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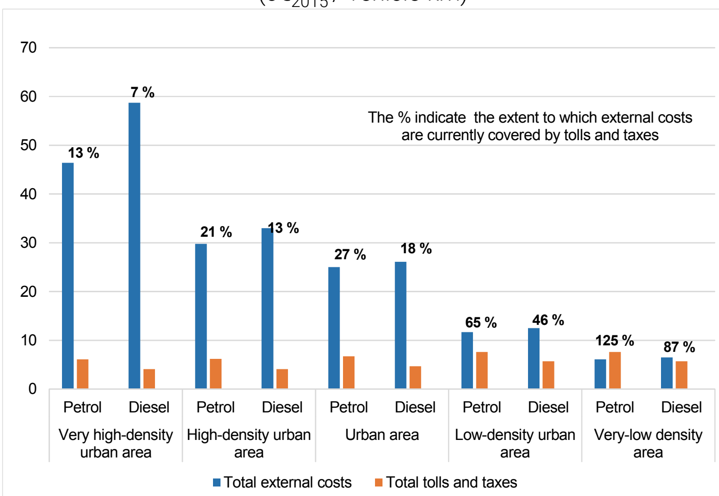
# Lessons from foreign urban charging schemes

- Car use generates costs for society in terms of greenhouse gas emissions, traffic jams and air pollution. In order to ensure economic efficiency, the cost of driving for car users should reflect these external costs alongside private costs (car purchase, repairs and fuel). This is currently not the case in France where, most of the time, car users do not pay for the social cost of their rides. This is especially true in urban areas where congestion is the heaviest and where more people are affected by local pollution. This leads to an overuse of cars and a reduced wellbeing for the community.
- With the aim to offsetting the under-pricing of car use in densely-populated urban areas, various cities around the world such as Singapore, Stockholm, Gothenburg, London, Rome and Milan have introduced congestion charges. Several studies conducted in London and Stockholm show that the implementation of such urban charging schemes can reduce both traffic jams and pollution levels.
- These foreign experiments have revealed that urban charging schemes must fulfil a number of conditions in order to be effective. These include using in-vehicle technologies, limiting their implementation to highly populated areas, charging schemes not being time-bound so as to ensure financial and socioeconomic return on investment, a transparent price grid for car users without any exemptions and, lastly, improving the public transport system.
- Several measures can foster the acceptance of urban charging schemes by the population, such as information campaigns displaying the reduction in congestion and pollution enabled by those schemes, government subsidies for in-vehicle equipment (insofar as the public cost is reasonable), and social measures for low-income households.
- Article 65 of the French Grenelle 2 Act allows the implementation of urban tolls by French local authorities. However, they are limited to three years, a maximum duration that seems way too short for recouping the cost of the investments, which explains in a large part why cities in France have not yet implemented urban charges.

**Drivers cost more than they pay**
(c€$_{2015}$ / vehicle-km)




*Source: General Commission for Sustainable Development (CGDD)/DG Trésor calculations.*

*External costs: congestion, local pollution, CO2 emissions, noise, accidents and infrastructure wear and tear.*

*Taxes and tolls: mainly tolls on the concessionary road network and the domestic tax on consumption of energy products (TICPE).*

# 1. The economic rationale and typology of urban charging schemes[1]

## 1.1 Economic relevance of urban tolls

While private car users pay the costs associated with the use of their vehicles (car purchase, repairs and fuel), they also cause "external costs" (mainly greenhouse gas emissions, congestion, noise, local pollution, accidents and infrastructure wear and tear). These external costs are not borne by those who cause them but by other individuals in the population. Currently, in France, car owners do not pay the whole social cost (meaning both private and external costs) of their drives, particularly in high-density urban areas.

For instance, any individual in a diesel car going through a high-density urban area creates external costs for society of 33 euro cents per km. These costs are mainly composed of congestion (23 cents) and, to a lesser extent, local pollution (4 cents). Regarding tolls and taxes they pay while using a car, in particular taxes on fuel, drivers only pay 4 cents per km when driving in high-density areas. In other words, a diesel car used in such areas only covers 13% of the external costs that it causes. This under-pricing leads to an overuse of cars in urban areas in comparison with the situation that would be the most beneficial for society and causes excessive pollution – with all its damaging effects for human health and the environment – as well as time waste because of traffic jams.

Various existing studies point to the fact that building new roads has very little effect on traffic jams reduction. In the medium and long term, traffic tends to adapt to new road capacities which ultimately increases the overall number of car drives and their associated negative external costs. The economic literature has been referring to this problem as the Downs-Thomson Paradox since the 1960s.

However, other external costs from car use, such as congestion and local air pollution, are not directly linked to fuel consumption are depend more on the location (and in particular the population density of the area) and the time of the day (peak or off-peak hours). Hence, from a theoretical standpoint, the first-best solution to curb the under-pricing of car use in high-density areas is the implementation of urban tolls so that users pay fot the external costs that they cause. These tolls are an efficient tools as they are designed to specifically address high-density areas, where the under-pricing is the most acute, and the prices they charge can vary upon the time of the day. Their economic efficiency derives from the fact that the drivers who benefit the most from being allowed to use their car can continue to do so insofar as they pay for the costs they induce for society, whilst other people adapt their behaviours and turn to other means of transport or may even cancel their journeys.

## 1.2 Examples of foreign urban tolls

Since the mid-1970s, various countries have implemented congestion charges, which provides us with extensive and useful feedbacks. Urban charging schemes may significantly differ depending on the end goal: congestion charging aims at making users pay for the waste of time they cause for others (e.g. Singapore since 1975, Stockholm since 2006, Gothenburg since 2013, the *Congestion Charge* in London since 2003, the *Area C* in Milan since 2012, Rome since 1996 and Tokyo since 2001); environmental charging aims at making drivers internalise the environmental costs of driving (i.e. the *Low Emission Zone* since 2008 and the future *Ultra Low Emission Zone* scheduled for 2019 in London, or the *Ecopass* in Milan from 2008 to 2012). In practice, both environmental and decongestion benefits stem from the fall in traffic levels that these two types of charges allow.

Two main technologies are currently used to levy tolls without the vehicle having to stop: automatic number plate recognition (ANPR) like in Stockholm, Gothenburg and London for instance, and in-vehicle devices like in Singapore. However, Singaporean authorities are planning to introduce beginning in 2020 a GNSS urban pricing scheme.

(1) This issue of Trésor-Economics summarises the content of DG Trésor's working paper no. 2018/1, April 2018, Gostner C., "*Péages urbains : quels enseignements tirer des expériences étrangères* ?". This document was includes contributions from Rome, Tokyo, Riga, Oslo, London, Singapore and Stockholm economic department teams.

### 1.3 How effective are urban tolls?

Studies conducted after the implementation of urban charging schemes in London and Stockholm highlight their socio-economic efficiency. Studies highlight they led to a significant reduction in both congestion and pollution levels:

- In Stockholm, the congestion charge brought about a 20% fall in traffic as from its first year of implementation and its impact has kept on rising ever since. A recent study pointed out that air pollution was cut by 5 to 15% which in turn reduced the number of asthma attacks suffered by young children.[2]
- In London, the introduction of the congestion charge led to 30% less road traffic from the very first year of implementation. It also brought about a reduction in greenhouse gases and pollutants emissions in the zone (–8% for $NO_x$, –7 % for $PM_{10}$, –16% for greenhouse gases).

## 2. Lessons for France

### 2.1 Implementing efficient urban charging schemes

Implementing urban tolls generates investment and operating costs. As a result, the socio-economic efficiency of the toll depends directly on minimizing these costs and maximising the expected socio-economic benefits at the same time. In this respect, the examples of urban charging schemes in foreign cities highlight the high importance of five different conditions to ensure the socio-economic efficiency of urban charges: the design of the price grid, the technology used, the perimeter boundaries and timeframe, the enhancement of the public transport system and the handling of potential side effects.

In terms of pricing, economists advise to charge varying prices based on the varying value of external costs by taking into account the travel distance, the day of the week, the time of the day, the area travelled and/or $CO_2$ and pollutant emissions, rather than charging a fixed price (for instance, a tariff per day). The Electronic Road Pricing (ERP) system used in Singapore provides a good example of well-defined, modular and foreseeable pricing grid with a list of rates that are known beforehand. Moreover, exemptions should be limited as much as possible sinceall vehicles cause congestion, accidents, roads wear and tear and – in the case of non-electric vehicles – air pollution.

Amongst current technologies available, the electronic recognition of in-vehicle badges should be favoured over ANPR, which is thought to be slightly more expensive. In the medium term though, the development of GPS systems should allow for distance-based pricing and, as toll gates would not be needed anymore, should also allow for a dynamic adjustment of the congestion charge boundaries.

In addition, congestion charging should only be implemented in high-density cities where socio-economic benefits of the urban tolls are more likely to cover its investment and operating costs. Studies available suggest that urban charging schemes should be limited to of at least 300,000 inhabitants. Urban tolls also need to be implemented for several years in order to cover investment costs: for instance, it took five years for the Stockholm congestion charge to be financially profitable. Furthermore, the longer a congestion charge is implemented, the higher the chance that drivers' behaviour will change for good.

In order for urban charging to bring about a long-lasting behavioural change, the public transport system may need to be enhanced and improved so that new transport solutions are offered to the population. The opportunity to invest in the public transport system should be assessed with a socio-economic analysis.

Lastly, the potential "side effects" of urban charging schemes that might reduce their socio-economic efficiency need to be tackled:

- A first possible effect is an accumulation of traffic around the toll zone. Such a problem can be mitigated thanks to an appropriate ex ante definition of the toll boundaries. For instance, in London, authorities arranged for a prior public consultation to find out how people would change their driving habits following the introduction of the congestion charge. This provided a better understanding and anticipation of changes in traffic flows. The toll boundaries can also be changed after the urban charging has been implemented, as it was the case in Singapore.
- A second possible side effect is a decentralisation of jobs and an increased urban sprawl if travelling to the city centre becomes too expensive. However, and conversely, implementing urban tolls could encourage households and businesses to move into the city centre. The increased appeal of the central district due to the fall in

(2) *Cf.* Simeonova E. *et al.* (2018), "Congestion Pricing, Air Pollution and Children's Health", *NBER Working Paper* No. 24410.

air pollution following the implementation of the urban charging may also attract new inhabitants and businesses in the city centre. Various studies suggest that the latter effect usually overrides the risks of increased urban sprawl.

### 2.2 Making urban charging schemes more acceptable

It is very important that the implementation of urban charging be preceded by an information campaign targeted to drivers. For instance, Stockholm in 2006 organised a campaign focusing on the expected benefits of an urban toll on congestion and local air pollution. it might also be useful to reassure the population regarding the expected effect of the urban toll on city centre shops and services.

Moreover, authorities could consider paying for all or part of the cost of in-vehicle equipment, provided that the impact of such a measure on public finances remains low. In 1998, in Singapore, during the months leading up to the implementation of the new ERP system, in-vehicle equipment was supplied and installed free-of-charge for all owners of road vehicles.

The opportunity of measures aiming at helping low-income households support the increased cost of driven should also be assessed. Their opportunity depends on the spatial and social context:

- Implementing a urban toll may deter low-income households living in areas poorly served by public transport from travelling to work.
- However, this is not an automatic phenomenon: available studies tend to show that the redistributive effect of urban charging schemes highly depends on the spatial and social characteristics of cities. Tolls may be either regressive (low-income households pay more than high-income households in proportion to their income) or progressive (the wealthiest households pay the most in proportion to their income).

When implementing a urban toll, the opportunity of compensating households must be assessed in light of those issues.

Many cities which have implemented urban charging schemes have spread out compensation schemes for low-income households. For instance, the city of Rome introduced varying price rates depending on income, and in Stockholm households whose travel time by car is significantly shorter than their travel time by public transport are allowed to deduct toll payments from their taxes.

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