The Ugly Side of Congestion Pricing?
An Overview of Concerns Surrounding the Equity of this Transportation Policy Instrument

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Introduction

As cities all over the world are growing larger, urban transportation poses many significant challenges to the likes of urban planners, policy-makers, economists, and engineers. Traffic congestion, caused by exceeded road capacity, is an urban transportation problem currently present in many cities. Congestion has many negative impacts on urban life, such as poor air quality, increased fuel costs, and increased travel times (Armah, Yawson, and Pappoe, 2010; Cookson, 2018). To combat traffic congestion, a transportation policy instrument known as "congestion pricing" (or "congestion charging", "decongestion charging", "road pricing") has been proposed and implemented in many urban contexts.

In this paper, my aim is to introduce the concept of congestion pricing as a transportation policy instrument and specifically address concerns surrounding its equity. Synthesizing discussions and findings from the wide body of literature on congestion pricing, I examine the equity of congestion pricing by looking at the distributional impacts of this policy instrument across an urban population. A more equitable outcome recognizes differences in transportation needs across different groups in society and offers greater equality in the distribution of welfare benefits across these groups.

I begin by introducing the concept of congestion pricing and highlight its aim to internalize the social, economic, and environmental costs associated with traffic congestion. I discuss that variety of ways in which congestion pricing can be implemented, providing examples from Singapore, London, and Stockholm. I also address the challenges associated with congestion pricing regarding public perception and political viability. I then highlight equity as one of the primary concerns surrounding congestion pricing. I investigate the equity of congestion pricing by examining the impact of the policy on the welfare of different groups. I then discuss policy options to promote the equity of congestion pricing. I conclude with a case study of the Stockholm congestion pricing system and discuss the impact that it has had on the welfare of different groups.

Section 1: Congestion Pricing as a Transportation Policy Instrument

Road transportation is associated with many negative externalities. An externality occurs when the social costs for an activity or good outweigh the private costs for such an activity or good. Such a case occurs when market forces are unable to account for the full social cost of a good or activity (Dahlman, 1979). Road transportation results in externalities such as road damage, road accidents, greenhouse gas emissions, air pollutants, and increased noise levels (Anas and Lindsey, 2011; Santos et al., 2010). While road users will often have paid for the construction of a road through government taxes, they do not feel the full marginal social costs of road use. As such, the decision-making practices of individual road users often disregard many important factors (Anas and Lindsey, 2011). Many transportation policies have been put in place in an attempt to internalize the negative externalities associated with road use. Fuel taxes, for example, act as an instrument to internalize the costs of carbon dioxide emissions.

Traffic congestion is a further externality associated with road transportation that has many detrimental social, economic, and environmental impacts. Congestion takes place in urban environments worldwide and is a result of exceeded road capacity. In the United States, research has shown that individuals spent an average of forty-one hours in traffic during peak hours throughout 2017, costing an estimated total of $305 billion (Cookson, 2018). These costs capture factors such as the wasted value of fuel and time, and the business fees from company vehicles stuck in traffic. Congestion also results in increased carbon dioxide emissions (Barth and

Boriboonsomsin, 2008) and contributes to poor air quality (Armah, Yawson, and Pappoe, 2010). Due to these widespread detrimental effects and the fact that congestion is continuing to increase in many urban areas (Cookson, 2018), congestion is critical topic for urban transportation policy.

The concept of congestion pricing is gaining salience as a market-based policy instrument to internalize the costs of congestion caused by excessive road use. Market-based policy instruments seek to encourage a particular type of behaviour through market signals, rather than through explicit government commands (Stavins, 2010). By creating a new cost associated with targeted forms of road use, congestion pricing seeks to discourage road use during peak times and in peak locations, thus reducing congestion and its associated negative impacts. Congestion pricing is an example of a "Pigouvian Tax", by which market externalities, such as congestion, are internalized (Pigou, 1920).

There is a diversity of ways in which congestion pricing can be implemented. London, Stockholm, and Singapore provide perhaps the most well-researched examples of how congestion pricing theories can be implemented in practice. In London, automobile drivers are charged a flat rate of 11.50 pounds when entering a defined "charging zone" (Transport for London, n.d.). As indicated by Figure 1, this charging zone covers the main downtown district of the city. The congestion charging system in Stockholm consists of eighteen charging points that are located at the primary points of access into and out of the inner city. Vehicles are charged variable amounts based on the time and place of travel (Eliasson, 2014). By adjusting the charge depending on location and time of day, congestion pricing can be more targeted in addressing the variable nature of congestion. Singapore's Electronic Road Pricing (ERP) functions in a similar manner whereby vehicles are charged when passing through gantries located at strategic locations throughout the city (Land Transport Authority, n.d.).

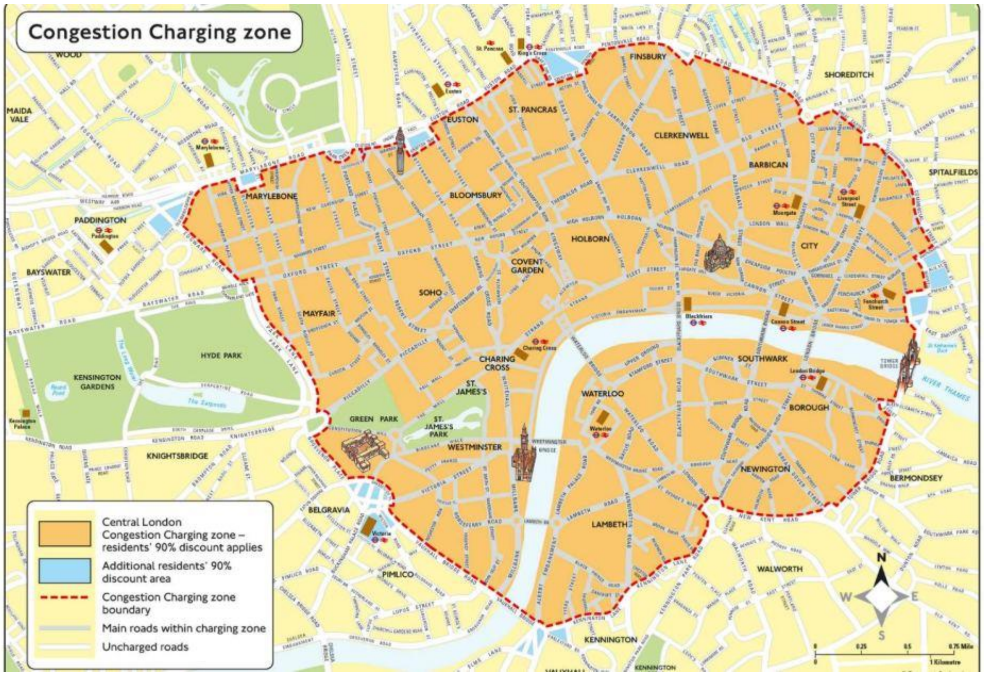

Figure 1. Map of London’s congestion charging zone (Source: Transport for London)

The congestion pricing schemes in London, Stockholm, and Singapore all reflect point-based approaches to congestion pricing. Vehicles are charged when crossing a specific point in a road. Such point-based approaches can be further broken and classified as facility-based schemes, cordon-based schemes, or zonal schemes (de Palma and Lindsey, 2011). Facility-based schemes charge vehicles for use of specific roads, bridges, and tunnels. Cordon-based schemes charge vehicles when crossing a cordon in inbound and/or outbound directions. Congestion pricing in Stockholm functions as a cordon-based charge, and pricing in Singapore functions as a combined facility-based and cordon-based charge. London’s congestion pricing functions as a zonal scheme, whereby vehicles pay to enter or exit a specific zone.

While point-based approaches to congestion pricing are the most common, other implementation approaches have been proposed. While not yet implemented in any cases, distance-based charging has been proposed as a means to tax vehicles based on the overall distance that they travel (de Palma and Lindsey, 2011). High occupancy toll (HOT) lanes have also been proposed as an approach to implement congestion pricing. High occupancy vehicles and other exempt vehicles (such as emergency vehicles) are able to travel in these lanes, while other vehicles must pay a fee to use these lanes. Each individual driver is thus afforded the option to either stay on a more congested road free of charge or pay to travel on a less congested road (Li, 2001). The province of Ontario is currently implementing HOT lanes along Queen Elisabeth Way in an effort to improve traffic flow and encourage carpooling ("High Occupancy Toll", 2016).

Today, many cities all over the world are exploring proposals to integrate congestion pricing into their roads (eg., New York City's "Fix NYC" panel and Vancouver's "It's Time" project). The past and continuing successes of this policy instrument indicate that it may be an appropriate means to combat the congestion that is growing in many cities. It has been reported that the congestion charging implemented in Stockholm resulted in approximately a 22% reduction in traffic levels (Eliasson, 2014). London's congestion pricing scheme has also been shown to reduce congestion and even address other road use externalities such as accident levels (Transport for London, 2008).

Despite these proven successes and the popularity of congestion pricing amongst economists and urban planners, there nevertheless remains significant public and political opposition towards the implementation of congestion pricing. Members of the public often focus on the new tax associated with congestion pricing, rather than on the net benefit (Giuliano, 1992). Many members of the public are opposed to the idea of either having to pay to maintain their current travel habits or being forced to adjust travel habits to avoid paying (Jaffe, 2013).

This poor public opinion may in part be due to difficulties in communicating the concept of congestion pricing to the public (Giuliano, 1992). When the benefit associated with congestion pricing is not clear to the public, congestion pricing may be perceived as a limitation placed on individual freedom.

Politicians are thus wary to back congestion pricing proposals out of fear of losing public support (Hu and Mickinley, 2018). Infrastructure to implement congestion pricing may also be costly to support. Fifty to sixty percent of the total revenue from London's congestion pricing system, for example, is estimated to be put towards the system's infrastructure and operating costs (de Palma and Lindsey, 2011).

Section 2: Congestion Pricing and Equity

Concerns surrounding the equity of congestion pricing also contribute to its often-negative public perception and lack of political acceptability (Eliasson and Mattson, 2006; Giuliano, 1992). Thus, to ensure that a potential congestion pricing scheme is well received by the public and accepted by politicians, it is critical to address these concerns.

Defining Equity

In the context of transportation, equity can have many definitions but often broadly refers to the fairness of distribution of transportation resources across different groups in society (Boschmann and Kwan, 2008). A "fair" distribution of resources acknowledges that not everyone in society has equal needs, and thus differentially distributes resources based on need (ibid.). Discussions of equity in the context of transportation policy also recognize that the costs and benefits of decisions are unlikely to be distributed evenly throughout an entire urban population (eg., Eliasson and Mattsson, 2006; Rajé, 2006). The expansion of a highway, for example, may benefit those that have access to cars, but may also result in noise pollution and poor air quality for those who live in nearby locations.

As a comprehensive consideration for the complex concept of equity is out of the scope of this paper, I will employ a simplified approach that seeks to analyse the distributional impacts of congestion pricing across a heterogeneous urban population. I consider a more equitable outcome for the implementation of congestion pricing to be one that acknowledges differences in transportation needs across groups in society and provides a more equal distribution of welfare benefits across these groups.

Differential Impacts of Congestion Pricing

To address the issue of equity in congestion pricing, I illustrate how this policy will differentially impact the welfare of individuals, leaving some better or worse off than others. Eliasson and Mattson (2006) identify four factors that contribute to the impacts of congestion pricing: increased travel costs, changes in travel behaviour, reduced travel times, and redistribution of revenue. With respect to the first three of these four factors (revenue redistribution will be addressed in the following section), I will discuss the distributional impacts of congestion pricing. Derived from the work of Cohen (1987), Levine and Garb (2002), Levinson (2010), and Giuliano (1992), Table 1 identifies four distinct groups of car users who are differentially impacted by a generalized and hypothetical congestion pricing policy:

Table 1. Differential impacts of congestion pricing on car users

Group	Tolled/Untolled	Behaviour Modification	Rationale	Impact
Group 1	Tolled	No behaviour change	These individuals pay the congestion charge happily, as the benefit of their time saved outweighs the cost of the charge	Advantaged by congestion pricing
Group 2	Tolled	No behaviour change	Behaviour change is not possible. These individuals pay the congestion charge reluctantly, as the benefit of their time saved does not outweigh the cost of the charge	Moderately disadvantaged by congestion pricing
Group 3	Untolled	Behaviour change; no longer travel in charged regions or along tolled roads	Payment of the toll is not financially possible and/or reasonable travel alternatives are present	Disadvantaged by congestion pricing
Group 4	Untolled	No behaviour change	Continue to travel in uncharged regions, which may now be more congested or busy than previously	Moderately disadvantaged by congestion pricing

Table 1 indicates how congestion pricing policies can result in a diverse set of outcomes for citizens, both improving and reducing welfare for different groups of individuals. The size and composition of each of the groups presented in Table 1 is contingent on a wide variety of factors, including the congestion pricing cost, number of potential travel alternatives, individual income levels, and specific travel needs of individuals. Effective congestion pricing requires that some individuals be "tolled-off" (Levine and Garb, 2002) roads, resulting in reduced congestion and faster travel times for those that choose to pay the charge. Thus, the cost of the charges must be significant enough to ensure that a significant number of people fall into Groups 3 and 4.

Members of Group 1 are the clear "winners" of this new transportation framework. These members benefit the most from congestion pricing as they are able to continue with their previous travel behaviours and benefit from the time saved as result of less congestion. Members of Group 1 may also experience improved accessibility, as overall reductions in congestion allow for greater flexibility of travel in previously busy areas (Levine and Garb, 2002).

Members of Group 2 may similarly benefit from the improved travel times and improved accessibility. These benefits, however, do not outweigh the costs of congestion pricing and so these group members are overall disadvantaged by the implementation of congestion pricing. Members of this group may continue to pay the congestion charge if transportation alternatives are insufficient.

Members of Group 3 are disadvantaged by congestion pricing. These group members must alter their travel behaviour to avoid the congestion charge. The degree to which these group members are disadvantaged largely depends on the presence of appropriate of travel alternatives. For instance, if an individual has access to the necessary public transportation, or if alternative routes are present, then this individual's accessibility may not be significantly impacted. If public transportation is insufficient or if no alternative travel routes are available, then an individual's accessibility may be significantly impacted.

Members of Group 4 are also disadvantaged by congestion pricing, due to increases in congestion on untolled roads (owing to the displacement of cars from tolled roads). These group members may find that their travel times have increased with the implementation of a congestion pricing policy.

Note that the outcomes in Table 1 do not account for the possible uses of revenue generated from congestion pricing, which will be further discussed in a subsequent section. The estimations of impact are also based on a subjective evaluation of the costs and benefits associated with the behaviour modifications of each group. A single individual may also be part of different groups, depending on the specific travel context. For example, an individual with a high valuation of his or her time during working hours and a surplus of financial resources may belong to Group 1 when commuting to work along a tolled road. This same individual may belong to Group 5 when the best option to get to the grocery store is along a road that has not been tolled.

Congestion Pricing and Social Exclusion

Members of Group 3, as highlighted in Table 1, are at risk of being significantly negatively impacted by the implementation of congestion pricing. Likely due to financial barriers, these individuals are unable or unwilling to pay the congestion charge and so must either find travel alternatives or limit their travel altogether. For these individuals, the congestion charge may place barriers on their travel opportunities, thereby limiting the overall opportunities for these individuals to engage in activities in society. This limiting of opportunities is often referred to as “social exclusion” (Lucas, Grosvenor, and Simpson, 2001).

Some of the specific difficulties potentially faced by members of Group 3 are highlighted by Rajé (2003). Through a series of focus group discussions, Rajé (2003) illustrates how congestion pricing may significantly reduce the travel behaviour of low income individuals in

Bristol, UK. Due to existing issues with public transportation (such as uneven coverage of infrastructure, perceived unsafety, language barriers, and unreliable schedules) in the area, many residents rely on cars or taxis as primary modes of transportation. The introduction of an additional charge associated with car usage would force many of these residents to change modes of transportation. As alternative modes of transportation are often inadequate, introduction of the congestion charge could lead to the forced suppression of trips. Residents may then find themselves without access to necessary goods, services, facilities, and social activities, leading to social exclusion (Rajé, 2003). The focus group results from this study highlight how those that are both underserved by existing public transportation and that are likely to be "tolled-off" the road may be significantly and disproportionately disadvantaged by the introduction of congestion pricing.

Section 3: Policy Interventions to Promote Equity

The discussion in the previous section highlights how congestion pricing, when solely employed as an effort to reduce congestion, provides greater transportation mobility and accessibility to some while limiting the transportation opportunities available to others (Condeço et al., 2011; Levine and Garb, 2002). Policy makers must address these differential impacts and focus on how the benefits in welfare created by congestion pricing can be more evenly distributed across different groups.

As there are few real-world cases where congestion pricing has been implemented, many of the policies to address equity concerns are still proposals. Proposals and existing policies to promote the equity of congestion pricing can be divided into efforts to redistribute the revenue generated from congestion charges, and efforts to provide discounts and exemptions for special cases. Table 2 provides an overview of these policies.

Table 2. Policy options to promote equity in congestion pricing

Theme	Policy	Example
Redistribution of revenue	Investment in public transportation	Addition of new bus lines
	Credit-based congestion pricing	Previously generated revenue is credited to residents for the payment of future congestion pricing fees
	Improvements in road infrastructure	Highway expansion in congested region
	Reductions to other taxes	Reduction in gasoline tax
Discounts and exemptions	Personal discounts and exemptions	Discounts or exemptions for disabled individuals who cannot use public transportation
	Vehicle based discounts and exemptions	Discounts or exemptions for electric vehicles
	Situational discounts and exemptions	Discounts or exemptions from paying more than once to enter a cordon multiple times within a single day

Revenue Redistribution

In addition to reducing congestion, congestion pricing also has the potential to generate significant revenue. Appropriate redistribution of this revenue can render congestion pricing more equitable for those that are forced off the roads or otherwise negatively impacted by congestion pricing (Ecola and Light, 2009; Giuliano, 1992; Levine and Garb, 2002; Rajé, 2003). Redistribution of revenue can also contribute to positive public opinions surrounding congestion pricing, thus improving its political feasibility (Levinson, 2010). By offering a greater number of transportation options, improving the accessibility of existing options, or directly crediting individuals, redistribution of the revenue collected from congestion pricing may more evenly spread the benefits of congestion pricing amongst residents.

The costs of congestion pricing, such as those born by low income residents who are unable to pay the congestion charge, may be alleviated (to some extent) by investments that offer alternatives to automobile-based transport (Rajé, 2003). Congestion pricing can thus be an opportunity for municipal governments to develop public transportation systems that better respond to the needs of residents who are unable or unwilling to use cars as a mode of transport. In the case of Stockholm, it was predicted that investments in public transportation using the revenue generated from congestion pricing would benefit women and low-income individuals (Eliasson and Mattsson, 2006). It is also reported that prior to the implementation of congestion pricing in London, the city added 300 new buses to its roads (Ecola and Light, 2009). Bus ridership then increased by 18% during the first year that congestion pricing was implemented in the city (ibid.).

Improvements in public transportation are not the only way that congestion pricing revenues can be redistributed to produce more equitable outcomes. For some individuals, such as shift workers or disabled persons, car-based travel may be the only feasible option (Rajé, 2003). Policies aimed at promoting the equity of congestion pricing must acknowledge these requirements. For low income individuals who are unable to use public transportation, revenue may be used to subsidize taxi journeys (ibid.).

Various forms of “revenue-neutral” congestion pricing policies have also been proposed. Kockelman and Kalmanje (2005) propose a credit-based congestion pricing strategy through which the revenue generated from tolls is directly redistributed to drivers in a uniform manner. Revenue would then function as a credit for future congestion pricing fees. This strategy would result in the “average” driver paying nothing to continue driving. Frequent drivers would subsidize the congestion charges for those who drive less frequently, effectively paying less frequent drivers to stay off congested roads (Kockelman and Kalmanje, 2005). This credit-based congestion pricing strategy has the potential to more evenly distribute the costs and benefits associated with congestion pricing across groups with different income levels and travel behaviours.

Revenue generated from congestion charges may also be used to reduce the costs of existing transportation-related taxes or provide tax credits to individuals. For example, households may be given a refundable mobility tax credit commensurate with factors such as income levels and location of residence. A tax credit such as this would aim to provide direct financial assistance with paying the congestion charge to low income individuals (Lewis, 2008).

Note that these proposals for revenue redistribution are not mutually exclusive. To accomplish multiple policy objectives, revenue generated from congestion charges may be redistributed to any number of sources. Goodwin (1989), for example, proposes that revenue be divided into thirds: road improvements, tax benefits, and public transportation improvements.

Discounts and Exemptions

Discounts and exemptions from congestion charges may promote the equity of congestion charging schemes by acknowledging the different travel needs of groups and individuals. Following Ecola and Light (2009), discounts and exemptions can be divided onto three categories: those for individuals or groups, those for vehicle types, and those for specific situations.

Discounts and exemptions may be provided for individuals who have limited transportation options. The city of London, for example, provides discounts of up to 100% for individuals with disabilities (Transport for London, n.d.). Individuals may also be provided discounts or exemptions based on geographic place of residence. Residents who live within London's charging zone are eligible to apply for discounts from the charge (ibid.).

Existing policies in London, Stockholm, and Singapore also offer discounts and exemptions for specific types of vehicles. Stockholm exempts emergency vehicles, motorbikes, and mopeds from paying the charges. In addition to those vehicle types, London provides discounts and exemptions for low emission vehicles, vehicles with over nine seats, vehicles used by disabled people, and taxis (Transport for London, n.d.).

Finally, exemptions may be provided for specific travel situations, such as for vehicles that pass charging points multiple times within a short time period (Ecola and Light, 2009).

Policy Challenges

Developing effective policies to address social equity in transportation is a challenging task. Twentieth-century transportation policies have commonly been mobility-based, with focus on issues such as congestion, traffic safety, and travel times (Manaugh et al., 2015). More recently, transportation policy has been directed towards efforts to promote sustainability. While metrics with which to evaluate progress in the realm of environmental sustainability are well-defined and tangible (such as GHG emissions levels), goals to advance social sustainability are ill-defined and intangible (ibid.). Values such as social equity do not have clear indicators and are difficult to measure. Accordingly, many existing policies aiming to promote social equity do not have clear measures or indicators with which to assess policy success (ibid.).

Promoting equity in congestion pricing invariably requires that trade-offs be made between equity and other objectives. For example, a large number of discounts and exemptions may promote the equity of a congestion pricing scheme by providing for those that are disadvantaged, but it will also significantly reduce the efficacy of the congestion pricing scheme (Ecola and Light, 2009). Discounts and exemptions do little to incentivize individuals to change their travel behaviour to reduce congestion. Thus, the more people who are offered discounts or exemptions, the more people who will continue to contribute to congestion.

It is also challenging to speak in a generalizable manner about effective policies to promote equity in congestion pricing. Firstly, as so few congestion pricing schemes have been implemented, many of the proposals for policies have not been tested in practice and are instead tested on predictive models. The geographic context and implementation specifics of a congestion pricing scheme also significantly impact the equity effects of that scheme, thus impacting the appropriateness of various policy responses.

Section 4: Stockholm Case Study

Stockholm first introduced congestion charges as a trial in 2006. During this trial period, public opinion surrounding the charges gradually changed from a large majority of citizens opposing the charges to a small majority of citizens in favour of the charges (Eliasson, 2008). Following a referendum, the charges were implemented permanently in 2007.

The overall goal of the Stockholm congestion pricing scheme was to improve speed through bottlenecks and reduce traffic volumes on the most highly congested roads (ibid.). As previously outlined, the charging system in Stockholm functions as a cordon charging system, whereby drivers are charged for entering and exiting a cordon around the city center. Figure 2 shows a map of this charging system. The dotted lines delineate the charging cordon and the red dots are specific charging points. The solid line represents the Essinge bypass, where drivers are not charged. The cost to cross the cordon varies with time of day. Citizens are charged either

SEK 10, 15, or 20. The various exemptions offered (eg. for buses and alternative-fuel cars) result in almost 30% of trips being uncharged (Eliasson, 2008).

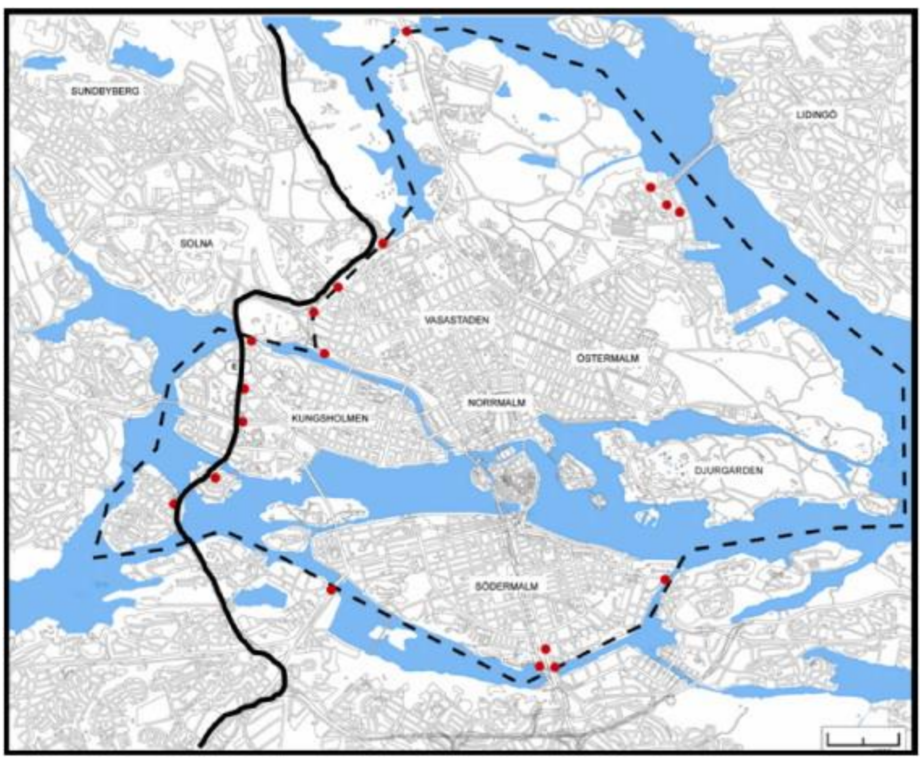

Figure 2. Map of Stockholm congestion pricing cordon (Source: Eliasson, 2008)

Prior to the implementation of the charges, Stockholm invested in public transit services for the city. Nearly 200 new buses were purchased, and 16 new bus lines were opened (ibid.). These investments offer travel alternatives to residents who do not want to pay the congestion charge. The revenues generated from congestion pricing were also earmarked by the city for future transportation investments in both roads and public transport (ibid.).

After implementation, it was found that the congestion charges substantially reduced traffic levels, indicating that many drivers adapted to the charge by switching to other modes of transport, or travelled at different times and to different destinations to avoid the charge (Börjesson et al., 2012). While the reduction in traffic levels has diminished over time, it nevertheless remains lower than before the charges were implemented (as of 2012) (ibid.). Charge exemptions for alternative fuel vehicles also resulted in increased sales for such vehicles (ibid.).

Considering the initial degree of public resistance, the eventual public acceptance of the Stockholm congestion pricing scheme is one of the most significant indicators of its success. The positive shift in public opinion regarding the Stockholm congestion charge may indicate that the policy had a widespread distribution of benefits to residents and was thus equitable in its implementation. Börjesson et al. (2012) note that, in the case of the Stockholm congestion charge specifically, standard analyses of the distributional effects (such as was done in the previous section) underestimate the total benefit of congestion pricing. While the previous section highlights how individuals in Group 3 are likely to be negatively impacted by the congestion charge, it does not appear as though this group is present in Stockholm (or at least it has not been identified in the literature). Instead, Börjesson et al. (2012) discuss how residents of Stockholm do not necessarily consistently fall into a single “group”. Based on the value that an individual assigns to a given trip, he or she may respond to the congestion charge differently and thus can belong to a variety of different groups. Due to the instability of individuals' travel patterns and responses to congestion charging, it is difficult to identify those that are consistently advantaged or disadvantaged by the policy.

Contrary to the wealth of literature suggesting otherwise, the authors also speculate that the redistribution of revenue contributed little to the eventual public acceptability of the charge. While it is unclear how much Stockholm's investment in public transportation and road infrastructure was of benefit to residents, the authors suggest that this use of the revenue was not a significant factor in residents' accepting of congestion pricing (Börjesson et al., 2012).

Overall, the literature provides few concrete conclusions about the equity of Stockholm's congestion pricing scheme. While Eliasson and Mattsson (2006) offer a quantitative assessment of the distributional impacts of congestion pricing in Stockholm, the results of this analysis are based on a transportation model and were presented prior to the actual implementation of the congestion charge. This gap in the literature reflects the challenges in assessing equity in the context of transportation policy. The impacts of congestion pricing on adjustments to traffic volumes or mode changes are much more easily analyzed than the impacts of congestion pricing on social welfare and equity.

Conclusion

Congestion pricing is a transportation policy instrument that is gaining salience as an approach to reducing congestion in cities. Congestion pricing is an example of a "Pigouvian tax", by which a market externality (traffic congestion, in this case) is internalized (Pigou, 1920). By increasing the costs associated with road use, it is hoped that congestion pricing will disincentivize road use during peak periods and encourage individuals to switch to other modes of transport that do not contribute to traffic congestion. It is hoped that these adjustments in the travel behaviour of individuals will reduce traffic volumes, increase travel times, and contribute to the reduction of other negative externalities associated with congestion such as poor air quality and fuel costs. London, Singapore, and Stockholm all offer examples of how congestion pricing has been implemented in practice.

Despite the reported success of these cases in reducing traffic congestion, congestion pricing continues to face significant public and political opposition. Concerns surrounding the equity of congestion pricing are a significant barrier to the perceived acceptability of this policy instrument (Eliasson and Mattson, 2006; Giuliano, 1992). In this paper, I address these equity concerns by examining the distributional impacts of congestion pricing across different groups in society. I illustrate how this policy instrument has the potential to improve the welfare of some groups and reduce the welfare of others. In particular, congestion pricing may contribute to the social exclusion of individuals who are unable to pay the congestion charge and have few travel alternatives available.

Nevertheless, there are policy options available to promote the equity of congestion pricing. Appropriate redistribution of the revenue generated from congestion pricing has the potential to more evenly spread the benefits of this policy instrument across different groups in society. Discounts and exemptions from the congestion charge also acknowledge the different travel needs of individuals and can be used to provide for those that would otherwise be significantly disadvantaged by congestion pricing.

A close look at the case study of congestion pricing in Stockholm illustrates how equity is a complex issue with respect to congestion pricing. While Stockholm's success in achieving public acceptability may indicate that the congestion pricing scheme is perceived to be equitable, it is difficult to fully understand how the benefits of the congestion pricing scheme are distributed across the city's residents. Despite the difficulties in assessing the equity of congestion pricing and creating effective policies to promote equity, it is critical that this issue continue to be addressed and researched.

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