemented a range of incentives to accelerate electric vehicle uptake (Figenbaum, 2017, Langbroek et al., 2016, Bjerkan et al, 2016; Lieven, 2015, Sierzchula et al., 2014) and these incentives have been analysed and scrutinised in order to understand their impact (Coffman et al, 2017, Egbue et al, 2017, Heidrich et al, 2017; Wang et al, 2017; Mersky et al, 2016; Zhang et al, 2013) and learn lessons.

It seems surprising then that governments at national and local level do not appear to have introduced incentives to encourage shared mobility. Save a few hundred bicycle-sharing schemes in place in cities throughout the world, many of which were originally implemented before the Internet age, and most of which receive a government subsidy, shared mobility is not being promoted by any government.[1]

One reason why governments have not actively encouraged shared mobility, in contrast with electric vehicle market penetration, may be that shared mobility is a much newer concept. Electric vehicles were already available, although to a much lesser extent than today, in the early 1990s, with Norway already introducing incentives for battery electric vehicles at that time (Figenbaum, 2017). Shared mobility, defined as technology-enabled mobility services in the Sharing Economy, on the other hand, is still emerging. Uber, for example, only started operations in 2009. Another reason why governments have not actively encouraged shared mobility may be that they are simply not interested in doing so, or are not clear on what benefits could be derived from such actions.

[1] There may be some pilot projects, probably small and localised. One example is the pilot Mobility Station in Munich. The City of Munich, in cooperation with the local public transport operator and Munich City Utilities, introduced a pilot Mobility Station in November 2014. This Mobility Station is a hub with a public transport station, with underground, tram and bus, taxi stand and private bike parking facilities, as well as six parking places are reserved for car-sharing vehicles of three different providers, and a bike-sharing station with 20 docks (Miramontes et al, 2017). It should be emphasised that this is a very small project with only six parking places reserved for car-sharing vehicles and 20 docks for shared-bicycles.

A systematic search in Scopus and Web of Knowledge using keywords such as shared mobility, car sharing, public transport/transit on demand, and transport in the sharing economy yielded a number of case studies (Schwieterman and Bieszczat, 2017; Tyndall, 2017; Ciari et al, 2015) focusing on impacts (Nijland and van Meerkerk, 2017), travel behaviour (Miramontes et al, 2017; Becker, Ciari et al, 2017; Kim et al, 2017; Kopp et al, 2015), comparisons of car-sharing systems (Nourinejad and Roorda, 2015), technical papers on how to coordinate/manage shared mobility (Bicocchi and Mamei, 2014; Bongiovanni et al, 2017; Hara and Hato, 2017; Morency et al, 2015, Mallus et al, 2017), and hypothetical use (Becker, Loder et al, 2017; Paundra et al, 2017; Prieto et al, 2017; Rinzivillo et al, 2017; Juschten et al, 2017). No academic papers appear to have ever been published on incentives to encourage shared mobility, although Bieszczat and Schwieterman (2012) concentrate on the lack of incentives for shared mobility in the US, and conclude that taxes on car sharing services are actually in general higher than local taxes on sales and taxes on other forms of passenger transport.

Before moving on to a discussion of incentives to encourage shared mobility, as well as impacts from shared mobility and research needs, it is necessary to define certain concepts.

2. Brief definitions

Shared mobility or mobility in the sharing economy is a loose concept, which includes a number of emerging new business models. The two features common to all of these new mobility services is that there is an element of sharing an asset (a vehicle) instead of owning it and that they rely on technology (apps and the Internet). There are four main models:

Model 1: Peer-to-peer platform where individuals can rent their cars when not in use. These are not companies but consumers allowing other people to use their vehicles. An analogous case is Airbnb, where people can rent a flat or house or even a room in a town or city for a short period instead of booking a hotel or B&B. Peers are linked via an online platform.

Model 1 examples:

- Turo (https://turo.com/)
- easyCar club (https://carclub.easycar.com/)
- hiyacar (https://www.hiyacar.co.uk/)

Model 2: Short term rental of vehicles managed and owned by a provider. The provider owns a number of vehicles which are strategically parked in a city or in certain areas of a city, either in dedicated parking lots and/or on authorised public roads. Potential users can look for a vehicle near to where they are, drive themselves to their destination, then park the car at the end of their trip in another dedicated parking lot or in an authorised public parking space. Locking and unlocking is typically done with a smartphone or smartcard. This is all done via an app (finding the car via a live map, registering details, paying, etc.) Many, though not all of these services, require membership and an annual fee.

Model 2 examples:

- Autolib (https://www.autolib.eu/en/)
- Car2Go (https://www.car2go.com)
- Zipcar (https://www.zipcar.co.uk/)
- Getaround (https://www.getaround.com/)

Interestingly, Getaround has partnered with Uber in San Francisco so anyone can hire a Getaround car and serve as an Uber driver (registration with Uber is a pre-requisite to be allowed to hire the Getaround car as an Uber driver). In this way, Models 2 and 3 (described below) can be combined.

It should also be highlighted that Model 2 has its origins in what used to be called Car Clubs. Car Clubs began in Switzerland in 1987 and then spread to Germany, Austria, the Netherlands, the UK, Denmark, Italy, Sweden, Canada and the US (Shaheen et al, 1998; Enoch and Taylor, 2006). Thirty years on, car clubs have not taken off on a wide scale. Whilst Model 2 mainly encompasses one-way trips, the pre-Internet age Car Clubs required users to return the vehicle to the same location from which it had been accessed (Shaheen et al, 2015).

Model 3: Peer-to-peer with a company as a broker. The companies own no cars themselves but they sign up ordinary car owners who act as drivers. The service relies on an app.

Model 3 examples:

- Lyft (https://www.lyft.com/)
- Uber (https://www.uber.com/en-GB/)
- Sidecar (was San Francisco-based but collapsed, could not compete with Lyft and Uber)

Model 4: On demand private vans or buses and other vehicles, such as big taxis, shared by passengers going in the same direction. It is essentially a user-oriented form of public transport. Users can dial-a-ride specifying pick-up and drop-off locations and required departure and/or arrival times.

Model 4 examples:

- Via (https://ridewithvia.com)
- Chariot (https://www.chariot.com/)
- UberPool (https://www.uber.com/en-GB/ride/uberpool/)
- LyftLine (https://www.lyft.com/line)
- Bridj (was based in Kansas City and Boston but collapsed)

3. Incentives to encourage shared mobility

Borrowing from the transport economics literature, a number of incentives to encourage shared mobility, both monetary and in-kind, could be put in place. Furthermore, choosing a package of incentives could be informed by (expensive and well-designed) randomised trials, as is often done in development economics and policy, where 'randomized evaluations clearly take a larger place in the policy conversation now than they did at the turn of the century' (Banerjee et al, 2016). Alternatively, assumptions and data on travel behaviour, elasticities and time and money costs, could be used to devise incentive packages, as it is commonly done in transport policy in most countries.

Incentives designed to motivate individuals to use shared mobility services would need to change relative generalised costs. This in itself is a challenging task. Before proposing specific incentives, a number of points need to be noted:

a) Short term rental of shared vehicles (Model 2 above, where vehicles are managed and owned by a provider) is 'not considered an attractive substitute for private-vehicle ownership, because it is rarely appropriate for a daily commute' (Bieszczat and Schwieterman, p. 105). Grosse-Ophoff et al (2017) report that a 2017 McKinsey survey revealed that 67% of US respondents prefer 'driving their own cars over using ride-hailing apps' (Model 3 above, where companies own no cars themselves but they sign up ordinary car owners who act as drivers), and 63% would not give up their vehicles for these types of rides, even if they were free. Given the above it may not be easy to convince consumers to switch to shared mobility services, especially those that entail simultaneously sharing a vehicle with strangers and compromising, even slightly, on departure and arrival times and travel duration (Model 4 above, where vans, mini-buses or big taxis collect passengers going in the same direction).
b) Basic transport economics defines the generalised cost of a trip as the monetary cost or out-of-pocket expenditure, plus the time taken to complete the trip times the value of time of the trip maker. Trip makers are assumed to be rational and to minimise their generalised cost of travel. The value of time varies according to a number of factors (Mackie et al, 2003), with the most important one being income. In addition, it has long been recognised that business (working) travel time values are different from non-working travel time ones, which include commuting and also travel for other purposes (Mackie et al, 2003; Wardman et al, 2015). Estimates of the value of travel time during the course of work are typically three to five times higher than those for other purposes, and traditionally travel time during working hours has been valued at the wage rate, although this practice has been recently challenged by Wardman et al (2015).
c) To complicate things further, there are many other factors that influence mode choice, such as reliability, convenience, and comfort to name a few. Reliability has lately been incorporated in the generalised cost of travel (Small and Verhoef, p. 32; Arup, ITS and

Accent, 2015a, p. 247, p. 256). Convenience is difficult to define and value but there have been attempts to value it for public transport (International Transport Forum, 2015). Arup, ITS and Accent (2015b, p. 12) recommend value of travel time multipliers for different modes of public transport, taking into account comfort. For example, for buses, they recommend different factors ranging from situations where there are plenty of seats free and the passenger does not have to sit next to anyone (0.83 to 0.85) to those where there are not seats free and the bus is densely packed (2.14). Evidence shows that passengers, even those who regularly travel by bus, prefer to be in a relatively empty vehicle and not have to seat next to anyone else. Convincing solo car drivers to share taxis or mini-buses may therefore be challenging, and will need strong financial incentives to more than compensate for the disutility caused by the reduction in comfort.

d) Last but not least, waiting time, for example, at bus stops or train stations, has a higher weight, mainly due to impatience. This has a long tradition and recent research provides evidence for multipliers to increase the value of time spent waiting of between 2.76 and 3.21 for train and 2.62 and 3.40 for bus (Arup, ITS and Accent, 2015, pp. 225-226).

Any incentives designed to tip the balance in favour of shared mobility will need to, at the very least, tip generalised costs, by changing the monetary, out-of-pocket, costs and not increasing, or even decreasing, travel time. If waiting time and comfort were also to be included then the financial incentive would need to be even higher.

This may be very difficult to achieve for business/working trips but it may be possible for other trips, although it will be difficult to shift high earners with very high values of non-working time as the financial compensation they would need could be higher than the benefit to society from them shifting from the private car to shared mobility.

An unintended effect of an incentives package to encourage shared mobility could be to decrease public transport patronage, which may not be beneficial in terms of traffic congestion and CO2 emissions. Public transport users may be attracted to public transport on demand (smaller, quicker shared vehicles), which may be more expensive but also quicker, more convenient and more comfortable. Finger et al (2017, p. 67) argue that competition from shared mobility (Models 1, 2 and 3) is threatening cross-subsidies in franchises of profitable services and non-profitable services, and could harm public transport in particular, when minimum frequencies are imposed and/or peak time services finance off-peak ones. Importantly, they assert that as individuals switch from traditional public transport to shared mobility, public transport revenues will go down, and this could also affect infrastructure funding (Finger et al, 2017, p. 10).

When designing incentives to encourage shared mobility, the Model (1, 2, 3 or 4) chosen by the regulator/transport agency/municipality would play an important role. Models 1 to 3 are different from Model 4 in that trips are not undertaken simultaneously with strangers.

3. 1. Incentives design

Once policy objectives and targets have been agreed, governments can choose the incentives they will introduce. These can be classified in three groups: command-and-control, financial and in-kind.

Command-and-control incentives are essentially regulations that are introduced and enforced, such as restrictions on circulation according to number plates, where private cars are only allowed to circulate on certain days of the week in order to reduce air pollution, as is or was the case in Mexico City, Bogotá, Athens, Santiago and São Paulo. Paris and Madrid had such a measure in place in December 2016, albeit only temporarily, to fight air pollution. This policy has had mixed success, due to households purchasing second, typically more polluting, cars (Eskeland and Feyzioglu, 1997).

Another example of a command-and-control policy is the restriction on vehicle circulation in certain areas, such as that in place in a number of Italian cities, including Rome, Florence, Pisa and Milan. These cities have implemented limited traffic zones in their historic (medieval) centres. Vehicles circulating in these limited traffic zones require a permit, and permits are restricted to a number of essential users.

From an economic point of view, command-and-control policies are effective but inefficient because the targets are not achieved at the least cost (Baumol and Oates, 1988). Nonetheless, if the aim is to deter motorists from using their cars and to shift to shared mobility services, limited traffic zones restricting access for privately owned and driven cars but not for shared mobility ones, would undoubtedly help.

One interesting way of controlling private car ownership is through restrictions on vehicle ownership. The only example of a direct quantity control of this sort is the Vehicle Quota System in Singapore, which was implemented in 1990 and is still in place today (Santos et al, 2004). This policy, however, is not, strictly speaking, a command-and-control policy, because prospective vehicle owners are required to purchase a Certificate of Entitlement, which is a licence that lasts ten years. The allocation of these certificates of entitlement is done through auction, and so there is an element of market mechanism embedded in the process. Having said that, the idea of the government imposing a cap on the total number of vehicles in circulation in a country would sound alien in Western Europe, and certainly draconian.

Financial incentives include charges or fees, subsidies and cap-and trade schemes. A combination of these, especially charges and cap-and-trade, is also possible (Hepburn, 2006). Despite governments being strapped for cash, subsidies have been used in transport to encourage the purchase of fuel efficient and/or clean vehicles or the scrappage of old ones (Santos et al, 2016). Subsidising Models 1, 2 and 3 does not seem warranted (given that in all cases there are profits to be made at the expense of some disutility from consumers, without any clear-cut benefits to society) but subsidising Model 4 may be justified on economic grounds, as will be shown in Section 4.

Cap-and-trade systems in road transport have been entertained to regulate different externalities (Verhoef et al, 1997), in particular, air pollution (Raux, 2004) and CO_2 emissions (Albrecht, 2001; Raux and Marlot, 2005; Wadud et al, 2008). Although cap-and-trade schemes have been successful in regulating environmental externalities in the US (Hahn and Hester, 1989; Hansjürgens, 2005) and importantly, GHG emissions in Europe through the EU ETS, the number of installations subject to the policy in all these cases has been relatively small. The EU ETS, for example, covers around 11,000 installations.[2] Regardless of what the aim of the policy was (which could be, for example, a cap-and trade system of permits for the privilege to use the roads), if individual motorists were to enter a cap-and-trade system, it is obvious that transaction costs would be very high, as would the costs of monitoring and compliance, given the very large number of drivers. A cap-and-trade system, therefore, would not be suitable to encourage shared mobility.

Charges and fees often lack public, and therefore political, acceptability, especially if they charge for something that was previously free, such as the use of certain roads during peak times. Having said that, the use of revenues generated through these charges can increase public acceptability, especially when these are returned to the transport sector (Santos et al, 2010).

Incentives in-kind can also persuade consumers to change behaviour. In Norway, for example, there is evidence showing that many consumers purchased electric vehicles thanks not only to financial incentives but also because electric vehicles had access to dedicated bus lanes (Bjerkan et al, 2016).

Bearing in mind the challenging task of tipping generalised costs to make shared mobility more attractive, an incentive package could contain:

- Command-and-control measures, such as closure of certain roads or areas to privately owned and driven vehicles;
- Subsidies to compensate for the disutility of waiting, taking longer to travel and/or sharing the vehicle with other passengers;
- Charges, such as congestion charges during peak times or simply charges for the privilege of using roads;
- Incentives in-kind, such as use of dedicated bus lanes for shared mobility vehicles

The structure of the incentive package would need to be informed by either a model with assumptions and data on travel behaviour, elasticities and time and money costs, or by randomised trials of the type used in development policy.

[2] https://ec.europa.eu/clima/policies/ets_en

4. Impacts from shared mobility

The impacts from shared mobility have been modelled and assessed to a certain extent, although mainly either focusing on small samples and case studies or making heroic assumptions about the future. The problem with assessing the impacts is that the proportion of trips made with shared mobility modes of transport is not only small, but also difficult to quantify.

Whilst it is relatively simple to access information on the size of the transport sector thanks to the statistics kept by governments and international organisations, the same cannot be said with respect to shared mobility services. For example, Transport Statistics Great Britain, an annual publication in the UK, does not have any information on shared mobility. Taylor et al (2015) set out to review Innovative Urban Mobility Services for the Transportation Research Board of The National Academy of Sciences in the US and found exactly the same problem: 'data and research on these services, while increasing, are far less developed than is the case for other modes of transportation, in part because the rapidly growing and controversial TNCs[3] have been sharing relatively little information with the public' (Taylor et al, 2015, p. 6). They therefore rely on anecdotal information, piecewise blogs and media articles, as do Finger et al (2017) in a report prepared for the European Parliament's Committee on Transport and Tourism. This is the approach taken in the present report as well.

Vaughan and Daverio (2016, p. 3) define shared mobility as 'individuals sharing a ride, car or parking space with others', and estimate the value of these services in Europe at €5.1 billion (Figure 1, p. 7). Grosse-Ophoff et al (2017, p.1) state that 'In three core regions—China, Europe, and the United States—the shared-mobility market was nearly $54 billion in 2016, and it should continue to experience impressive annual growth rates in the future'. They do not explain how they define shared mobility but they say that in China and the US the shared mobility market is dominated by Model 3 defined above, i.e., peer-to-peer services with a company as a broker, where the companies own no cars themselves but they sign up ordinary car owners who act as drivers. The sum of $54 billion is not high. The GDP in 2016 for the US, China and Europe was $18.6 trillion, $11.2 trillion and $16.4 trillion, respectively.[4] According to these figures, the shared mobility market in China, Europe, and the United States represents 0.12% of their combined GDP, a negligible share.

Taking into account that not only is the size of the shared mobility market probably negligible, but is also very difficult to determine, a number of studies have attempted to assess its impacts on the basis of surveys or models. In Germany, for example, 12% of respondents to a survey of Model 2 car-sharing users reported giving up a car in their households (and the authors estimate that the total vehicle kilometres travelled by the households that gave up a car is on average

[3] TNCs: Transportation Network Companies
[4] https://data.worldbank.org/country/

50% lower than those households that did not), 40% reported they had abstained from buying a car, and 27% reported they were considering giving up a car (team red Deutschland GmbH, 2015, cited in Miramontes, 2017). In the Netherlands, another survey of car-sharing users (Models 1 and 2) found 30% less car ownership amongst car sharers and 15% to 20% fewer car kilometres than prior to car sharing, with the shared cars mostly replacing a second or third car (Nijland and van Meerkerk, 2017). The authors also found that thanks to reduced car ownership and car use, car sharers emit between 240 and 390 fewer kilograms of CO2 per person, per year, which, according to them, is between 13% and 18% of the CO2 emissions related to car ownership and car use. Viegas and Martinez (2017) concentrate on the effects of full-scale implementation of shared mobility in the whole of the Lisbon Metropolitan Area (Model 4), assuming 100% replacement of all car and bus trips by new shared modes, rail-based public transport and walking. On the basis of this completely unrealistic assumption, they conclude that total vehicle kilometres in peak hours would be reduced by 55%, relative to 2011, and CO2 emissions would be reduced by 62%, results that can only be used as a threshold for reference, or as the very authors state, as 'a conversation starter' (Viegas and Martinez, 2017, p. 37). Furtado et al (2017) conduct a more realistic exercise for Helsinki, and assume a number of different scenarios. Assuming that only 20% of car and taxi trips were replaced with shared mobility (Model 4), they find that vehicle kilometres travelled would go down by 7%, CO2 emissions would go down by 2%, and congestion would go down by 13% (Furtado et al, 2017, Table 16, p. 53).

It is difficult to determine the percentage of trips that could realistically be replaced with shared mobility services (Models 1 to 4) in any city. Grosse-Ophoff et al (2017) assert that 30% of vehicle miles could be replaced by shared mobility (Model 2) but they do not explain how they arrive at the conclusion. They also assert that shared mobility services (Model 2) are only addressing 1% of that 30%. Furthermore, the increase in the market share of these new mobility services may simply reflect a shift from taxis rather than private cars. For example, Uber's 'fast rise… directly correlates with the decrease in traditional taxi usage',[5] as can be seen on Figure 1 below. However, 'in the context of the overall ground transportation system in the United States… taxis and limousines account for a small proportion of trips. Taxi and limousine services represent 0.30% of person trips, 0.20% of household vehicle miles travelled, and 0.16% of person-miles travelled in the United States. These figures are higher in larger metropolitan areas and lower in smaller metro and non-metropolitan areas. Taxi and limousine trips account for 0.39% of all trips in metro areas with populations of 1 million or more, compared with less than 0.1% in metro areas with populations of less than 500,000' (Taylor et al, 2015, p. 12). There is no reason to think that replacing taxi trips, which in any case represent a small proportion of total trips, with Uber trips, would yield any change in congestion and CO2 emissions.

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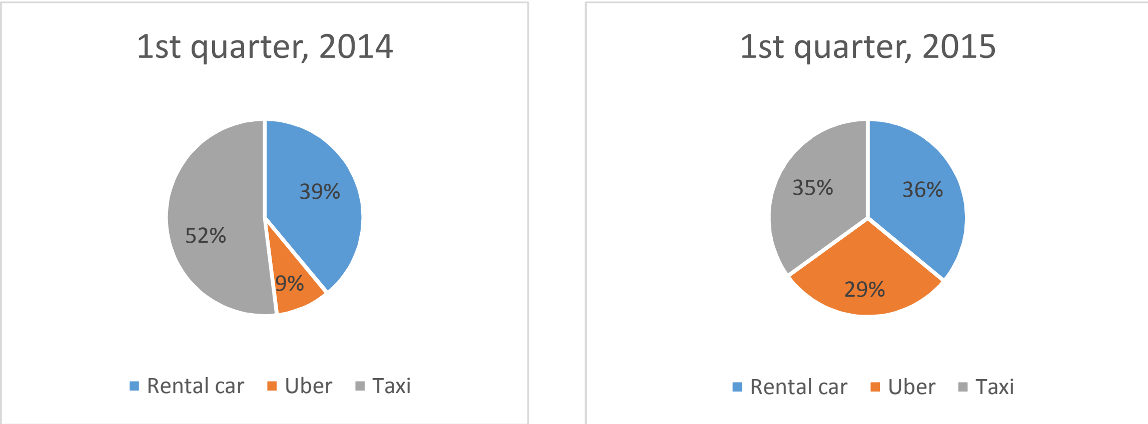
[5] https://www.bizjournals.com/newyork/blog/techflash/2015/04/uber-taxi-expense-report-certify-study.html

Figure 1: Uber vs Taxi vs Car Rental in the US



Source:https://www.bizjournals.com/newyork/blog/techflash/2015/04/uber-taxi-expense-report-certify-study.html

5. Research needs

Given the big gap in the literature, which has been made evident in the preceding sections, there are three questions which are worth asking, and that should shape research:

a) Would it be in local and national governments' interest to increase shared mobility by introducing incentives?
b) What incentives could be introduced?
c) What would the impact of these incentives be?
d) How would the costs and benefits of introducing incentives compare, from the point of view of the government?

These research questions are simple but the answers are not straightforward and require data collection, modelling and cost-benefit analysis. Question (a) would need to weigh the costs of introducing incentives with the benefits that those incentives would yield. The Models that are emerging (1, 2, 3 and 4) are all quite different. There is (limited) evidence showing that Models 1 and 2 are not and will not replace the modes currently used for commuting trips. They seem to be substitutes for traditional taxi services (Taylor et al, 2015) or long distance trips currently taken by bus or train (Finger et al, 2017). Model 3 has its origins in what was known as car clubs before the Internet age. Although Apps are clearly helping boost this Model, the (again, limited) evidence shows that households may give up a second or third car rather than become car-less and completely rely on these services. In the unlikely event that some households were to give up owning a car altogether, and instead use one only when required, the fixed costs of owning a car and variable costs of operating it would be replaced with variable costs, and this would probably lead to different choices in terms of which mode is chosen for a particular trip, with potentially increased use of public transport.

Models 1 to 3 are business models that yield profits to private parties and the social benefits they provide are not clear. Even if positive, they may be very small.

Model 4 is the Model that has the largest potential for reducing congestion and CO2 emissions but at the same time, it seems the most challenging to sell, given the disadvantages in terms of waiting time, travel time, comfort and convenience, relative to the private car.

The first research question, question (a), would need to look at these issues in detail.

The second research question, question (b), would need to scrutinise incentives and incentive packages, and propose a number of options for consideration. This could be informed by an in-depth literature review on incentives used in the transport sector for other purposes.

The third research question, question (c), would need to either model the impacts of the different options proposed as a result of work on question (b) or design randomised trials in order to assess the incentives' impacts. A model would need to be informed by a substantial amount of information regarding travel behaviour, elasticities and time and money costs. A randomised trial would need the local government support and would need a careful design.

The fourth research question, question (d), would need to focus on comparing costs and benefits from these incentives over a period of time of 10 to 20 years, even if benefits were to be narrowly defined to only include the direct, immediate impacts from the incentives.

There are many other research questions, which although interesting, fall outside the remit of the present report. These include impacts of shared mobility on accessibility of vulnerable groups, such as younger, older, disabled and those without driving licences, impacts on land-use, especially impacts on the location of households and firms (Taylor et al, 2015), impacts on vehicle depreciation and vehicle sales (Grosse-Ophoff et al, 2017), impacts on physical infrastructure, especially that funded by the public sector (Finger et al, 2017), need for regulation of new shared mobility services (Finger et al, 2017), especially regarding employment status of drivers, personal security of drivers and passengers, safety for all road users, and insurance requirements for car-sharing companies (Taylor et al, 2015).

6. Conclusions

Shared mobility or mobility in the sharing economy is characterised by the sharing of an asset (a vehicle) instead of owning it and the use of technology (apps and the Internet) to connect users and providers. There are four main models, namely, peer to peer platform where individuals can rent their cars when not in use, short term rental of vehicles managed and owned by a provider, peer-to-peer with a company as a broker, on demand private vans or buses and other vehicles, such as big taxis, shared by passengers going in the same direction.

The first three models can essentially yield profits to private parties and given the evidence available they do not seem to have potential to reduce congestion and CO2 emissions substantially. The fourth model, which entails individuals not only sharing a vehicle but actually travelling together at the same time, is promising in terms of congestion and CO2 emissions reductions, but also the most challenging one, given the disadvantages in terms of waiting and travel time, comfort and convenience.

There is very limited data on the different models and their market share but what there is points towards a negligible share, albeit set to increase (Vaughan and Daverio, 2016; Grosse-Ophoff et al, 2017). The question is whether it would be in local and national governments' interest to increase shared mobility by introducing incentives, what those incentives should be, what their impacts would be, and how costs and benefits of introducing incentives to shared mobility would compare.

At present no government anywhere has any incentives in place to increase shared mobility market penetration, except for the odd pilot study. This in itself may also be a sign that governments are not interested in encouraging shared mobility. It may also be a sign that they are not clear on what benefits shared mobility can provide, which is understandable given the lack of robust evidence and the range of business models. Another possible explanation is that shared mobility is a relatively new concept which is still emerging and governments need more time to react.

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