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The Swedish congestion charges: Ten years on

Maria Börjesson[a,b,*], Ida Kristoffersson[a]

[a] VTI Swedish Road and Transport Research Institute, Sweden
[b] KTH Royal Institute of Technology, Sweden

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ABSTRACT

Time-of-day dependent cordon-based congestion charging systems were introduced in Stockholm in 2006, and in Gothenburg in 2013. The Stockholm system was significantly extended in 2016, and the peak charge has been increased in the two cities. This paper analyses the effects of the first decade with the Swedish congestion charges, specifically effects of the system updates, and draws policy lessons for the years to come. Should we introduce congestion charges in more cities? Should we extend the systems that we have? We synthesize previous research findings and focus on the long-term effects that have varied over time including the recent years: the price elasticities on the traffic volume across the cordon, the revenue and system operating cost, the public and political support, and consequences for the transport planning process. We also explore the effects on peak and off-peak, and different types of traffic (trucks, company cars and private passenger cars), because of access to novel data that make this analysis possible. We find that the price elasticities have increased over time in Stockholm, but decreased in Gothenburg. We find that the public support increased in the two cities after their introduction until the systems were revised; since then, the public support has declined in both cities. We find that the price elasticity was substantially lower when the charging levels were increased, and when the Stockholm system was extended, than when the charges were first introduced, a likely reason being that the most price-sensitive traffic was already priced off-the road at the introduction.

1. Introduction

In 2016, the Swedish congestion taxes celebrated their tenth anniversary. Time-of-day dependent cordon-based congestion charging systems were introduced in Stockholm in 2006 and in Gothenburg in 2013. In Stockholm, the peak charge was increased by 75% in January 2016 and the system was extended significantly, to include all car traffic between the north and south part of Stockholm. In Gothenburg, the peak charge was increased by 22% in January 2015.

The five-year effects of the Stockholm system and the one-year effects of the Gothenburg system, with regard to traffic effects and public and political support, have been studied in previous papers (Börjesson et al., 2012; Börjesson and Kristoffersson, 2015). The key findings from these papers are (i) that the charges initially caused substantial traffic reductions across the cordon in both cities, (ii) that the traffic reduction increased over time in Stockholm, and (iii) that the public support increased once the charges were introduced in both cities. The aim of this paper is to analyse long-term trends in effects that have not remained stable over time and how they responded to the revisions of the systems. We compare the trends and effects between the two cities, indicating the transferability between cities.

Since the Gothenburg system was implemented seven years after the Stockholm system, the trends analysed for Gothenburg are

* Corresponding author.
E-mail address: maria.borjesson@vti.se (M. Börjesson).

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not as long-term as for Stockholm. However, the effects analysed in this paper are more long-term than the one-year effects previously analysed. In addition, we will contribute to the previous research on the Swedish congestion charges by computing elasticities separately for different types of traffic (company cars, light and heavy trucks and private passenger cars). This has not previously been possible due to limitations in the data from the charging systems. We also analyse in more depth why the peak elasticity is lower than the off-peak elasticity, and why the transport models could predict the peak effect reasonably well, but not the off-peak effect (Eliasson et al., 2013; West et al., 2016). We also describe how the political drivers of the charges, and their impact on the infrastructure investment planning, have shifted in recent years.

In Section 2, we describe the system design, focusing on the system revisions. Section 3.1 computes the long-term price elasticities. There is some literature on the effectiveness of congestion charges in reducing traffic volumes in Singapore (Phang and Toh, 1997), London (Santos, 2004; Santos and Shaffer, 2004), Stockholm (Börjesson et al., 2012; Eliasson, 2009), Gothenburg (Börjesson and Kristoffersson, 2015) and Milan (Gibson and Carnovale, 2015). Janson and Levinson (2014) review a number of elasticity estimates for toll roads and find them to be −0.30 to −0.36, which is lower than what is found for the European congestion charging systems. Analyses of long-term effects of congestion charges are scarce. However, in consistency with the findings from Stockholm, Odeck and Bråthen (2008) find that the short-term elasticity of −0.45 is lower than the long-term elasticity of −0.82 for the Norwegian toll projects. Goodwin et al. (2004) find that the long-term fuel price elasticities are higher than the short-term; presumably travellers have more possibilities to adapt their behaviour in the long-term. Beria (2016) finds that the effect of the Milan pollution charge introduced in 2008 declined after some years, due to replacement of charged vehicles with newer, exempt, vehicles.

Section 3.2 compares the elasticities of an increase in charging levels with those of the first introduction of the charges. This analysis will have implications for the benefits of dynamic charging levels. Evidence from London (Evans, 2008) and Singapore (2017) indicates small demand effects in response to adjustments in pricing levels. Janson and Levinson (2014) even find a positive price elasticity of toll increases for the MnPASS High Occupancy Toll (HOT). They explain the positive price elasticity by travellers expecting a higher travel-time saving on the toll road when the price is high. Foreman (2016) and Olszewski and Xie (2002) find lower price elasticities for increases in charges, compared to the elasticities at introduction of charging. Finkelstein (2009) attributes the low price elasticity to the electronic road pricing system. Section 3.2 also analyses how different types of traffic respond to the revision of the system. As Olszewski and Xie (2002), we find higher elasticities for private cars than for professional traffic.

Section 3.3 analyses the peak and off-peak price elasticities. Comparisons of peak and off-peak price elasticities of road pricing are scarce. However, analysing the effects of the time-varying toll on the San Francisco-Oakland Bay Bridge, Foreman (2016) finds a positive increase in the traffic volume in the off-peak (due to traffic shifting from the peak). Olszewski and Xie (2005) find the price elasticity in the morning peak to be lower than in the afternoon peak, which we also find for Stockholm. However, Agarwal et al. (2015) show that the cross-price elasticity with respect to public transport is higher in the morning peak. They suggest that the lower cross-elasticity in the afternoon peak is due to a more flexible trip schedule in the afternoon peak. Polak and Meland (1994), on the other hand, find that the elasticity in the morning peak is higher than in the afternoon peak for the Trondheim toll ring. Litman (2013) finds elasticities for off-peak transit travel to be 1.5–2 times higher than for the peak. We find off-peak price elasticities to be 1.7 times higher than peak elasticities in both Stockholm and Gothenburg, mainly because off-peak trips are travelling in the peak in the other direction.

Section 4 describes how the public and political support has changed over time. Public support for congestion charging has been observed to increase after the introduction of congestion charges in several cities, e.g. London (Transport for London, 2003), Stockholm (Eliasson, 2014), Norway (Tretvik, 2003), the United States (Zmud (2008) quoted in Anas and Lindsey (2011)), and Milan (Ozer et al., 2012). Increased public support was also observed in Gothenburg, which can be explained primarily by status quo bias (Börjesson et al., 2016). In this paper, we extend the previous analysis on public support by long-term trends in Gothenburg and Stockholm. Interestingly, we find that the public support declined in both cities after revisions of the systems. In Stockholm, this was a trend break after almost a decade of increased support for the charges. Stockholm and Gothenburg have both had referendums concerning the charges. Hårsman and Quigley (2009) show that in Stockholm districts where the voters gain more or lose less show stronger support for the charges. However, West and Börjesson (2016) find that this does not hold for Gothenburg. Hårsman and Quigley also show that the outcome of the referendum is strongly correlated with political views. Green and liberal views tend to be associated with support of the charges whereas concerns with taxes and social equity are associated with opposition to the charge (Börjesson et al., 2016).

Cost Benefit Analyses and effects on income redistribution of the initial systems (Eliasson, 2009; Eliasson and Mattsson, 2006; West and Börjesson, 2016) and efficiency and equity of extensions to the Stockholm system (Börjesson and Kristoffersson, 2014; Kristoffersson et al., 2017) are described elsewhere. We also leave out effects on land-use because they seem negligible even after a decade,[1] although there were concerns that the charges would reduce the attractiveness and economic activity of the city (Eliasson, 2008). The effects on the emissions cannot be measured directly because air quality depends heavily on weather conditions. It can, however, be approximated from the effects on traffic volumes.

Section 5 ends this paper with a forward-looking summary and policy implications for the decade to come.

[1] Comparing travel survey data, a decade after the introduction, Bastian and Börjesson (2017) find that the reduction of car trips is more than compensated by an increase in bicycle and public transport trips to and from the inner city; similar trends were observed for London (Transport for London, 2015).