Chapter 11

Traffic Congestion Pricing: Methodologies and Equity Implications

Ammar AbuLibdeh

Additional information is available at the end of the chapter

http://dx.doi.org/10.5772/107156

Abstract

Road traffic congestion is recognized as a growing and important urban ill. It occurs in different contexts, takes on many faces and is caused by a variety of processes. It affects both work trips and non-work trips, both passengers and goods flow. It affects the quality of life and the competitiveness of a region. It is an additional cost that arises in the forms of delay, environmental degradation, diminished productivity, standard of living and wasted energy. Congestion pricing can result in winners and losers among different socio-economic groups. However, different studies differ in their conclusions about who wins and who loses because of different assumptions made. This paper reviews the concepts of congestion pricing as a mitigation policy to reduce road congestion and reviews the concept of equity. This paper aims to provide theoretical research that enhances our understanding of congestion pricing policy and the equity implications of this policy.

Keywords: congestion pricing, cordon pricing, equity, cost of congestion, mitigating/managing congestion

1. Introduction

Congestion pricing is an untapped transportation strategy that can reduce traffic congestion, improve air quality and raise the revenue essential to implement needed transportation measures that are effective in improving transportation services and facilities. While experience with congestion pricing is limited, there are sufficient examples and experiences around the world to demonstrate that, when implemented properly, it virtually never fails to be an effective tool to curb congestion. Yet, when initially proposed, it never fails to be controversial. This is in part due to the lack of research on the equity impacts on different socio-economic groups. This is the dichotomy and the dilemma of congestion pricing that every city must face in implementing this new approach to congestion management.

Congestion pricing is the policy of charging drivers a user fee for using certain lanes of roadways that experience congestion, thereby discouraging many drivers from using those lanes and keeping them free of congestion [1, 2]. Congestion pricing captures congestion, operating and capital and environmental costs of vehicle use; therefore, it is considered the best way to deal with congestion and environmental problems [3]. The main purpose of congestion pricing is to mitigate/manage traffic congestion by encouraging drivers to switch to use other modes of transportation, use other routes, or change time of travel (shifting peak-period travel to other off-peak period) [4]. One of the objectives of congestion pricing is to reduce the number of congestion points along roads and hence minimize the length of individual queues that do form. This results in relatively smooth traffic flow with improved fuel economy and reductions in emissions [5].

Several types of congestion pricing have been implemented in several cities around the world. Recent studies in Europe and Asia envision road pricing in the form of area licensing, high-occupancy toll lanes or cordon tolls [6, 7]. This system has been implemented recently in Stockholm. Cordon pricing charges motorists whenever they pass any of the charging points that are located at the entrances of an imaginary zone around a congested area. Charges are flexible, meaning that they vary according to vehicle type, time of day, location and direction travelled [8]. The charges vary between peak and off-peak hours and between weekdays and weekends. This system has proven to be effective in mitigating congestion.

Congestion pricing impacts the travel activities of different socio-economic groups in different ways, albeit in varying ways depending on the circumstances. Cordon pricing has been implemented in some European and Asian cities and has been proposed, but not implemented for North-American cities. All the studies investigated the changes that may occur on people's travel behaviour and hypothesized different ways of redistributing the generated revenues to achieve equity among different travellers based on their socio-economic characteristics. But none of these studies tried to investigate the traveller's preferences in redistributing the generated revenues to achieve equity between different socio-economic groups.

Concerns about equity are raised when considering this system. Travellers who come from outside the cordon have to pay the tolls while residents inside the cordon receive the benefits; also travellers who must travel into and out of the cordon many times during the day have to pay each time. For example, the proposed cordon pricing in Edinburgh, Scotland, was found to be inequitable since people living at equal distances from the proposed cordon were treated differently. Affluent neighbourhoods were exempted from payment as a result of the city's administrative boundaries. On the other hand, it was suggested that less affluent neighbourhoods be subjected to the cordon charges [9, 10]. This example demonstrates the importance of the link between income distribution and spatial equity when designing cordon-pricing systems.

Congestion pricing is a traffic-demand management tool that helps move transportation in the direction of economic and environmental sustainability. At the same time, however, it raises equity issues related to social sustainability as it impacts the travel behaviour of commuters. Equity is operationalized by analysing the progressivity or regressivity of the effects of cordon pricing on groups of travellers based on their socio-economic and demographic factors. Congestion pricing is considered to be regressive or progressive policy if it burdens or favours disadvantaged groups of travellers relative to each other. The interpretation of equity

http://dx.doi.org/10.5772/107156

is also based on the broader assessments of transport equity that seek fairness in accessibility and mobility across different socio-economic and demographic groups [11].

In transportation planning, equity is a central element because transportation is perceived as a basic right. That is, access to transportation services is a right to members of all social groups within the society. Thus, many scholars have identified equity concerns as one of the main obstacles to public acceptance of congestion pricing proposals.

2. Approaches for mitigating/managing congestion

Over the years, various approaches have been proposed or implemented to curb traffic congestion and improve the roadway level of service in many countries around the world. These approaches can be considered under either supply management or traffic demand management. Supply management, which is the conventional response to traffic congestion, consists of different techniques such as increasing roadway capacity by expanding or upgrading existing roads or by building new ones. Conventional approaches focus on managing congestion by maximizing the ability of road network to accommodate current and future traffic demand. This approach seeks to maximize the physical usage of road capacity to enhance the levels of service.

A second method is by using different traffic demand management techniques such as encouraging people to use public transit, discouraging peak-period travel, imposing bans on commercial vehicles, parking restrictions and limiting access to congested areas. Another group of traffic-demand management techniques focus on improving the efficiency of the road system to accommodate the same demand at a lower cost. Examples of this approach include imposing charges on road users, high-occupancy vehicle lanes and metering access to highway entrance ramps. **Table 1** describes different approaches to manage/mitigate congestion [12].

The effectiveness of the different approaches in mitigating/managing traffic congestion can be summarized as shown in **Figure 1**. This figure is based on a regional scale and shows that traffic congestion is a consequence of "increased travel demand or inadequate road supply". Traffic congestion mitigation strategies include supply management, demand management and a third alternative which is to do nothing. The "Do nothing" option results in reduced accessibility and mobility and consequently reduces the level of service (LOS). "Increase infrastructure" which is the main action of "supply management" leads to a temporary improvement in the LOS. Put simply, roads are provided, the cost to travel decreases (e.g., higher speeds) inducing more traffic, soon the new road capacity is used during peak-periods, which tend to expand, resulting in traffic congestion and a vicious cycle continues.

For "traffic demand management", different TDM techniques can be implemented to manage/mitigate traffic congestion, including congestion pricing, which is the focus of this research. As a result of implementing "congestion pricing" the LOS will improve. The improvement of LOS also needs to have a two-way relationship with congestion pricing. Pricing is a tool that can be used to maintain an acceptable LOS, requiring "dynamical" adjustments in the toll rates/fees/charges (in real time) to manage the demand and LOS.

Supply management	***Building new infrastructure*** This approach aims to increase the roadway capacity. However, it is constrained by a lack of space in dense urban areas as well as funding and environmental restrictions. This approach is expensive to implement and it is considered as the last approach to mitigate traffic congestion. In addition, this approach provides only a temporary solution.
	Modifying existing infrastructure The aim of this approach is to increase the capacity of the roadway by including new lanes, modifying intersections, creating one-way streets and modifying the geometric design of roads. These techniques can benefit public transit as well as car users. However, this approach also requires extensive funding.
Traffic demand management	***Access management*** This approach restricts access to specific places or to specific road links. Some of the techniques used in this approach are physical breaks and barriers to block through traffic, permit-based system or traffic bans and ramp metering. This approach is used for safety and is considered most appropriate for reducing the number of cars and increasing the usage of public transit. Some limitations of this approach are that it requires robust enforcement and that road traffic is diverted to other roads creating new congestion.
	Parking management This approach has the potential to modify demand. However, it is under-utilized by many authorities. It can help to reduce demand for automobile travel and, as a result, tackle traffic congestion on the basis of location and time. One limitation of this approach is that the capacity that is freed-up may be filled from through traffic. This approach needs to be supplemented by other approaches to achieve the desired outcomes.
	Improving traffic operations This approach is a cost-effective method to achieve improved travel conditions. The techniques used in this approach include road traffic information system, implementation of dynamic speed, pre-trip guidance and coordinated traffic signal. This approach allows road users to select alternative travel mode or reschedule their trips to off-peak periods.
	Improving public transport This approach is considered a fundamental congestion management strategy. It has the potential to transport more travellers than personal automobiles for a given amount of road space. It can achieve and maintain a high level of access throughout urban areas if the quality of service that it provides is enhanced and sufficient (e.g., safety, comfort, reliability, security) for travellers.
	Mobility management Several mobility strategies can be utilized to mitigate congestion. This approach includes car-pooling, promoting bicycling and walking and large trip generators.

Table 1. Different approaches to manage/mitigate congestion.

The improvements of LOS enhance mobility and accessibility represented as: "transportation" and "land use", respectively. The attributes of mobility/accessibility are applicable to both categories. Transportation and land use need to be coordinated since the trip and location decisions co-determine each other. The spatial distribution of activities co-determines the need for travel and goods movement to overcome the space between the locations of activities. On the other hand, the location decisions of households and firms depend on the

http://dx.doi.org/10.5772/107156

accessibility of locations which results in changes of the land-use system. Under the "transportation" condition, the diagram includes the role of congestion pricing in the decision making process of making a trip by an individual (trip generation/trip distribution, mode choice, traffic assignment/route choice). Congestion pricing has an impact on every step and varies according to the type of congestion pricing scheme, the rates, the area covered and the availability of alternative modes of transport. The distribution of land use determines the location of human activities and consequently the location decisions of investors and users.

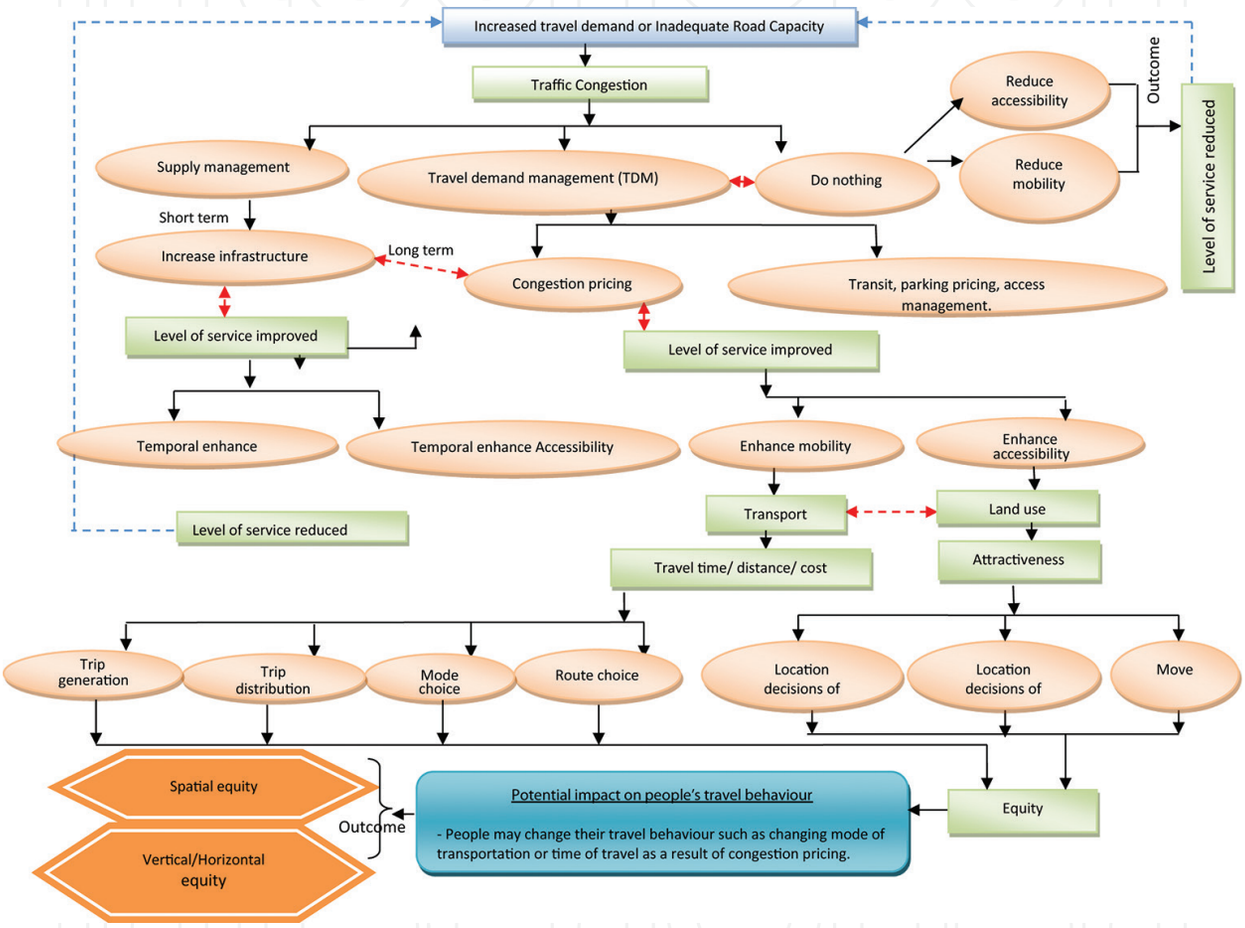

Figure 1. Comparison between different approaches to manage congestion.

To overcome the distance between human activities in space, spatial interactions or trips in the transport system are required. Changes of land use system are associated with the distribution of accessibility in space which co-determines location decisions. In this regard, it is of utmost importance to emphasize the role of congestion pricing in addressing equity concerns (whether spatial or social). Congestion pricing may impact travel behaviour of different socio-economic groups of travellers. People may change their travel behaviour such as changing mode of transportation or time of travel. This questions the impacts of congestion pricing on the equity implications of this policy.

3. Typology of road pricing

Road pricing is a terminology used to include all direct charges imposed on road users including fixed tolls (e.g., toll way) and charges that vary according to the time of the day, location and vehicle size (e.g., congestion pricing) as shown in **Figure 1** [13–16]. Several types of congestion pricing have been implemented in several cities and are identified in the literature. The most implemented forms of congestion pricing projects are shown in **Figure 2** and are presented below:

3.1. Flat-rate toll roads

The aim of imposing fees on travellers in the conventional toll roads is to generate revenues to repay bonds issued to finance the full cost of designing, developing, financing, operating and maintaining the toll way. This system is not considered as a form of congestion pricing since it aims to generate revenue and not to mitigate/manage traffic congestion. Charges are fixed and do not fluctuate according to time or location and can be collected manually or electronically using the transponder technology.

3.2. Cordon pricing

Cordon pricing charge motorists whenever they pass any of the charging points that are located at the entrances of an imaginary zone drawn around a congested area. Charges are flexible, meaning that they vary according to vehicle type, time of day, location and direction travelled [6, 11]. The charges vary between peak and off-peak hours also between weekdays and weekends. Residents inside the cordon pay discounted fees or are exempted from paying the charges. This system is proven to be effective in mitigating congestion.

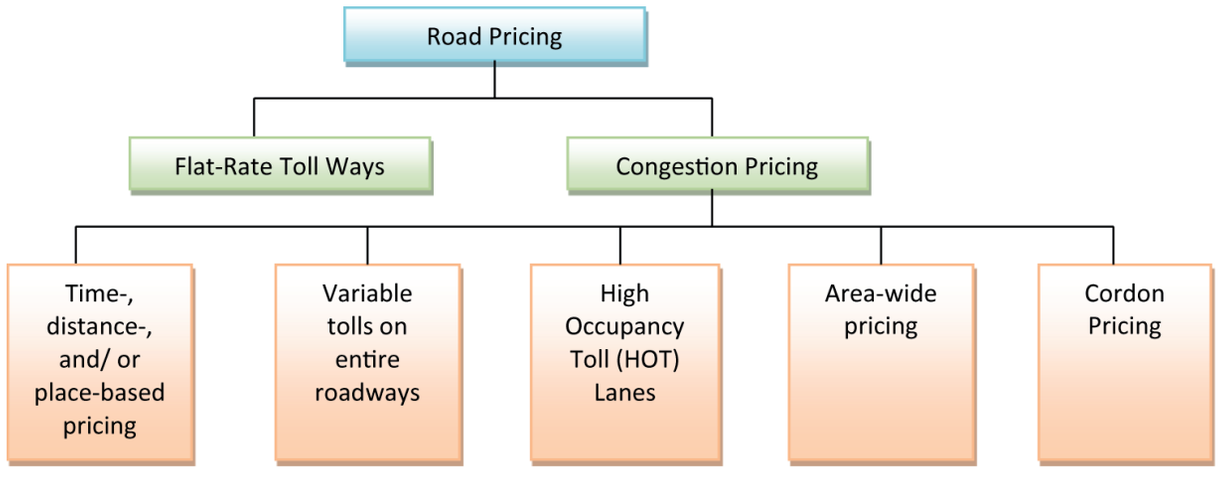

Figure 2. Road pricing typology.

Cordon pricing calls for greater reliance on demand management and on public transportation usage. One aspect of this policy is the restriction of the actual growth of automobile usage

http://dx.doi.org/10.5772/107156

through levying a charge on travellers when they cross the priced zone. Cordon pricing in London and Stockholm have been successful in reducing congestion levels and travel time and generating revenues to support transport strategies in these two cities. In addition, the traffic and delay reductions have been maintained over time.

3.3. Area-wide charges

This toll strategy imposes cordon-crossing charges for entering a certain geographic area either by crossing the priced zone or distance travelled (per-km of travel). It is different from cordon pricing in that it charges travellers a fixed fee for traveling across the cordon area for an unlimited number of journeys into and within the priced zone. This system provides a discount for the residents inside the cordon. It is less effective than the cordon pricing at reducing congestion since the fees are fixed and do not change with the number of trips to and from the priced zone; however, it may be perceived to be fairer. Singapore and London implemented this type of congestion pricing in 1975 and 2003, respectively.

3.4. High-occupancy toll (HOT) lanes

This strategy involves variable charges on separated lanes within a highway. It encourages carpooling during peak-periods. HOT lanes are considered a version of high-occupancy vehicle (HOV) lanes. Ride-sharing travellers can use HOT lanes for free or at a discount, while single-occupant vehicles or those that do not meet the minimum passenger occupancy requirements to access the lanes must pay. Typically, transit and emergency vehicles are charged at a reduced rate or are free of charge. All vehicles still have the choice to travel in free, parallel, general-purpose lanes. This strategy is implemented in many cities of the United States. This type of strategy encourages people to use carpooling and the transit system as an alternative to driving alone.

3.4.1. Variable tolls on entire roadways

This strategy depends on changing the charging rate during the peak periods to be higher than off-peak periods. This strategy applies to existing toll roads and bridges to control traffic flow and manage the highway capacity. This aims to encourage drivers to shift to off-peak periods when they use the roads allowing for traffic during the peak periods to flow more freely.

3.4.2. Time-, distance- and/or place-based pricing

This strategy charges travellers based on the distance travelled, location, vehicle type and time of day. The advantage of this system is that it does not require any infrastructure on the ground. It mainly depends on advanced technology where a transponder and a mobile communication device must be installed in each vehicle. This system is implemented in Germany for all heavy-duty trucks operating on the national system. Netherland is in process to develop this system for its entire street and road network.

4. Effect of congestion pricing on travellers based on their socio-economic characteristics

Congestion pricing can result in winners and losers among different socio-economic groups. However, different studies differ in their conclusions about who wins and who loses, as shown in **Table 2**, because of different assumptions made. Earlier studies articulated this issue [17–20] and concluded that low-income or less-flexible travellers (e.g., based on flexibility of working schedule) are considered the worst-off groups and that the approaches of distributing the generated revenues would not make congestion pricing too regressive as the revenue would be used to benefit those who are left worse off. Recent research focused on addressing the importance of equity issues prior to the implementation of congestion pricing scheme and particularly in the design stage [21–23]. Some of these studies proposed a welfare indicator that gives more weight to low-income and disadvantaged groups in terms of cost/benefit ratio. Others proposed a framework for maximizing social welfare (by calculating the optimal road toll) by focusing on spatial equity.

Theoretical studies are different from empirical studies in their conclusions about who wins and who loses. Theoretical studies [24–26] focus on whether congestion pricing benefits low income, high income or both. Different outcomes can be generated based on the assumptions made about different groups in terms of their preferences and travel behaviours. For example, some researchers argue that high-income people believe that their time has a higher value than that of low-income people and hence they (high-income people) benefit the most. In addition, these scholars argue that low-income people live in the suburbs and the work destination for many of them is located inside the city. Therefore, those scholars consider congestion pricing regressive. Other scholars consider congestion pricing as progressive. They argue that the low-income group benefits the most from congestion charging since they more often use public transport; hence investing the generated revenue in improving this mode of transportation benefits this group. On the other hand, quantitative (empirical studies) studies have been conducted to study congestion pricing equity for some cities [27–30]. Most of these studies conclude that high-income people are more negatively affected by a congestion pricing system since they drive more than low-income people. Also, high-income people tend to live in areas with poor access to public transportation and hence will be more affected by this policy.

Differences in conclusions about who may win and who may lose can be attributed to two main reasons, which are researcher's background and the methods used in the analysis. Geographers have long held interest in addressing the challenges that urban commuting poses to society [41, 42]. Geographers focus on spatial dimensions when addressing commuting problems. The spatial separation of people's origin (e.g., home) and destination (e.g., work) and the prevailing urban structure influence people's commute. Several geographers, as a result, focused on addressing, theoretically and empirically, the connection between travel patterns and land use [43]. Therefore, in assessing the equity implications of transportation in general and congestion pricing in particular, geographers, as well as transport planners, look at those who may be disadvantaged (e.g., because of age, gender, disability, income) with respect to transportation. In terms of congestion pricing, it is important for geographers to know where people live since some neighbourhoods may

http://dx.doi.org/10.5772/107156

burden charges more than others. Traffic engineers, on the other hand, are concerned more with system efficiency more than system equity [44]. They seek to enhance transportation infrastructure to increase roadway capacity and to improve traffic flow to maximize tangible benefits for a given cost [44]. Economists tend to group people based on their income level and are concerned with the distribution of costs and benefits among these groups to assess the equity implications of transportation and congestion pricing.

Reference	The overall effects	Winners	Losers
[1]		People with full-time employment, those from higher income neighbourhoods; and this holds true when the population is broken out by gender, age group, household size and occupational class	Professionals, those who live in one- and two-person households and those who are aged 65 and older would be disproportionately affected; those who work in manufacturing would be less affected
[31]	A proper allocation of revenue such as investing in public transportation network and infrastructure or reduce regressive local tax would have better effect on low-income drivers when implementing charging scheme		Low-income travellers are harmed by the imposition of the charging scheme hence the time saving they would gain would not compensate what they pay
[26, 32]		High-income travellers	
[33]		Car travellers changing their mode of transportation to public transit if time savings of these facilities are substantial	
[34]	Road pricing would not be too regressive as the revenue would be used to benefit those who are left worse off		Those who work in the charged area, drivers with low values of time, solo drivers or travellers in vehicles with lower occupancy, travellers that do not have time flexibility and those who cannot switch to other modes of transportation to avoid charges
[24, 27, 31, 35]	Congestion pricing will be regressive as the monetary value of time for high -income travellers is greater than those of low-income and hence they are more willing to pay the charges as they feel that their time gain is worth the fees		High-income travellers working in small economic margins suffer more from congestion pricing as they cannot avoid the charges levied during peak hours as they have inferior possibilities to decide their time of work

Reference	The overall effects	Winners	Losers
[36]	Identified few regressive effects of cordon pricing in London since high-income travellers use their own cars in their commuting more often than low-income travellers		Even though low-income travellers benefit as a group from this policy, yet low-income individuals who cannot switch to other modes of transportation and still needed to use their cars would be severely affected
[37]		Travellers valuing the time savings higher than the fee Persons now finding it "profitable" to undertake a trip (or change trip timing, route or mode choice), even with a fee, because the travel time will be reduced Public transport passengers experiencing time savings Commercial enterprises which undertake substantial transport activities	travellers valuing the time savings below the fee, but having only unattractive travel alternatives Persons abstaining from travel or changing to less attractive travel times, routes or modes to avoid fee Persons experiencing congestion on a road or on public transport, caused by persons who have changed travel behaviour to avoid fee
[38]	Road pricing is progressive rather than regressive as low-income group benefit more as they tend to use public transportation more often The final effect of this system would be progressive if the generated revenues are distributed on improving public transportation, enhancing cycling and walking and enhancing traffic calming	Those who currently use other modes of transportation than cars for their daily commuting Those who have a high value of time	Those who encounter increase in travel cost or take more time as a result of using alternative modes of transportation as well as those who have lower value of time and continue to travel by cars and hence time benefits are not offset by the cost of the charges
[39]		Public transportation users would all be winners because they reap the benefits of low road congestion and the improvements in public transportation network without paying the charges	Travellers that pay the standard charges will be the losers because they will most likely experience reduced road congestion and increase in travel speed that are not sufficient to offset the financial loss of the fees Those who transfer to use public transportation as they are not traveling by their preferred mode of transportation

http://dx.doi.org/10.5772/107156

Reference	The overall effects	Winners	Losers
[23]	Progressivity or regressivity of such a policy is mainly related to the choice of the method of allocating the generated revenue Neglecting the refund scheme, the welfare effects of the policy are borne largely by high-income travellers as they are predominantly car users and therefore the scheme itself tends to be progressive		Low-income travellers who use their cars also bear a high burden
[21]			High-income travellers are more likely to live in the suburban areas outside the city core in areas where public transport is poor
[19, 21, 28–30, 40]			High-income people are more likely to drive more than low income people and tend to live in areas with poor access to public transportation therefore they will be more likely affected by congestion pricing policy

Table 2. Winners and losers when road pricing is implemented on an existing road system.

The second reason is the methods used in the analysis. Different empirical approaches and analytical techniques were used in addressing equity in terms of congestion pricing. These techniques can be grouped into three different categories which are mathematical models, GIS and key-interviews and surveys. Mathematical models are built to address different aspects of equity. Numerous data are used such as origin/destination, travel time, gender, income, location, car ownership and family situation and occupational status. However, the results of some studies that used this approach are contradictory. The second approach is the use of geographic information system (GIS). This approach was used by many geographical scholars to address the impact of transportation on the environment and on the society as a whole. GIS is used in commute studies because it has the capability of handling the spatial data that is important in road network modelling process which is vital for computing streets-based measures of both distance between zones and travel time [45]. Studies that used GIS to address transportation and congestion pricing equity used several types of data such as place of residence, place of work, mode of choice, socioeconomic characteristics and commuting flows. The third approach used is a combination of key interviews, surveys and focus groups. This approach is an excellent method to collect information about opinions, meanings and experiences. It is used frequently as a flexible tool to obtain in-depth information from the

respondents. However, this approach is restricted by possible bias introduced by the presence of the researcher and researcher's data interpretation and respondents' personal differences in articulation [46].

5. Overview of the concept of equity

The determination of just distribution of rewards, resources, rights, duties, obligations and liabilities or costs; and the allocations of positive and negative outcomes within social systems are of considerable interest to social scientists. Equity is the value of being equal or fair. As equity is concerned with the fair distribution of society's resources among individuals and groups, it is extensively received as positive and as an objective in social policy. Moreover, it has become a significant criterion in assessing public policy and programs dealing with the optimal use and distribution of resources [15, 47]. Many social policy definitions include aspects of equity, equality, justice or fairness (see the definitions given in Refs. [15, 47]). Equity is frequently identified as "distributional fairness"; as its main concern is "who gets what" and with "who pays" [48, p. 19]. "Equity objectives can be identified in four main sets: guaranteeing minimum standards; supporting living standards; reducing inequality; and promoting social integration" [47, p. 48].

To achieve equity, the distribution of costs and benefits, whether monetary or non-monetary, must be seen by society to be fair and just depending on an array of criteria. Thus, a policy can be described as equitable if it satisfies a normative standard of fairness [15]. However, reaching an agreement on what constitutes equity is almost always context-specific. Therefore, as Murray and Davis [49] argue, the definition of equity requires a set of universally accepted norms; while its practice and interpretation are both comparative and specific.

5.1. Theories and principles of equity

The "egalitarian principle" is the starting point of social justice theory that calls for equality among individuals in a society and equality is understood as the treatment of people as equals. However, applying the egalitarian principle is difficult. For example, a society may try to achieve an egalitarian distribution of wealth by ensuring that equal inputs (food, education, …etc.) are offered to each individual. However, this fails to take into consideration the difference among different members of the society in labour as some individuals may convert inputs into greater wealth generation than others. In reality, what comes into view as an egalitarian distribution of wealth may at the end lead to inequality. On the other hand, in *Distributive Justice*, Rescher [50] argues that society should commit unequal inputs to accomplish equal rights for members. He defines rights as the traditional personal freedoms and equal opportunity to education and employment. His solution starts by assuring all members a minimum equal standard of living that he referred to as "utility floor" that points to the minimally acceptable share of necessary goods, such as food and shelter. Beyond this point, he believes that in order to motivate individuals to boost production and consequently, to stimulate the furthermost good for most of the members in a social system, output inequality in terms of inequality of wealth and circumstances should be allowed in society. Without this inequality, which he describes as incentive, scarcity may take place and may hinder the achievement of the "utility floor" for all individuals.

http://dx.doi.org/10.5772/107156

Although the egalitarian principle suggests that resources should be distributed equally among citizens without any segmentation, Osterle [47] argues that egalitarian principles might be regarded as appropriate in some areas of social policy, while in others they may be regarded as inappropriate. For example, these principles are appropriate in social policy regarding child benefits or education aiming at equal opportunities, while these principles do not seem appropriate when distributing equal shares of care without taking into consideration different levels of disability.

Despite the continuing debate, a revolution in our collective understanding of the concept of equity has taken place as many authors have adjusted their earlier definitions taking into consideration the differences in needs and abilities of members of society. Equity theorists are occupied with determining the principles of distributive justice under different social settings and with identifying when such principles are perceived as fair or just by individuals within the social system. Focusing on outcomes or procedures, equity theories imply principles of how equity should be defined and suggest principles to be applied in different contexts. On the other hand, empirical equity studies emphasize equity viewpoints and equity judgments or on testing certain equity interpretations. These are often derived from theories of justice or equity judgments. While, evaluating particular interpretations of equity has received significant attention by scholars, fewer studies consider how concerns about equity are translated into social policy practice. Although, there is increasing information about the distribution of costs and benefits according to particular interpretations of equity, a lack of evaluation research is noticed dealing with "whether and to what extent these interpretations reflect explicit or implicit social policy objectives, or whether there might be competing equity concerns" [47, p. 49]. As Osterle [47, p. 56] further notes, "no attempts have been taking place to study the complete range of such questions and to propose a conceptual and theoretical framework to illumine how institutions distribute costs and benefits". This has led to a significant gap between "searching for ideal concepts of equity and investigating societal outcomes".

On the other hand, equity concerns in social policy are often determined by three dimensions: what is to be shared (resources and burdens); among whom (the receivers); and how (the principles). Taking into account these three dimensions is a means for the illumination of equity objectives that are in many cases vague or not well-defined [47]. Campbell [51, p. 3] wrote three decades ago: "The question of how to make operational the equity principle will become an increasing concern. At the heart of these concerns will be defining equity, developing measures of it, collecting and interpreting relevant data and developing policies responsive to it". Campbell's questions and concerns still occupy many researchers from different disciplines particularly, human geographers, planners and economists.

With regard to evaluating equity in social policy, it is important to emphasize that a lack of specifically and clearly defined equity objectives is a key difficulty when assessing equity concerns. However, three different sets of approaches can be distinguished in the literature. First, theories of justice are considered as the point of departure to evaluate equity in social policy. However, the issue of equity is at the core of the debate about these theories. Some scholars emphasize issues of social policy as healthcare, for example, by searching for the content of a just distribution of resources [47]. Le Grand (1991 qtd in Osterle, 2002) [47, p. 49] evaluates equity by looking at the range of opportunities and choices that exists for individuals

in a society. He states that "*situations where one person is disadvantaged relative to another due to factors beyond either's control are commonly judged inequitable; situations where the disadvantage arises because of differences in individual choices freely made are not*". Within the same context, Daniels [52, p. 57] states that "shares of the normal range will be fair when positive steps have been taken to make sure that individuals maintain normal functioning, where possible and that there are no other discriminatory impediments to their choice of life plans". Although, theories of justice are considered by scholars following such approaches as the point of departure in evaluating equity in social policy, the prospective of these approaches in empirical work remains limited. This is due to constraints in translating ideas of welfare economics, for example, to assessment applications. The second set of approaches emphasizes equity beliefs, expectations and judgments. Furthermore, causes and effects of such judgments are also emphasized. This approach is useful in the descriptive examination of equity and is considered as the foundation for explanatory studies regarding judgments and beliefs by individuals. However, the main critique within the debate about such an approach is the taking apart from normative, philosophical ideas of justice. The third set of approaches emphasizes the analysis of outcomes. It highlights the extent to which empirical distributions respond to definite interpretations of equity. In healthcare, there are several studies that address such questions. For example, some scholars examine equality in the distribution of health, while others examine the distribution of public expenditure and outcome for a variety of policy areas such as health and social services. In many cases, the analysis is based on five different interpretations of equality: equal public expenditure, equal final income, equal use, equal cost and equal outcome. Equity studies are rather rare in other areas of social policy; a number of studies in long-term care are exceptions [47].

5.2. Equity implications of congestion pricing

In transportation planning, equity is a central element because transportation is perceived as a basic right. That is, access to transportation services is a right to members of all social groups within the society. Thus, many scholars have identified equity concerns as one of the main obstacles to public acceptance of congestion pricing proposals. Indeed, a claim that potential equity impacts have not been carefully examined makes the implementation of congestion pricing very slow.

Equity is a major concern that is raised prior to and after congestion pricing implementation. This is due to imposing charges on access to roadways that were previously free, which may be perceived to harm especially lower income groups because they will either have to pay the fees or be priced off the roads. Advocates of congestion pricing argue that implementing this system is more equitable and less regressive than the current systems (e.g., motor fuel taxes, property taxes, license fees and registration fees) to manage the use of roads as well as to fund transportation improvements. In short, drivers who contribute most to road congestion under a congestion pricing scheme will pay more for using transportation facilities. Critiques of the current financing system in North America suggest that it is regressive and not equitable since low-income drivers pay a higher proportion of their income for transportation fees and taxes than the high-income drivers. In terms of congestion pricing, some critics argue that congestion pricing is unfair, particularly to lower income people who need to drive, because it imposes "double charging", given that drivers already pay registration and

http://dx.doi.org/10.5772/107156

fuel taxes. Moreover, some drivers pay more than others which raises debate about what pricing is equitable and how modifications can be fair and advantageous to the drivers. Another dimension of equity of congestion pricing is its ability to reduce air pollution. This is particularly beneficial to low-income neighbourhoods that are sometimes located in the vicinity of major roads and other transportation facilities.

Within the economic literature of equity and congestion pricing, the work of Rawls [53] noticeably renewed the approach of justice within the analysis of transport policy. According to the theory of Rawls leads to the identification of three dimensions of equity directly relevant to the transport realm and its pricing. These are shown in **Table 3**. Within these dimensions, there are four main points that should be highlighted: First, horizontal equity implies that members of the same group or same circumstances should be treated identically. Horizontal equity is concerned with allocating public resources equally among like individuals and like classes; in other words, it is concerned with fairness between persons and groups with equal resources, abilities and needs. According to this definition, equal persons or groups should get what they pay for and pay for what they get. They should be treated equally, tolerate equal cost and receive the same shares of resources.

Second, vertical equity is concerned with the distribution of differential effects on individuals or groups that differ by socio-economic factors such as income; in other words, it is concerned with the treatment of persons and groups that are dissimilar. Based on that, the allocation of costs and benefits should reflect individuals' needs and abilities.

The third and fourth principles deal with motorists as actors. More specifically, the third principle is that those who contribute to a social cost should pay for doing so; this is referred to in the literature as the "cost principle". Fourth, those who receive social benefits pay for them; this is referred to in the literature as the "benefit principle".

In terms of the use of any potential profits from road pricing schemes, there is a difference of interpretation between horizontal and vertical equity. Horizontal equity implies that profits should be devoted to roadway projects or rebated to vehicle users as a class, but this condition is reduced or removed if the analysis distinguishes the need for users to recompense for the external costs they entail. In contrast, vertical equity justifies employing revenues to the advantage of under-privileged people, such as low-income drivers as a class and non-drivers. Litman [54] notes that this can be accomplished by utilizing resources to benefit lower income drivers or to develop transportation alternatives such as transit, bicycling and walking; and to furnish public services that benefit low-income earners in the society.

Equity could be in terms of who pays/who benefits (car users, transit, non-motorized), income equity (need to look for poverty levels and whether charging is more regressive than other taxes), gender equity (male/female), geographic equity (urban/rural/suburban), its relationship to other charges and fees (property taxes, how transportation projects are funded), accessibility to travel alternatives (if I leave my car to avoid charges, are there reliable transit alternatives), business equity (impact on businesses in areas with congestion charges versus those that are not impacted). Equity reflects the changes in the allocation of impacts (costs and benefits) across socio-economic groups, resulting from the introduction of pricing decisions, relative to the existing allocations.

Dimensions of equity	
Spatial equity	• "Corresponding to the 'principle of liberty', in which the society must guarantee everywhere the access rights to the goods and the services" [55]. • Benefits of transport strategies and services should be equally distributed particularly on those with special needs; lower income residents, elderly and disabled people, those who do not own cars and those living in underprivileged areas. • This dimension of equity is concerned with avoiding worsening accessibility, the environment or safety for any of the social groups. • Social inclusion is a related issue concerned primarily with accessibility (or lack of it) for those without a car or whose mobility is prejudiced.
Horizontal equity	• "Corresponding to the 'principle of equal opportunity', which concerns the equal treatment between users and the user-pays principle" (PATS, 2000, p. 59). • Horizontal equity implies that all people in a given group are equal and should enjoy equal social, political and economic rights and opportunities. It simply means similar distribution of costs and benefits to individuals within a group. • A transport policy is horizontally equitable if similar individuals are provided with equal opportunities or are made equally well off under the policy. • Horizontal equity assumes that "like should be treated alike." It is often interpreted to mean that individuals should "get what they pay for and pay for what they get". • Road pricing revenues should be dedicated to road improvements or to provide other benefits to people who pay the fee. • Horizontal equity implies transferring benefits from one group (those who pay the fee) to another (those who do not).

http://dx.doi.org/10.5772/107156

Dimensions of equity	
Vertical equity	• "Corresponding to the 'principle of difference', which explicitly takes into account the inequalities and its consequences as regards transport." (PATS, 2000, p. 59). • Vertical equity is concerned with the treatment of individuals and classes who are unalike. Therefore, the distribution of costs and benefits should reflect people's needs and abilities. • It often differentiates between groups based on ability to pay, which is typically measured by an individual's income or wealth. • A transport policy is progressive or regressive depending on whether it favours or burdens, based on some measurable criteria and disadvantaged individuals relative to others. • While these costs and benefits are often expressed in monetary terms, they could be measured in other ways as well. • Vertical equity often requires that disadvantaged people receive more public resources (per capita or unit of service) to accommodate their greater need than those who are advantaged. • It justifies employing revenues to the advantage of underprivileged people, such as low-income drivers as a class and non-drivers. Litman (2007) notes that this can be accomplished by utilizing resources to benefit lower-income drivers or to develop transportation alternatives such as transit, bicycling and walking; and to furnish public services that benefit low-income earners in the society.

Table 3. The three dimensions of equity based on Ref. [53] Rawls' theory.

This leads us to the problem of deciding how to make comparisons among different social groups within the society. The economics literature classifies members of the society based on their income or their place of residence or work, while the planning literature consider those who may be disadvantaged with respect to transportation because of disability, age or gender.

However, congestion pricing must also consider where people live, as some neighbourhoods may experience greater burden than others because of the way in which we implement congestion pricing.

In conclusion to the above discussion, one may argue that there is no easy answer available to the question that is often raised, "Is congestion pricing equitable?" There is not a theory of equity but multiple meanings of the concept proposed by human and social sciences. And the answer to this question largely depends on how we measure equity and how we define groups, the details of the site and lastly, to what we judge against congestion pricing. However, in an attempt to answer the above question, the literature about congestion pricing and equity has been reviewed and one can suggest the following conclusions regarding this issue:

First, an equity evaluation must carefully consider socio-economics, demographics as well as location. The distribution of residents, job opportunities and other vital destination has, to a great extent, a significant impact on equity implications for all types of congestion pricing. Cordon pricing, for example, may be progressive, regressive or neutral based on the place of residence of low-income people.

Second, an important factor for the net impact of congestion pricing is how revenues are used. Differences in this respect reduce differences in other factors such as values of time. Having to pay for what was freely available and the risk of exclusion for low-income social groups for the extra cost of driving causes political hostility. Thus, from an economic perspective, spending revenues in ways that benefit low-income and other transportation-disadvantaged social groups will make congestion pricing more likely progressive rather than regressive. This is largely dependent on how congestion pricing is implemented. However, if revenues and benefits are distributed equally within society, congestion pricing may be taken as a whole as regressive. On the other hand, even with spending revenues in ways to benefit low income, it is still possible that some members will still be disproportionately burdened.

In terms of equity impacts, the literature on road pricing has focused mainly on income equity issues and to a lesser extent on spatial equity. In general, the three congestion pricing projects that were implemented in the Asian city (Singapore) and the two European cities (London and Stockholm) gave equity only limited attention and evaluation. When charges are imposed on travellers, these result in perceived road user's "winners" and "losers". This is attributed to the way that travellers value time savings, where some road users value these savings more than the fees they pay. The losers, who are tolled off, may change their travel routes, shift to off-peak times, change the mode of transportation, shift to carpool or make fewer trips. In Singapore, gainers from congestion pricing project were found to outnumber losers 52 to 48% [50]. Also, after implementing congestion pricing in Singapore it was found that residents outside the priced zone considered this project as negative while residents inside the priced zone considered it positive. The enhancement of public transit before implementing congestion pricing can be considered a way to achieve equity between different income groups. In Stockholm, transit service was extended by 7% by adding 16 new bus lines, additional departure for train lines and new park-ride facilities 4 months before the start of the tolling.

http://dx.doi.org/10.5772/107156

Two commonly suggested ways to mitigate the risk of negative impacts of congestion pricing on low-income and disadvantage groups are found in the literature. The first approach is to distribute the revenue generated from congestion pricing through public works and in particular, on the public transit system to create better options not to drive and to ensure that project benefits flow to those most disadvantaged individuals by congestion pricing. Other ways identified in the literature on redistributing the generated revenue are through tax credits and credit-based systems to ensure that redistribution is made on an individual basis. However, none of these ways were tested or implemented in reality; therefore, their effectiveness is difficult to judge. The second approach is discounts and exemptions for disadvantaged (e.g., disabled persons) and low-income individuals, vehicles or types of trips. This approach leads to a less expensive congestion pricing system. However, the incentives to discourage drivers to travel on congested roads will be reduced if a large number of people get discounts or exemptions.

The last point on promoting equitable outcomes is that a region seeking to implement congestion pricing should look at measuring and assessing equity in the early phases of the planning process. Most importantly, a proposal of congestion pricing should be tested through modelling to determine who are more likely to pay the charges and whether the situation of the low income and transportation-disadvantaged social groups will be worse off with the proposed project. Furthermore, public participation should be facilitated so members of the society affected by this project are aware of it and also are given the chance to offer suggestions. Lastly, even after the implementation of the congestion pricing, equity has to be monitored and changes should be made every so often to the system if the early tools to endorse equitable outcomes are not achieving their goals. It would be also functional to develop an "equity audit tool" to facilitate this process.

In conclusion to the above discussion, the concept of equity is subject to broad interpretation. This notion deals with principles that identify the fair or just distribution of resources among members of the society. Because the formation of these principles entails ethical and subjective judgment, the study of equity is burdened with definitional mystification and "pluralism". In general, equity definitions stress the significance of a fair distribution of benefits and burdens. Furthermore, accurate definitions of equity are rare in both policy making and policy evaluation. Thus, reaching an agreement on what constitutes equity and the fairness of a specific distribution is almost unattainable which makes the concept of equity a complex one. The difficulty in defining *equity* as descriptive and normative has made the theoretical literature on equity very debatable.

Lastly, it may be useful here to clarify the link between theories and principles of equity ("economic theory", "social justice theory", "Rawls' theory") that are introduced in this chapter. A theory of social equity was developed and positioned as the "third pillar"; in addition to economy and efficiency for transportation planning including road pricing. In terms of the theoretical progress of equity in the last two decades, the work of Rawls provided a language and a road map for transportation planners to understand the complexity of the subject and to integrate notions of fairness, justice and equality in their planning.

Rawls derives his two principles of justice: "the liberty principle" and "the difference principle" from his theory that is known as "Justice as Fairness". He claims that adopting two such principles organizes the distribution of economic and social benefits across society. The difference principle justifies unequal distribution of goods only if those inequalities are to the advantage of the worst-off members of society. With the emergent focus on congestion pricing, concern is rising about whether congestion-based charging policies can be designed in an equitable way. Therefore, Rawls' theory, particularly the difference principle, can help planners to develop criteria for assessing public policy and programs dealing with the optimal use and most importantly, the distribution of resources. The next chapter has further discussion about theories and principles of equity with regard to congestion pricing.

6. Conclusion

Congestion continues to increase in many cities around the globe and the traditional approaches of expanding transportation infrastructure or building more roads to operate at minimum congestion at all times will not be a solution due to financial and environmental reasons. Congestion pricing has become an increasingly practical option implemented in various forms for managing congestion, protecting the environment and raising revenue for investments in transportation. It has been easily implemented in recent years because of the advances in technologies that make it achievable to charge motorists as they drive. Although, transportation planners and policy makers are considering congestion pricing as a promising alternative to mitigate/manage congestion, it has thoroughly faced an unreceptive public and political environment. While few cities succeeded in implementing different schemes of congestion pricing, yet many proposals were discarded based on equitability concerns. In general, equity has been given limited attention and evaluation when cordon pricing was implemented in different cities around the world.

However, the equity of pricing schemes is a major concern among the public and elected officials prior to and after congestion pricing implementation. This is due to charges being imposed on access to roadways that were previously free, a change that may harm different socio-economic groups such as low-income travellers, because they will either have to pay the fees or be priced off the roads. The issue of equity is at the core of the debate in social science, particularly with regard to assessing equity in social policy. Several reasonable and conflicting notions of equity exist and, as identified in, this is related to the fact that there are several impacts to be considered. But, at the same time, many of these are difficult to measure and there are numerous ways to classify "winners and losers". There is not an accepted and commonly used manual for evaluating equity in transportation policies.

In conclusion to the above discussion, one may argue that there is no easy answer available to the question, "Is implementing congestion pricing policy is equitable?" There is not a theory of equity but multiple meanings of the concept proposed by human and social sciences. However, the answer to this question largely depends on how we measure equity and how we define groups. Taking into consideration all aspects of equity is impossible. However, in an attempt to answer the above question, one can suggest the following conclusions regarding this issue:

http://dx.doi.org/10.5772/107156

It is concluded that the most important factor for the net impact of congestion pricing is how revenues are used. Differences in this respect reduce differences in other factors such as values of time. Having to pay for what was freely available and the risk of exclusion for impacted socio-economic groups for the extra cost of driving causes political hostility. Thus, spending revenues in ways that benefit people from low-income neighbourhoods and other transportation-disadvantaged social groups will make congestion pricing more likely progressive rather than regressive. On the other hand, even with spending revenues in ways to benefit these groups, it is likely that some members will still experience a burden.

Although utilizing revenues to improve transit services is considered to be an effective strategy for increasing equitable outcomes, still not all transit is created equal and it is not considered by many as a viable strategy for addressing equity concerns. Investments in various modes of transportation and different neighbourhoods may have different impacts.

Different approaches can generally evaluate the measurement of equity in transportation in many ways. The difficulties of these evaluations are greater when applied to congestion pricing than other forms of transportation demand management or financing schemes such as taxation. This is due to the fact that the range of congestion pricing impacts is quite larger. The evaluation of equity for congestion pricing policy can be complicated due to the many variables involved. For example, the incidence of congestion pricing relies on location. Therefore, the places where individuals in the same income groups live, worship, work and shop are a critical element of how these individuals experience congestion pricing.

Other essential factors are cost, convenience, presence and cost of alternatives to driving. Equity implications are different if individuals can switch from using their own automobiles during congested time to other modes of transportation such as public transit, walking or cycling. In addition, comparing equity implications of cordon pricing in different cities around the world is fundamentally impossible because of the many other factors that may play a significant role in the outcomes.

Author details

Ammar AbuLibdeh

Address all correspondence to: a.abulebdeh@uaeu.ac.ae

Department of Geography and Urban Planning, Facility of Humanities and Social Sciences, United Arab Emirates University, Al Ain, United Arab Emirates

References

[1] Abulibdeh, A., Andrey, J. and Melnik, M. (2015), Insights into the Fairness of Cordon Pricing Based on Origin–Destination Data. Journal of Transport Geography. Vol. 49, pp. 61–67.

[2] Black, R. W. (2010). Sustainable Transportation: Problems and Solutions. Guilford Publication, New York.

[3] Kitchen, H. (2008), "Financing Public Transit and Transportation in the Greater Toronto Area and Hamilton: Future Initiatives". Completed for: Residential and Civil Construction Alliance of Ontario, 25 North Rivermede Road, Unit 13, Vaughan, Ontario.

[4] FHAW (2006), "Issues and Options for Increasing the Use of Tolling and Pricing to Finance Transportation Improvements", Final Report, Work Order 05-002.

[5] Abulibdeh, A. (2012), "Equity Implications of Cordon Pricing in Downtown Toronto", A Thesis Presented to the University of Waterloo in Fulfillment of the Thesis Requirement for the Degree of Doctor of Philosophy in Geography. Waterloo, Ontario, Canada.

[6] Hyman, G. and Mayhew, L. (2002), "Optimizing the Benefits of Urban Road User Charging." Transport Policy, Vol. 9, No. 3, pp. 189–207.

[7] de Palma, A., Kilani, M. and Lindsey, R. (2003), "Congestion Pricing in the City: Metropolis Simulation Results", Presented at 50th Annual Meeting of the Regional Science Association International, Philadelphia, PA.

[8] NCHRP (1994), "Road Pricing for Congestion Management: A Survey of International Practice", A Synthesis of Highway Practice, Synthesis 210, Transportation Research Board.

[9] Raje, F., Grieco, M. and McQuaid, W. R. (2004), "Edinburgh, Road Pricing and the Boundary Problem: Issues of Equity and Efficiency", Stirling and Glasgow: Scottish Economic Policy Network.

[10] Rouwendal, J. and Verhoef, T. E. (2006), "Basic Economic Principles of Road Pricing: From Theory to Applications", Transport Policy, Vol. 13, pp. 106–114.

[11] Levknson, D. (2010), Equity Effects of Road Pricing: A Review. Transport Reviews, Vol. 30, No. 1, pp. 33–57.

[12] Black, R. W. (2003), Transportation: A Geographical Analysis, The Guilford Press, New York.

[13] Evans, E. J., Bhatt, U. K. and Turnbull, F. K. (2003), "Road Value Pricing Traveler Response to Transportation System Changes", Chapter 14: Road Value Pricing. TCRP Report 95, Transit Cooperative Research Program. Transportation Research Board. Washington, D.C.

[14] Ungemah, D. (2007), "This Land is your Land, This Land is my Land: Addressing Equity and Fairness in Tolling and Pricing". Transportation Research Record: Journal of the Transportation Research Board, No. 2013, Transportation Research Board of the National Academies, Washington, D.C., pp. 13–20.

[15] Ecola, L. and Light, T. (2009), "Equity and Congestion Pricing: A Review of the Evidence", Technical report, Published 2009 by the RAND Corporation, Transportation, Space and Technology, Santa Monica, CA.

[16] FHWA (2006), "Congestion Pricing: A Primer", Publication Number: FHWA-HOP-07-074.

[17] Richardson, H. W. (1974), "A Note on the Distributional Effects of Road Pricing", Journal of Transport Economics and Policy, Vol. 8, pp. 82–85.

[18] Cohen, Y. (1987), "Commuter Welfare under Peak Period Congestion Tolls: Who Gains and Who Loses?" International Journal of Transport Economics, Vol. 14, No. 3, pp. 239–266.

[19] Fridstrom, L., Minken, H., Moilanen, P., Shepherd, S. and Vold, A. (2000), "Economic and Equity Effects of Marginal Cost Pricing in Transport Case Studies From the European Cities", 71, VATT, Helsinki, Finland.

[20] Giuliano, G. (1994), "Equity and Fairness Considerations of Congestion Pricing", Transportation Research Record, No. 242, pp. 250–279.

[21] Eliasson, J. and Mattsson, L. (2006), "Equity Effects of Congestion Pricing Quantitative Methodology and A Case Study for Stockholm", Transportation Research Part A, Vol. 40, pp. 602–620.

[22] Sumalee, A. (2003), "Optimal Toll Ring Design with Spatial Equity Impact Constraint: An Evolutionary Approach", Journal of Eastern Asia Society for Transportation Studies.

[23] Franklin, P. J. (2006), "A Non-Parametric Analysis of Welfare Redistribution: The Case of Stockholm's Congestion Pricing Trial", Submitted to Transportation Research, Part A: Policy and Practice. December 1, 2005.

[24] Arnott, R., de Palma, A. and Lindsey, R. (1994), "The welfare Effects of Congestion Tolls with Heterogeneous Commuters", Journal of Transport Economics and Policy, Vol. 28, pp. 139–161.

[25] Bhatt, K., Higgins, T. and Berg, T. J. (2008), "Lessons Learned From International Experience in Congestion Pricing" Final report, prepared for U.S. Department of Transportation, Federal Highway Administration.

[26] Giuliano, G. (1992), "An Assessment of the Political Acceptability of Congestion Pricing." Transportation, Vol. 19, pp. 335–358.

[27] Evans, A.W. (1992), "Road Congestion Pricing: When is it a Good Policy?", Journal of Transport Economics and Policy, Vol. 26, pp. 213–243.

[28] Karlstrom, A. and Franklin, J. P. (2008), "Behavioral Adjustments and Equity Effects of Congestion Pricing: Analysis of Morning Commutes During the Stockholm Trial", Transport Research Part A. doi: 10.1016/j.tra.2008.09.008

[29] Ramjerdi, F. (2006), "Equity Measures and Their Performance in Transportation", Transportation Research Record: Journal of the Transportation Research Board, No. 1983, Transportation Research Board of the National Academies, Washington, D.C., pp. 67–74.

[30] Eliasson, J. (2009), "A Cost–Benefit Analysis of the Stockholm Congestion Charging System", Transport Research Part A. doi:10.1016/j.tra.2008.11.014

[31] Small, K. (1983), "The Incidence of Congestion Tolls on Urban Highways", Journal of Urban Economics, Vol. 13, pp. 90–111.

[32] Hau, T. D. (1992), Economic Fundamentals of Road Pricing. Policy Research Working Paper, Transport Division, Infrastructure and Urban Development Department, The World Bank, Washington, D.C.

[33] Gomez-Ibanez, J. A. (1992), The Political Economy of Highway Tolls and Congestion Pricing", In: Federal Highway Administration (Editor), Exploring the Role of Pricing as a Congestion Management Tool. FHWA, Washington, USA.

[34] Flowerdew, A. D. (1993), Urban Traffic Congestion in Europe: Road Pricing and Public Transport Demand, Research Report, The Economics Intelligence Unit, London.

[35] Moses, L.N. and Williamson Jr H. F. (1963), "Value of Time, Choice of Mode and the Subsidy Issue in Urban Transportation." The Journal of the Political Economy, 71, 247–264.

[36] MVA (1995), The London Congestion Charging Research Programme, Final Report, Vol. 1: Text, Government Office for London, HMSO, London.

[37] Langmyhr, T. (1997), "Managing equity: The Case of Road Pricing", Transport Policy, Vol. 4, No. 1, pp. 25–39.

[38] Leeds City Council (2000), Road Pricing in Leeds, Leeds City Council, Leeds.

[39] Transport for London (2002). The Greater London (Central Zone) Congestion Charging Order 2001: Report to the Mayor. Transport for London, London.

[40] Santos, G. and Rojey, L. (2004), "Distributional Impacts of Road Pricing: The Truth Behind the Myth", Transportation, Vol. 31, pp. 21–42.

[41] Horner, W. M. (2004), "Spatial Dimensions of Urban Commuting: A Review of Major Issues and Their Implications for Future Geographic Research", The Professional Geographer, Vol. 56, No. 2, pp. 160–173

[42] Rodrigue, P. J., Comtois C. and Slack B. (2006), The Geography of Transport System, Routledge, New York, NY

[43] O'Kelly, M. and Mikelbank, B. (2002), Social Change and Transportation in US Edge Cities. In Black, W. and Nijkamp, P., (eds), Social Change and Sustainable Transport, Indiana University Press, Bloomington.

[44] Deka, D. (2004), "Social and Environmental Justice Issues in Urban Transportation", in Hanson, S. and Giuliano, G., (eds) The Geography of Urban Transportation, 3rd edition, The Guilford Press, New York, NY, pp. 332–355.

[45] Miller, H. and Shaw, S. (2001), Geographic Information Systems for Transportation: Principles and Applications. Oxford University Press, New York

[46] Dunn, K. (2005), "Interviewing". In Hay, I., (ed.) Qualitative Research Methods in Human Geography). University Press, Oxford, pp. 79–105.

http://dx.doi.org/10.5772/107156

[47] Osterle, A. (2002), Evaluating Equity in Social Policy: A Framework for Comparative Analysis. Evaluation, Vol. 8, pp. 46–59.

[48] Truelove, M. (1993), "Measurement of Spatial Equity", Environmental and Planning C: Government and Policy, Vol. 11, pp. 19–34

[49] Murray, T. A. and Davis, R. (2001), "Equity in Regional Service Provision", Journal of Regional Science, Vol. 41, No. 4, pp. 577–600.

[50] Rescher, N. (1966), Distributive Justice. Bobbs-Merrill, Indianapolis, Indiana

[51] Campbell, A. K. (1976), "Approaches to Defining, Measuring and Achieving Equity in the Public Sector". Public Administration Review, Vol. 36, pp. 556–562.

[52] Daniels, N. (1985), Just Health Care. Cambridge University Press, Cambridge

[53] Rawls, J. (1971), A Theory of Justice. Clarendon Press, Oxford, UK.

[54] Litman, T. (2007), "Developing Indicators for Comprehensive and Sustainable Transport Planning", Transportation Research Record: Journal of the Transportation Research Board, No. 2217, Transportation Research Board of the National Academies, Washington, D.C., pp. 10–15.

[55] PATS, (2000), "Socio-economic principles for price acceptability", Deliverable D2, Status (D). Project funded by the European Commission under the Transport RTD programme of the 4th framework programme.

IntechOpen