

# Congestion Charges: Side Effects, Strengths and Weaknesses

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## Abstract

The congestion charge is one of the most successful transportation management measures to mitigate the effects of congestion in cities. Although it was initially not well received by the citizens, it was little by little shortened as its results were favourable. This paper critically analyses the measure supported quantitatively by evidence reported in the literature, also to answer the question: How does the congestion charge other factors associated with transport as accidents, pollution, and urban economics, among others? The conclusions of this paper show that although the advantages are broad, it nevertheless requires a large amount of technical support and technical personnel to make it sustainable.

**Keywords:** Congestion charge, accidents, pollution, urban economics.

## I. INTRODUCTION

Congestion charges are fees usually imposed during specific periods of the day (usually peak periods) along with a transport network or particular areas. The idea behind this measure is that users perceive the real cost of congestion to reduce road occupancy levels and discourage users from using other alternative modes (for example, public transport, bicycle, walking) [1]. On the other hand, this type of measure also seeks to reduce externalities other than congestion, such as accidents and emissions. There are several different approaches to charging this type of fee and defining the area in which the fees apply.

The first congestion charge system was implemented in Singapore in 1975 and since then other cities such as Rome (1998), London (2003), Stockholm (2006) and Milan (2008), have followed. Singapore has the oldest congestion charge in the world. This policy is designed to reduce the high rates of congestion today still afflicts the large cities on the planet. This is to charge drivers for driving on the streets of certain areas in the city. The charging system does not have barriers or tollbooths, instead there is a network of cameras that record the number plate of the vehicle and with this data, an automatic money from an account is that the car must have duly registered and loaded with money [2].

The policy has had critics and supporters. The critics think that although the policy confers a benefit in reducing rates of congestion, this is not enough to offset the high costs resulting from its implementation, commissioning, and operation through time. In contrast, supporters compared the benefits arising from the policy in cities like London where traffic fell by 27%, representing a reduction of 80000 vehicles per day, resulting changes in the modal split increasing the use of bicycles and public transport 66% and 45%, respectively [3]. Similar findings were made in interviews with people living in the Stockholm's inner after of the implementation the congestion charge. The citizens appreciated that there were fewer cars and less congestion [4].

As can be seen, evaluation and analysis of this policy have focused on congestion. However, there is curious to know, how does the congestion charge other factors associated with transport as accidents, pollution, and urban economics, among others? in order to answer this question, this essay a review of aspects that will be done to understand what the impacts on other underlying factors that have been also determine sociocultural and economic dynamics of a city. Then, it will show parallel what has been the experience of this policy in cities where it has been implemented.

The rest of the paper is structured as follows. Section 2 the nature of congestion charges is shown. That is important because the economic principle on which the congestion charge is based is an essential requirement. Congestion charges in numbers is described in Section 3. Finally, the conclusions are made in section 4.

## 2. NATURE OF CONGESTION CHARGES

A congestion charge is an urban toll that gives access to move about some city areas. Usually, the amount to be paid is an economic compensation for the congestion in the referenced location. The amount of money raised is recommended to be used to strengthen public transport and sustainable modes by encouraging their use. Understanding the economic principle on which the congestion charge is based is an essential requirement to be able to implement it. The concept of externality is the most important antecedent to understand [5].

The first economists who addressed the issue of taxation have converged on taxes allow consumers confront total social costs of an externality [6]. This concept applied to congested roads dates back to Walters [7] and Vickrey [8]; they postulated that users should be able to internalize the costs they impose other travellers as an incentive for efficient and rational use of roads. If a fee is not charged in congested conditions, investment to build infrastructure to meet the excess demand and mitigate the effects of this externality becomes untenable.

The implementation of the congestion charge in Stockholm it proved to be a milestone in the development of urban road pricing. According to Eliasson et al [9], Stockholm initially determined the value of the collection aiming to achieve a reduction by 10-15%. However, it experienced a decline by 16% in traffic flow (and thus congestion). The move generated a financial surplus of US \$ 55 - 66 million each year for the city. In addition, half of the drivers who decided to change so did the public transit, which resulted in overcrowding into the subway. Surprisingly, improvements in travel times also occurred far from the city centre. In terms of contribution to the environment decreases in carbon dioxide emissions in the city centre it was perceived by 14%. According to Trivector [4] externalities such as personal injury accidents within the charging area were reduced by 9-18%.

### 3. CONGESTION CHARGES IN NUMBERS

Another case of implementation of a congestion charge in the literature corresponds to London. The London Congestion Charging Scheme began in February 2003. The charge of £5 allowed to vehicles entering a central London zone between the weekday hours of 07:00–18:30. Although several types of vehicles are exempt from the tax, the immediate effect of the measure was reflected in the reduction of the kilometres travelled by vehicles by -15%. Likewise, travel times decreased due to increases in the speed of around 4 km / h [10].

Early indications showed significant reductions in the distances traveled within the area where the charge is applied. Comparisons of the year immediately before and after the implementation of the congestion charge showed that the total distance driven by cars fell by 34% [11]. At the same time, the distances traveled by bicycles, motorcycles, taxis and buses increased by 12%, it is resulting decrease the distances traveled in vehicles. This proved to be enough to reduce congestion lost time by 30% [3]. This allowed deducing that the policy reduced congestion in the area where it was applied, generating social benefits in reducing travel times. Green et al [12] showed that in parallel with these improvements also reduced air pollution and potentially fewer accidents and loss of life was experienced. Green et al [12] noted that the number of bicycle accidents increased. However, this growth reflects only a flood of new riders and increase in the distances covered by these users, there

is no proven cause associated with this result. It has also been showed that the number of traffic accidents reduced significantly in both the original and extended charging zone [13].

The first results of implementing the congestion charge in London showed significant reductions in the distances travelled within the area. These comparisons of the year immediately before and after loading showed, for example that the total distance travelled by cars dropped by a whopping 34% [11], [12]. The distances travelled by bicycles, motorcycles, taxis and buses increased, resulting in a 12% reduction in distances travelled in these modes. However, this was enough to reduce time lost to congestion by almost 30% [3]. According to Small et al [14], the social benefits of this type of measure are significant since the values assigned by people to reduce travel time and improve reliability are usually significant.

However, so far they have highlighted a number of benefits that have the policy not only towards reducing congestion, but also accidents, pollution and travel times, showing evidence supporting these findings. However, in the academic literature and in the practice (see for example Hansla et al [15], the introduction of congestion charges in urban areas has been controversy and public debate. One of the first aspects to emphasize and in which there is great uncertainty is the inequality caused by this policy, since it favors large part of the population with high incomes who are financially able to pay this tax, while users with lower incomes they are those who are forced to change their travel for public transit. Another controversial and no less important aspect is the fate of the collected resources; although it is logical to think that should be invested in public transit it is also conceivable to earmark the economics resources for improvement and maintenance of road infrastructure or distributed among users who changed their travel patterns because of congestion charge which can be consolidated as a progressive extent.

In cities like Stockholm, the measure has been a successful case study. The traffic reduction compared to 12 months before stabilised after the first month at around 22% (see Fig. 1) [9].

Initially, the congestion charge was not accepted by the city's inhabitants, reaching the point that it had to be submitted to a referendum for approval after an initial trial in 2006. But by 2014, more than two-thirds of its residents approved—the rate has given the broad benefits that the measure showed after it was implemented.

Good results reported by the policy have been the evidence by the governments of other cities seeking to implement the policy, however in some places has not been successful; example highlights Hong Kong (China), Edinburgh (Scotland), New York (United States) and Manchester (England). The causes in some cases due to the aversion showed citizens before implementation and in others was not politically supported [16].

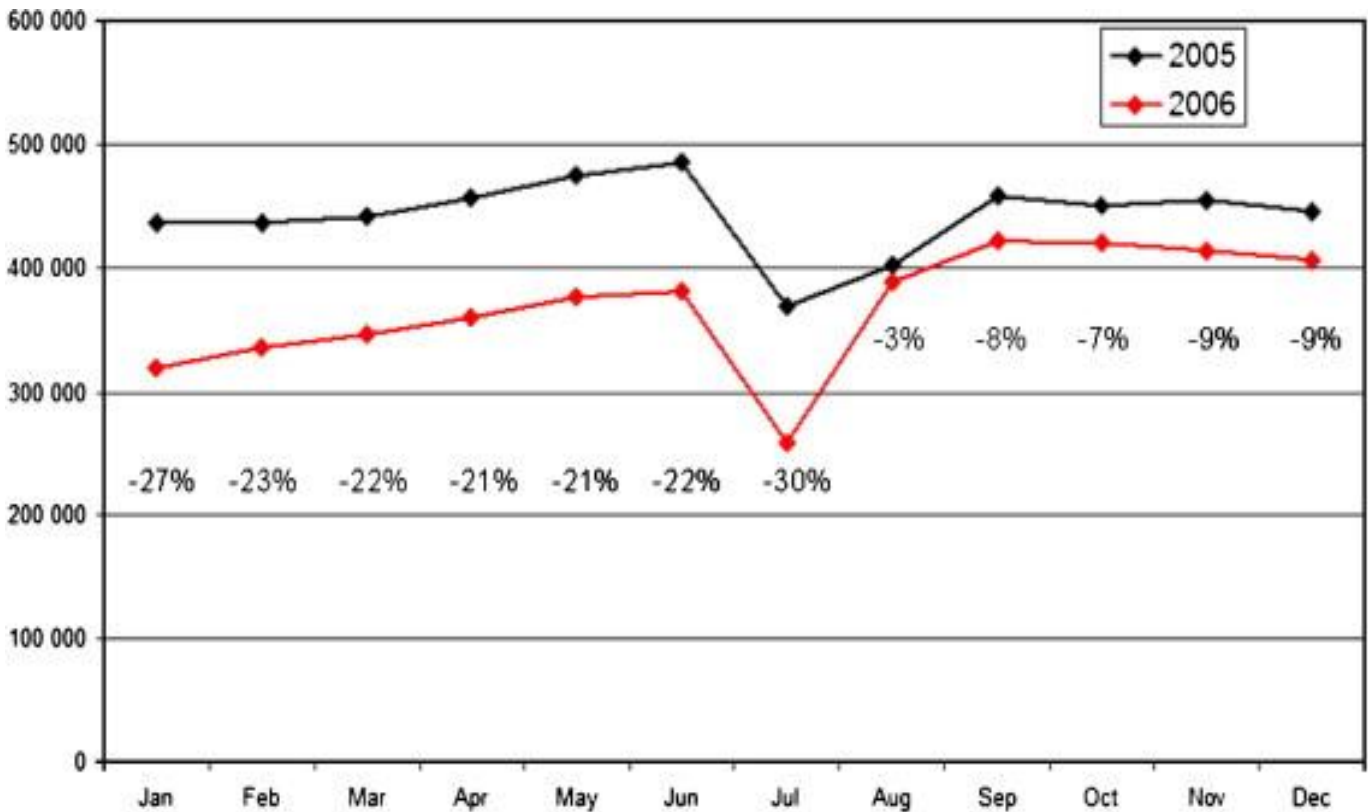


Fig. 1. The number of vehicles passing across the cordon during day-time (6.00–19.00 weekdays). Source: [9].

#### 4. CONCLUSIONS

It can be noted that congestion charge has worked for which has been initially created (decrease traffic flows over an area and therefore congestion). However, it is also undeniable that the policy has served to mitigate other effects that also affect the sociocultural and economic dynamics of modern cities as decreased accident, travel times and pollution; on the other hand, other benefits are described such as increases in flow rates, financial surplus for cities, improvements in the operation of public transport, growth in the use of sustainable and healthy as cycling and walking transport.

It also requires that the policy still leaves doubts on various aspects that do not quite convince part of the population and those responsible for legislating such as the involvement of the economically most vulnerable population, impacts on the urban economy and adequate allocation of resources collected. Regarding the latter aspect as posit, several options as resources should be invested in public transport, maintenance of road infrastructure or distributed among users who changed their travel patterns.

The congestion charge shows that the effects associated with dynamic urban areas have been successful, generating the maximization of social welfare in the population not only in the areas where pricing is applied but also around itself.

Congestion charges have been evaluated only from the point of view of urban transport, it is recommended that future research

should focus on the study, analysis and impacts of fee schedules congestion on other relevant issues for cities such as urban quality and / or the preservation of historical heritage in the areas in and around where the policy is applied.

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