

Referendum Voting in Road Pricing Reform: A Review of the Evidence

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Abstract

Voting support for congestion charging has a very recent history with, until now, only two congestion charging schemes approved by a majority in referendum voting (Stockholm and Milan). This paper presents a review of referendum voting behaviour in road pricing reform, in which a number of key factors that influence voters' behaviour are identified including voter expectations, awareness of what road pricing reform means, familiarity with the road pricing debate, perceived fairness, environmental concerns, car dependence, and the value of a trial. The two most important reasons that the majority of congestion charging proposals were voted against in referenda in jurisdictions such as Manchester and Edinburgh in the UK are uncertainty associated with the effectiveness of congestion charging and the lack of information on congestion charging. Based on two successful congestion charging referenda and ideas from research studies, this paper proposes a two-step approach to address the barriers to the successful implementation of congestion charging in a package of transport reform initiatives.

Keywords: referendum, voting behaviour, acceptability, trial, congestion charging, road pricing reform, ex ante and ex post experiences

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Introduction

Policy reform is a decision-making process which critically requires interactions with stakeholders. Stakeholders are heterogeneous and this makes the process very complex. The process of reform typically consists of two stages: a consultation process that includes problem discussion, stakeholder consultation including the media, solution forming/presentation, implementation/supplementary measures, and follow-up assessment (Schade and Schlag 2003a); followed in some instances by a referendum which involves direct voter participation in decision making, or an announcement, guided by elements of the consultation process.

Including referendum voting in major reforms is a way to reflect direct democracy. In a referendum, citizens are called to vote on new constitutional, political, economic, or environmental proposals (e.g., the 1992 Canada's referendum on constitutional reform, the 1999 Australian referendum on the monarchy, the 2000 Denmark's referendum on euro as the currency, and the 2000 Swiss green tax reform). A referendum can be held at the national (or federal) level (see e.g., Canadian 1992 constitutional referendum), or at the local level (see e.g., Corvallis's¹ 1998 referendum on funding a riverfront improvement project through increased property taxes). In the context of transport reforms such as road pricing, referendum voting has been conducted to gain support in moving from traditional pricing regimes (such as fuel taxes, parking fees, and car registration fees) to more use-related schemes such as congestion charging.

The aim of this paper is to review referendum voting behaviour in road pricing reform, with a particular focus on congestion charging, and to investigate the key factors that influence the public's support for a congestion charging scheme, as revealed in real applications of congestion charging, as well as from empirical studies of potential responses to a pricing reform agenda. Although this paper focuses on transport policy reform, the findings from the broader literature (e.g., political and environmental research) are drawn on to reinforce the evidence on some interesting phenomena such as dramatic improvements in support *ex post*, for a congestion charging scheme.

Recent Congestion Pricing Referenda

Congestion charging is being recognised in a number of countries, albeit at a relatively slow pace, as an effective travel demand management instrument to tackle traffic congestion (Hensher and Puckett 2007, Richards 2006). This is despite the political hurdles that stand in the way of many of the proposals. Historically, the first congestion charging scheme was introduced in Singapore in 1975, followed by Bergen in 1986, Oslo in 1990 and Trondheim in 1991, Durham in 2002, London in 2003, and Valletta and Stockholm in 2007². In January

¹ Corvallis is a city located in central western Oregon, United States.

² The Swedish city of Gothenburg looks set to see the introduction of congestion charging by 2013. The Swedish Riksdag has decided to move forward with plans to initiate congestion charges in Gothenburg in order to reduce traffic congestion and environmental wear in the region. As of 1 January 2013, drivers will be charged for entering the city limits. A share of the money received will go towards the future development of infrastructure in the Göteborg region. In January 2011, The Mayor of Budapest announced that he is planning to introduce congestion charges in the Hungarian capital. Up to three zones could be set up in the city. The first zone would be the city centre up to Nagykorut ring road, the border of the second zone would be Hungaria ring road and the outer zone would reach the M0 orbital. Upgrades to the city's public transport systems would be

16, 2012, Milan replaced the EcoPass (an emission charge, introduced in 2008)³ with a cordon congestion charge (called Area C).⁴ In some, but not all, of the charging contexts, a referendum has been held before the scheme is formally implemented, although outcome has been mixed with both support and rejection of the charging scheme. Some recent congestion charging referenda are summarised as follows.

The UK

In Edinburgh, a two-cordon charging scheme was proposed to start in 2006. Under this proposal a City Centre cordon would be operating between 7 am and 6.30 pm, and an outer cordon inside the Bypass would be operating between 7 am and 10 am. Motorists would pay a once-a-day charge of £2 for crossing either of the two proposed cordons in the inbound direction (Hu and Saleh 2005). In February 2005, 290,000 Edinburgh residents (a turnout of nearly 62 percent) voted in a referendum on the implementation of such a charging scheme. This charging scheme was rejected by nearly 75 percent of the voters (Gaunt *et al.* 2007).

In Manchester, in 2008, a two-cordon congestion charging scheme was proposed. If supported, the proposed scheme was to be introduced in 2011, under which motorists would pay £2 when entering the outer cordon and a further £2 for those entering the inner cordon during the morning peak; during the afternoon, a £2 charge would be applied when exiting each cordon. At a local referendum in December 2008, with a turnout of 53.2 percent, the Greater Manchester scheme was rejected by 79 percent of voters. (see <http://www.guardian.co.uk/politics/2008/dec/12/congestioncharging-transport>). In Birmingham, congestion charging was also opposed by a majority of voters in a local referendum (see De Borger and Proost 2012).

Part of the argument for voter rejection is that the proposed cordon schemes in Edinburgh and Manchester were more complicated than other schemes that had succeeded such as London. For example, there were two proposed cordons for each scheme, unlike the existing cordon scheme in London which is single-cordon based. This complexity was seen to increase the difficulty in gaining a clear picture of the proposed schemes and to increase uncertainty for voters. For example, a survey conducted three months after the referendum in Edinburgh showed that only 47.8 percent of the sampled respondents knew the correct charge level of £2 per day, with 20.2 percent stating that the charge would be more than £2, compared to 13.9 percent who answered that it would be lower than £2 (Gaunt *et al.* 2007). Despite the proposed charge being fixed at £2 per day, 18.2 percent of respondents misperceived that the maximum daily charge would also depend on the number of times they entered the cordon.

crucial however. The congestion charging system could only be introduced following the construction of a new metro underground line and extensions to two tram lines, while the city would also have to set-up up new park and ride car parks and improve bus services. According to estimates, the total cost of the project including the purchase of CCTV cameras would cost €146.22 million. The congestion charge for vehicles would be equivalent to the price of a single ticket for public transport.

³ Although initially the primary purpose of Milan's scheme was pollution abatement, it has also substantially reduced traffic congestion.

⁴ The majority of existing congestion pricing systems are cordon based, under which drivers have to pay for entering or leaving the charging zone (normally the central city area) during the designated time periods of the day. In recent years, there has been growing interest in charging regimes that are based on a distance charge (\$ per km) across an entire road network. The proposed (but currently deferred) distance based charging scheme in the Netherlands is the most ambitious to date, planned for all vehicles on all roads in the entire country. In 2008, prior to the decision to not proceed the Dutch Cabinet agreed to an average charge for cars of 3 euro cents per kilometre in 2012 (varying by the class of car), increasing to 7 euro cents in 2017.

Moreover, some respondents thought that the charge would be operational in both directions; despite it being announced that the charge was applicable for inbound traffic only. These misconceptions have been used to explain why there was a greater aversion towards the proposed charging schemes than might have been the case if the scheme was simpler.

Stockholm

After a seven month congestion charging trial period from 3 January to 31 July 2006, a referendum was held on 17 September 2006 in Stockholm city on whether to make the congestion charging scheme permanent. 51.3 percent of voters voted 'yes'. This makes Stockholm city the first city in which a congestion charge was approved by a majority (Schuitema *et al.* 2010). On August 1 2007, Stockholm city commenced its congestion charging scheme on a permanent basis, with the charge imposed on vehicles entering and exiting central Stockholm between 6:30 am and 6:29 pm during weekdays. There are 18 control points for the payment within the charging zone (see Figure 1). The time-of-day charging rates vary from 10 Swedish Krona (SEK) to 20 SEK.

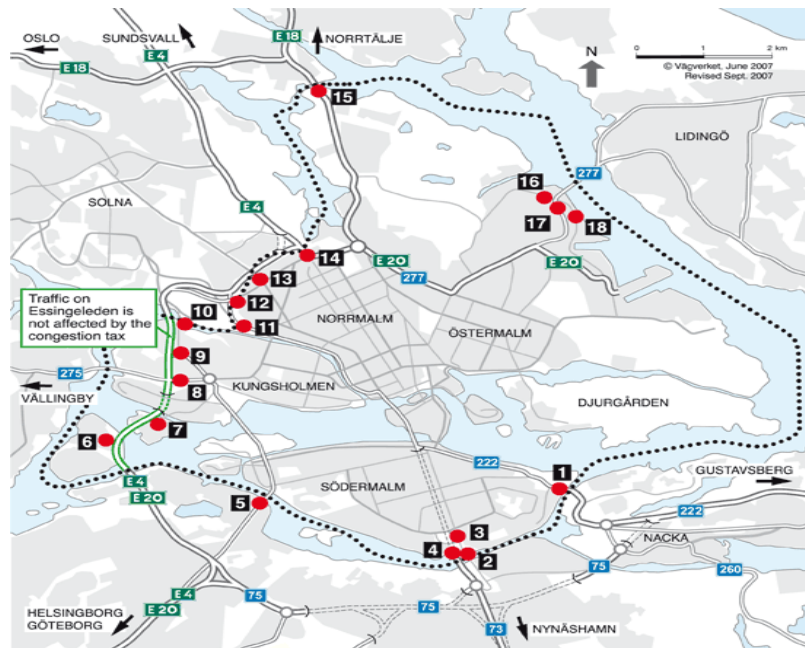


Figure 1: Control points in the Stockholm Charging Zone
Source: Schuitema *et al.* (2010)

Under the Stockholm congestion charge trial, traffic to and from the city of Stockholm decreased by over 20 percent (Eliasson 2007). However outside the inner city, traffic only reduced by just over five percent (Eliasson 2008). Given that the trial and the permanent charging scheme were almost identical in terms of charging rates and payment methods, residents were confident that the permanent scheme would also be successful in Stockholm city. It has been suggested that this may be the underlying reason that the charging scheme was approved in the referendum held in the city of Stockholm; while it was rejected in the

referenda in other municipalities of the County of Stockholm.⁵ Another potential reason for the different voting behaviour between Stockholm city and outlying counties is that residents living outside the city area would face higher travel costs.⁶

Milan

In 2008, Milan implemented EcoPass, an emissions-based charge applied to Milan's 8.2 square kilometres Limited Traffic Zone (LTZ). The charging rates of EcoPass were determined by several characteristics including the Euro emission class of the vehicle, the fuel type, and the type of transport (personal or goods). Under EcoPass, alternative fuel vehicles, petrol vehicles with Euro 3, 4 and 5 emission standards, and diesel cars with Euro 4 and 5 engines, were free of charge. In June 2011, a referendum was held, with 80 percent of voters supporting a replacement of EcoPass with an extended congestion charging scheme for all types of vehicles (Martino 2011). Following the referendum, a new congestion scheme named Area C was implemented on 16 January 2012. Area C, a cordon congestion charge, has the same charging zone as EcoPass with 43 entry points (see Figure 2); however a €5 fixed charge applies to all vehicles when entering the charging zone from 7.30am to 7.30pm during weekdays. Only alternative fuel vehicles are exempted from the scheme; while Euro 0 petrol vehicles and Euro 1, 2 and 3 diesel vehicles are not allowed to access the city centre. This is the first scheme that bans entry by specific classes of vehicle.



Figure 2: Cordon charging area of Milan's Area C
Source: Comune di Milano (<http://www.comune.milano.it>)

Given the evidence supporting simplicity as a condition to reduce uncertainty, a major reason for Milan's success is that the new congestion charging scheme (Area C) is much simpler compared to its predecessor (EcoPass). The switch from relative complexity to relative

⁵ If the proposed congestion charging scheme is cordon-based around the city area, similar voting patterns (central city vs. suburbs) are expected to be observed as happened in Stockholm. However, if the proposed charge is distance-based in all locations, there would be some difference. Compared to a cordon-based charging scheme, a distance-based scheme is less likely to be approved, given that more uncertainty is associated with the latter.

⁶ We thank a reviewer for this suggestion.

simplicity turned out to be significant plus gaining acceptance for further reform. For example, the charging rate of Area C is fixed at €5 per day; however EcoPass used a variable charging structure, under which the charges were determined by the Euro emission class of the vehicle, the fuel type, and the type of transport (personal or goods). Area C is easier to understand, and hence it is preferred over EcoPass. The failure of the Edinburgh and Manchester charging schemes and the success of Milan’s Area C suggest that in order to gain voter support in a referendum, policy makers should begin with a simple and well understood charging regime. Enhancements might be considered in subsequent periods of review, if appropriate, after there have been demonstrated real benefits from the initial scheme.

Lessons from Successful Congestion Charging Referenda

The impact of congestion charging on traveller behaviour in Stockholm and Milan has been dramatic. For example, Franklin *et al.* (2008) found a 24 percent reduction in work trips by car across Stockholm’s cordon, where modal shift to public transport is the major contributor to this reduction. Through more efficient pricing, car drivers (or car trips) with lower values of travel time savings would change their travel mode, route or departure time to avoid a charge. Table 1 summarises the real impacts after the first year of implementation of three congestion charging schemes (noting that London did not have a referendum), which shows that the various schemes resulted in significant reductions in traffic during charging hours (over 14 percent), faster speeds (e.g., 14 km/h to 18 km/h for London), and increased public transport mode share (from a 6.2 percent increase for Milan to 9 percent for Stockholm). The impacts of congestion charging have been monitored continuously. For example, in Stockholm, the reduction in traffic crossing the cordon, compared to 2005 (no cordon), is 18 percent for 2009, 19 percent for 2010, and 20 percent for 2011 (Börjesson 2012).

Table 1: Real impacts of congestion pricing schemes

Impacts	London	Stockholm	Milan
Reduction in traffic (vehicles with four or more wheels) entering the zone during charging hours	18%	trial: 22%, after permanent implementation:18%	14.2% (23% during the morning peak hours)
Reduction in cars entering the zone during charging hours	33%	Not available	Not available
Change in traffic beyond charging hours	Observed peak traffic after the charging hours in the first year, normalized in the coming years.	Observed peak traffic after the charging hours in the first year, normalized in the coming years.	Observed peak traffic after the charging hours
Change in traffic round the charging zone	-5%	+10%	-3.6%
Change in traffic in the inner road	+4%	+5%	Not available
Increase in speed inside the charging area	30% (from 14 km/h to 18km/h)	30-50% (33% in the morning peak hours)	4%
Change in speed in the inner road	Not available	Not available	Not available
Increase in bus speed inside the charging area	6%	Not available	7.8% attributed to charging zone in combination with bus lanes.
Increase in the use of public transport	above 7% totally, 37% in bus passengers entering the zone	9%	6.2% totally, 9.2% in metro passengers
Reduction in CO ₂ emissions within the charging zone	16%	16%	14%

Reduction in NOx emissions within the charging zone	8%	8.5%	17%
Reduction in PM10 emissions within the charging zone	6%	10-14%	18%

Source: Papathanasopoulou and Antoniou (2011)

Despite the evidence that congestion charging is capable of reducing traffic congestion and improving travel times, only two schemes were successful in a referendum vote. Stockholm's congestion charging scheme is the first scheme that was approved by a majority of voters in a referendum, followed by Milan's congestion charging scheme (Area C). Stockholm and Milan are two unique cases, where a trial program and a predecessor (i.e., Milan's EcoPass) were introduced before the referenda. The support rate was around 30 percent before Stockholm's charging trial, and increased to over 52 percent at the end of trial. During the trial period, Stockholm's residents experienced significant benefits such as reduced travel time, improved travel time reliability, and better air quality, resulting in a significant social surplus (Eliasson 2009). The trial had a positive impact on the attitudes of Stockholm residents towards congestion charging. Stockholm's experience suggests that, if possible, a congestion charging trial program should be implemented before holding a referendum, during which the residents can gain more information on the scheme as a strategy to reduce resistance. What the trial was able to do is to improve the psychological effect of cognitive dissonance, closing the inconsistency gap between attitudes and behaviour.

Before the introduction of Stockholm's congestion charging trial, three statistical demand models were developed to forecast the traffic impacts associated with introducing a congestion charging scheme. The models (i.e., nested logit models linked to a static equilibrium model) were estimated and calibrated on different data sets, all of which delivered, *ex post*, accurate forecasts of the effects of congestion charging (Eliasson 2008). Such forecasts were doubted before the trial. In Milan, it was predicted that Area C would reduce traffic by over 25 percent (Martino 2011), which is similar to its actual effect during its early operation (i.e., a 33 percent reduction, see Santucci 2012). A number of stated preference and opinion studies predicted that the number of car-commuting trips would be reduced by 4-15 percent under various charging schemes across different locations (see Li and Hensher 2012 for a review). What this suggests is that "a well-designed charging scheme that seems to work in a traffic model is actually also likely to work in reality" (Eliasson 2008, p. 402), finding that are very encouraging in terms of traffic congestion relief.

Referendum Voting Behaviour and Acceptability of Congestion Charging

In this section, we draw on empirical studies that have investigated voter behaviour in the context of future road pricing reform with specific reference to congestion charging, and which have considered the extent to which a specific charging scheme is acceptable. ⁷Jaensirisak *et al.* (2005) investigated voting behaviour responses using a stated preference

⁷ In the broader literature, a large number of empirical studies have been conducted to understand voting behaviour. For example, Clarke and Kornberg (1994) investigated voting behaviour in Canada's 1992 national referendum on constitutional reform; Vossler and Kerkvliet (2003) conducted a behavioural analysis of Corvallis's 1998 referendum on funding a riverfront improvement project through increased property taxes; and

(SP) referendum study in which 660 respondents in Leeds and 170 respondents in London were sampled. In their SP experiment, a cordon charge was effective from 7am to 7pm on weekdays, established as a mix of a fixed charge (British pounds (£) per day with four levels: £1, £3, £5, £7), distance based (£ per mile with four levels: £0.1, £0.3, £0.6, £1 per mile), time based (£ per minute with four levels: £0.02, £0.05, £0.08, £0.12 per minute) or delay-time⁸ based (£ per delayed-minute with four levels: £0.05, £0.15, £0.25, £0.40 per delayed-minute). In each SP task, there are four alternatives, and each of them is represented by three basic attributes (a congestion charge, car travel time reduction and bus travel time reduction (with travel time reduction having three levels: a quarter, a half or three quarters)), plus an additional attribute (either revenue allocation (public transport, tax reduction or 50:50 public transport and tax reduction), environmental improvement (as now, slight or substantial), charged area (small or wide⁹), charged time (7am-7pm or 7am-10am) or charge type (see Figure 3 for a voting example). Each respondent was asked to indicate how each alternative situation would benefit herself/himself and society on an 11-point scale; whether or not to vote for each alternative; and to choose a mode of travel under each alternative situation from four options: car, car with a different departure time, bus, and other. In the experiment, each respondent undertook one SP activity (out of five) only with four SP tasks. A fractional factorial design was used.

Please consider the four situations (A-D) inside the North/South Circular Roads presented below and answer the following questions.

Situation	A	B	C	D
Charge for using car	£3 per day	£1 per day	10p per mile	60p per mile
Charging method	Fixed	Fixed	Distance based	Distance based
Car delayed time reduced by	A quarter	A quarter	A half	A half
Bus delayed time reduced by	A half	A quarter	Three quarters	Three quarters

- If you travelled to work by car, do you think how much you would be charged per day? (Distance-based charge is a charge related to the distance spent travelling on roads inside (but not including) the North/South Circular Roads between 7am-7pm).

In situation C: (approx.) £ _____ ; In situation D: (approx.) £ _____

- How much would each situation benefit yourself and society?

(Please circle numbers where: -5 = very detrimental, 0 = no impact, +5 = very beneficial)

Situation	To yourself?					To society?					
	Very detrimental		no impact		Very beneficial	Very detrimental		no impact		Very beneficial	
A	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
B	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
C	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
D	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5

- Would you vote for each situation? (If there was a local referendum)

Situation	Vote?
A	<input type="checkbox"/> Yes <input type="checkbox"/> No
B	<input type="checkbox"/> Yes <input type="checkbox"/> No
C	<input type="checkbox"/> Yes <input type="checkbox"/> No
D	<input type="checkbox"/> Yes <input type="checkbox"/> No

- In each situation, how would you travel to work?

(If you currently do not work, please answer about non work journeys)

Situation	Travel by?
A	<input type="checkbox"/> Car <input type="checkbox"/> Car earlier/later* <input type="checkbox"/> Bus <input type="checkbox"/> Other _____ (please specify)
B	<input type="checkbox"/> Car <input type="checkbox"/> Car earlier/later* <input type="checkbox"/> Bus <input type="checkbox"/> Other _____ (please specify)
C	<input type="checkbox"/> Car <input type="checkbox"/> Car earlier/later* <input type="checkbox"/> Bus <input type="checkbox"/> Other _____ (please specify)
D	<input type="checkbox"/> Car <input type="checkbox"/> Car earlier/later* <input type="checkbox"/> Bus <input type="checkbox"/> Other _____ (please specify)

* Car earlier/later means travelling by car before and/or after the charged time

Figure 3: A referendum voting task from Jaensirisak *et al.* (2005)

De Vreese and Semetko (2007) analysed the impacts on the vote in Denmark's 2000 referendum on euro as the currency.

⁸ Delayed time is defined as "the time spent moving slowly or stopped in congested traffic, at traffic lights, or bus stops", and a delayed-time based charge is a charge according to the delayed time travelled.

⁹ Wide and small areas are within the North/South Circular Roads and Inner Ring Road for London, and the Outer Ring Road and Inner Ring Road for Leeds

Jaensirisak *et al.* (2005) found a low voting-support level for congestion pricing in the UK. Their empirical analysis, based on a multinomial logit model,¹⁰ found that ‘to achieve substantial environmental improvements’ has the most positive impact on increased support, followed by ‘reduced delayed time for cars’. Compared with car users, non-users show higher support on average, mainly because congestion charging would have a lesser impact on them. They also found that the support is stronger amongst people who perceived pollution and congestion as very serious issues, who regarded the current situation unacceptable, and who believed that congestion pricing is able to reduce congestion. Eliasson and Jonsson (2011) identified similar sources of impact on the attitudes towards Stockholm’s congestion charging scheme, such as environmental concerns (positive) and car dependence (negative).

Jou *et al.* (2007) also found a very low acceptance level associated with introducing congestion charging in Taiwan. Their stated preference study found a congestion charging proposal would be more acceptable for car commuters when travelling during peak hours, with longer travel times associated with the morning trips, with higher willingness to pay to save time (also see Ubbels and Verhoef 2006), as well as in situations where there exists more positive perceptions of congestion pricing.

Hensher *et al.* (2012), using a stated choice experiment, investigated support for road pricing reform in Sydney within the framework of a referendum voting choice model. Central to the task is how to identify *ex ante* support for specific road pricing schemes, such that the evidence is believable. Their approach is centred on a mixed logit error components referendum voting choice model for alternative road pricing schemes in which they incorporate information that accounts for the degree of belief (as well as risk attitude) of the extent to which such schemes will make voters better or worse off. They find that accounting for belief in the benefits results in sizeable reductions in the sensitivity to the levels of the charge, but quite small impacts on the sensitivity to revenue allocation. The findings (see Table 2) suggest that a cordon-based charge in the central business district is a sensible initial scheme to introduce, since it is predicted *ex ante* to obtain more than a 50 per cent (specifically, 62.4 per cent) vote when the daily peak entry charge is \$8 and the off peak charge is \$3, provided that 100 per cent of funds are allocated to public transport improvements (RP scheme 12). This reduces to 60.9 per cent when the revenue is allocated 50:50 to public transport and road improvements (RP scheme 13). Distance-based charging (RP schemes 5-7, 9-11) is less popular, with the highest percentage voting for a scheme in their examples (Table 2) being 32.2 per cent. A particularly important finding (in a context of no experience with congestion charging through a trial) is that when the revenue allocation is recognised in conjunction with distance-based charging, the support increases from 17.6 per cent to between 25.5 and 27.1 per cent (depending on the revenue allocation plan).

¹⁰ All variables are entered into the utility function relating to the ‘yes’ responses, with the utility of a ‘no’ response set to zero. The charge is specified in pence per day and the delayed time reductions are in minutes per day. All other terms are dummy variables.

Table 2 Predicted support for a Road Pricing Scheme under a Referendum: Illustrative Scenarios

Attribute of Road Pricing Scheme	RP Scheme (SQ = status quo)												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Current cost elements (fuel) \$/km	SQ	SQ	SQ	0.5SQ	SQ	SQ	SQ	0.5SQ	0.5SQ	0.75SQ	SQ	SQ	SQ
Current cost elements (registration) per annum	SQ	SQ	SQ	SQ	SQ	SQ	SQ	0.5SQ	0.5SQ	0.75SQ	SQ	SQ	SQ
New distance based charging (\$/km) - peak	-	-	-	-	5	5	5	-	8	5	3	0	0
New distance based charging (\$/km) off peak	-	-	-	-	0	0	0	-	3	3	0	0	0
New cordon-based charging (\$/day) - peak	10	20	20	20	0	0	0	0	0	0	0	8	8
New cordon-based charging (\$/day) – off peak	5	5	10	10	0	0	0	0	0	0	0	3	3
Improving public transport revenue allocation (%)	0	0	0	0	0	50	100	0	100	100	100	100	0
Improving existing and construct new roads revenue allocation (%)	0	0	0	0	0	30	0	0	0	0	0	0	0
Reducing personal income tax revenue allocation (%)	0	0	0	0	0	20	0	0	0	0	0	0	0
Predicted Voting Support	47.74	46.6	45.1	58.1	17.6	25.5	27.2	79.1	9.5	10.3	32.2	62.4	48.9

Source (Hensher *et al.* 2012)

Jaensirisak *et al.* (2003) investigated the impact of selfish (i.e., primarily concerned with their own benefits) and social perspectives (i.e., primarily concerned with society’s well-being) of individuals on voting behaviour. They found that voting support is influenced by the perceptions of personal and society benefits, while the impact of personal well-being is stronger. Based on a survey conducted in four European cities, Schade and Schlag (2003b) also found that the perceived effectiveness of congestion charging has a positive impact on its acceptance level (which is in line with Jaensirisak *et al.* (2003), Ubbels and Verhoef (2006), Jou *et al.* (2007) and Eliasson and Jonsson (2011)), as well as social norms (the perceived social pressure to accept the strategy) and personal outcome expectations.

In addition to the perceived effectiveness of congestion charging, perceived fairness also has an important influence on acceptability. Emmerink *et al.* (1995) argued that perceived unfairness due to income and regional differences may result in low acceptability.¹¹ This hypothesis is empirically supported by Jakobsson *et al.* (2000), who surveyed 524 car owners living in a metropolitan area of Sweden, and through a modelling exercise found that the acceptance level of road pricing is negatively influenced by perceived unfairness and perceived infringement on freedom. Similar findings are also given by Bamberg and Rölle (2003).

¹¹ A number of studies have conducted comprehensive reviews on the equity implications for different socioeconomic classes (see e.g., Safirova *et al.* 2005; Eliasson and Mattsson 2006; Gehlert *et al.* 2011). The common conclusion of these reviews is that findings on equity vary from study to study. A literature review by Gehlert *et al.* (2011) reveals a contradictory picture on socioeconomic differences (e.g., age, gender, and education) in public acceptability, as well as on socioeconomic differences in car use adaptation towards charging. Eliasson and Mattsson (2006, p.604) concluded: “These disparate views indicate that it is difficult to come to clear-cut conclusions about the distributional effects of congestion pricing”.

In Harrington *et al.* (2001), 1,743 Southern California residents were asked whether they would support a distance-based congestion charge (5-10 US cents per mile) in a referendum, which would be levied on all freeways in the region. During the survey, each respondent was also given an estimate of the monetary charge and expected time savings according to her/his reported traffic condition. This base policy was supported by 36.4 percent of respondents. The whole sample was then randomly divided into three groups and each answered questions related to one of the following policies: (1) part of (25 percent-80 percent) the revenues generated from congestion charging would be used to reduce taxation; (2) coupons would be given which could be used for a variety of transportation-related services; or (3) the charge would be only applied to the left-most lane of all freeways. A series of binary probit models were estimated. Harrington *et al.* found that an increase in the charging level would decrease voting support. Car ownership would also have a negative impact, as well as income. Other factors such as the proportion of revenue used in tax reductions, the perceived seriousness of the congestion problem, and the amount of time savings, would positively influence voting support.

Hårsman and Quigley (2010) analysed voting patterns of Stockholm's congestion charging referendum in response to economic and political incentives. Their regression models showed that a 10 percent reduction in commuting time would lead to a propensity in favour of congestion charging by an average of two percent; while the increased cost has an opposite effect. They also found that voters' political preferences in terms of the preferred political party also influenced voting behaviour (i.e., voters would be more likely vote for congestion charging if their supported political parties were in favour of it). Male voters would be more likely to vote against congestion charging. However, people with a higher education would be more likely to support it. With regard to the impact of education on voting behaviour, some similar findings were identified in the literature. For example, Ubbels and Verhoef (2006) found that better-educated people tend to have a clearer picture and better information on congestion charging so that they would show greater support for congestion charging, given that the lack of information is a major reason for the rejection of congestion charging (see the next section for more details).

Gaunt *et al.* (2007) investigated the reasons for the failure of the proposed Edinburgh congestion charging scheme. Edinburgh's referendum was held in February 2005, which was rejected by 74.4 percent of voters. Gaunt *et al.* interviewed 368 Edinburgh residents in May 2005, and found that the strong opposition of car owners to the proposed scheme is the primary reason for its rejection. Another key reason is the lack of a clear understanding of the scheme. For example, some respondents thought that the charge would be applied in both directions; despite it being planned for only inbound vehicles. Uncertainty with respect to the effectiveness of the scheme in terms of reducing congestion and improving public transport also played an important role in the overwhelming rejection.

De Borger and Proost (2012) used a partial equilibrium approach to develop a voting model within which to analyse the impacts on voting behaviour with respect to the introduction of congestion pricing. In De Borger and Proost's model, two types of uncertainty were considered: uncertainty about the modal substitution costs (or willingness to pay for car trips) and uncertainty about the efficiency of politicians in using the revenues. De Borger and Proost found that individual uncertainty about the modal substitution costs would imply a negative expected benefit for car drivers, and increase opposition to congestion charging from existing drivers, which consequently results in a majority against introducing congestion

pricing *ex ante*. Secondly, political uncertainty with respect to the use of the revenues also has a negative impact on voting support.

Revenue disbursement has been identified by many studies as crucial to the welfare effects of road pricing (see e.g., Parry and Bento 2001; Calthrop *et al.* 2010). Two alternative revenue allocations are considered in De Borger and Proost (2012): subsidies to public transportation and a tax refund to all voters, with the finding that the former is supported much more than the latter. Based on evidence from a stated preference study, Farrell and Saleh (2005) suggested the revenues generated from congestion charging should be used to improve public transport through lower fares, frequency improvements, and reliability improvements. An empirical study conducted in the Netherlands by Ubbels and Verhoef (2006) found that the use of revenues to replace existing car taxes¹² or to lower fuel taxes would lead to a higher acceptance of congestion charging, in line with the recent evidence from Sydney in Hensher *et al.* (2012).

Similar to the findings in Hensher *et al.* (2012), Jaensirisak *et al.* (2005) found that a fixed cordon charge is preferred over a variable cordon charge (e.g., distance based) in the UK, mainly because the former is more transparent.¹³ However, a major drawback of a fixed charge is a lack of efficiency (i.e., all trips are charged at the same rate, despite that they produce different levels congestion at different departure times or with different trip lengths). Given this, some flexibility needs to be added into the fixed charging regime. Jou *et al.* (2007) found that a time-of-day cordon charge is more acceptable than the fixed cordon charge in Taiwan. Ubbels and Verhoef (2005) promoted a time-of-day kilometre charge as an instrument to relieve peak time congestion. O'Fallon *et al.* (2004) revealed that a fixed cordon charge is more effective in terms of modal shift (from car to other modes) in Wellington, New Zealand; while an 'everywhere' kilometre charge is preferred in Auckland and Christchurch. The difference is mainly attributed to different time of day travel patterns (e.g., a higher percentage of sampled Wellington drivers indicated that they had entered the cordon area before the experiment). When designing a congestion charging scheme, some relevant issues identified from previous studies that need to be considered in future studies are the travel patterns of drivers and the geographic characteristics of the city. For example, in Wellington and Christchurch the cordon areas were largely limited to the CBD, but in Auckland the unusual geography (an isthmus) means that the local body responsible for strategic transport planning was most interested in a cordon area much wider than the central business district.

Changing Attitudes towards Congestion Charging: *Ex Ante* vs. *Ex Post*

Public support is crucial to the implementation of congestion charging. However, the voting-support level revealed in recent referenda is low (e.g., a 25 percent support for Edinburgh's scheme and 21 percent in Manchester). Low support or acceptability is also revealed by many

¹² Current car taxation in the Netherlands consists of two main components: a tax on car ownership (annual charge) and a tax paid when purchasing a new car.

¹³ Li and Hensher (2010) found similar evidence in the context of toll roads in Australia: "A distance-based charging scheme appears in reality, to create more uncertainty for drivers, as the amount of toll charge is relatively ambiguous, unlike the flat toll road, where drivers know the exact amount before they use the toll road" (p.560).

opinion surveys and stated preference studies (see Jaensirisak *et al.* 2005; Li and Hensher 2012; and Hensher *et al.* 2012). Uncertainty is a major reason for the lack of support when introducing new policies. Evidence from political research revealed that the status quo is at an advantage compared to new proposals when pitted against the status quo, mainly because voters are uncertain about whether new policies (especially in the absence of a trial) will achieve their targets (see e.g., Ingberman 1988; Samuelson and Zeckhauser 1988). Jones (2003) also argued that a major reason for resistance to congestion charging is uncertainty over its effectiveness. Allen *et al.* (2006) found that the majority of their sampled respondents were uncertain or disagreed that Edinburgh’s scheme can significantly reduce congestion and improve public transport, which is a reason for the rejection of Edinburgh’s congestion charging scheme. De Borger and Proost (2012) found that individual uncertainty about the modal substitution costs and political uncertainty about the use of the revenues generated are two major reasons for low support for congestion charging proposals *ex ante*.

The Sydney data set (discussed in the previous section) includes evidence on the awareness of and familiarity with road pricing. Figures 4 and 5 show clear evidence of the poor state of knowledge of the topic, despite the growing levels of traffic congestion and calls in the media for road pricing reform. This reinforces the need for much more information and education as a pre-requisite to an informed referendum.

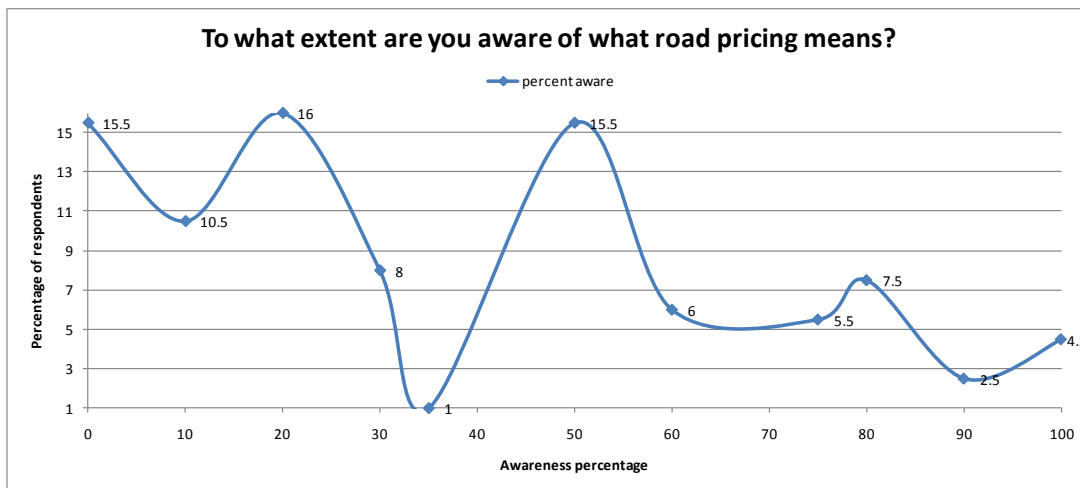


Figure 4: Resident awareness of what road pricing means in Sydney

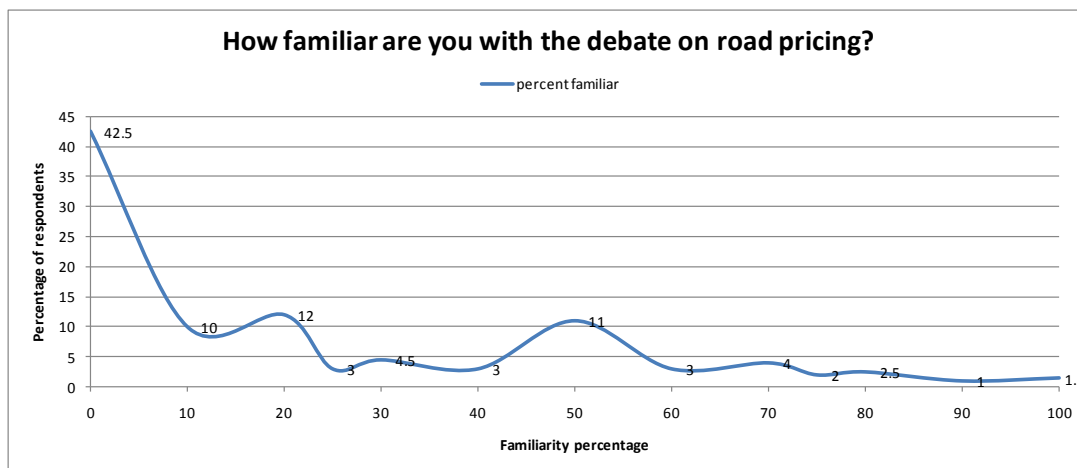


Figure 5: Resident familiarity with the road pricing debate in Sydney

Insufficient information is another primary reason for the rejection of new policies in referenda. In the broader literature, O'Neill (2001) argued that insufficient information would significantly diminish the expected value of a new policy for voters. Based on 140 ballot measures between 1981 and 1999 in Switzerland, Christin *et al.* (2002) found that voters with less information on the contents of a proposal tended to vote against it. Christin *et al.* interpreted this tendency as risk-averse behaviour. In the context of congestion charging, Gaunt *et al.* (2007) found that the lack of a clear understanding of the proposed scheme is a contributing reason for why Edinburgh's congestion charging proposal was rejected in the referendum. Odeck and Kjerkeit (2010) analysed survey data collected by the Norwegian Public Roads Administration, and found that people who have inadequate information on the charging schemes would be 2.14 times more negative towards congestion charging, compared to those who are well informed, holding all other factors constant.

Despite the lack of support *ex ante*, evidence shows dramatic improvements in the public's support for congestion charging schemes after their introduction, from a majority rejection before they were introduced to reduced opposition or even a majority support after the charges were introduced. For example, in Norway, three cordon congestion charging schemes (Bergen in 1986, Oslo in 1990 and Trondheim in 1991) have experienced this shift. For Bergen's congestion charging scheme, it was opposed by 51 percent of participants in a poll conducted a month before its opening; however this opposition reduced to 36.5 percent within a year after it commenced operations (Larsen 1988). 70 percent of Oslo's residents were negative towards congestion charging in 1989, which dropped to 64 percent one year after its implementation, and reduced to nearly 50 percent in 1997 (Tretvik 2003). Trondheim has a similar story: before congestion charging was introduced, the share of negative attitudes was 72 percent, which decreased to 48 percent two months after its operation, and 35 percent in 1992-93.

Six months after the introduction of London's congestion charging scheme, the support rate increased to over 50 percent, from 40 percent before it was implemented (Transport for London 2004). In Stockholm, the congestion charging trial carried out before the referendum gained a majority support. However, before the trial, the support rate was 36 percent (Börjesson *et al.* 2012). A poll conducted in December 2007, four months after the permanent scheme commenced, showed that the support rate jumped to 66 percent. A follow up poll in May 2011 showed that the support kept climbing with 70 percent support (Börjesson *et al.* 2012). The finding of Börjesson *et al.* is in line with the evidence reported in Winslott-Hiselius *et al.* (2009).

Reasons for Increased Support for Congestion Charging *Ex Post*

The evidence presented in previous sections suggests three key reasons for increased support after congestion charging was introduced. The strongest element ensuring greater support is the experience of real benefits. For example, the London congestion charging scheme resulted in some dramatic changes in traffic after six months of its operation including: (1) the number of cars entering the charging zone decreased by 60,000 (30 percent of total non-exempt cars) compared with the same period in 2002. Over 50 percent of this reduction was contributed by the switching to public transport; (2) traffic in the zone was reduced by 16 percent, which led to an approximately 30 percent decrease in congestion; (3) the average travel speed increased from 13 km/h to 17 km/h, and there was a 14 percent decrease in

journey times to, from and across the charging zone (Transport for London 2004)¹⁴. With these benefits, there was an improvement in support for congestion charging from 40 percent to over 50 percent.

Odeck and Brathen (2002) also suggested that the positive impacts of the Norwegian congestion charging schemes increased their ongoing acceptance. Schuitema *et al.* (2010) conducted an empirical study to investigate the impact of experienced benefits on acceptability of congestion charging, using the survey data collected before and after Stockholm's congestion charging trial. In this study, respondents were asked to indicate the acceptable level on a 7-point Likert scale, ranging from very unacceptable to very acceptable. The data showed higher acceptability after the trial, mainly because in reality the charge delivered more positive consequences (e.g., less congestion and reduced pollution) and less negative consequences (e.g., increased travel cost) than respondents had expected beforehand. Schuitema *et al.* concluded "that acceptance of the congestion charge had increased because people experienced positive consequences of the charge" (p. 99). Eliasson and Jonsson (2011) also concluded that the most important reason aligned with changing attitudes towards Stockholm's congestion charging scheme is its real effects, in particular reduced congestion. Eliasson and Jonsson also showed that positive attitudes in turn resulted in a stronger belief with respect to the benefits created by congestion charges.

Secondly, improvements in support of congestion charging may be partially attributed to the effect of cognitive dissonance. Cognitive dissonance theory is a popular social-psychological theory, proposed by Festinger (1957), which assumes that individuals tend to seek consistency among their cognitions, and would try to reduce or eliminate the dissonance if there is inconsistency between attitudes and/or behaviours. One way to reduce the dissonance is to develop new (more positive) attitudes towards an inevitable event. Brundell-Freij *et al.* (2009) analysed improving support for Stockholm's congestion charging scheme, using data from three surveys during different phases of the implementation process: before the trial (autumn 2005), during the trial (spring 2006), and after the permanent introduction of the scheme (autumn 2007). In addition to the effectiveness of the charge, they argued that the cognitive dissonance phenomenon was another potential contributor to the improved attitudes towards charging over time. Whether cognitive dissonance theory can be used to explain the changing attitudes towards congestion charging was also empirically tested by Schade and Baum (2007), using a controlled experiment based on a one-factorial variance-analytical design with four levels (low, medium, high probability, control condition) of the likelihood of an introduction of road pricing in Germany. 140 car drivers were sampled. Schade and Baum found that the respondents who had been made to more strongly believe that the introduction of congestion charging is inevitable, tend to have more positive attitudes. They concluded that the observed attitude shifts (i.e., growing support over time) after the implementation of road pricing are to some extent influenced by cognitive dissonance reductions.

In addition to the effectiveness of congestion charging schemes and the psychological effect of cognitive dissonance, the changing opinion of political parties is another significant contributor to the improving support level. Using Stockholm as an example, the standpoints of its political parties with regard to congestion charging changed over time, from strong

¹⁴ In 2012 the average travel speed has returned to levels experienced prior to the introduction of the congestion charging scheme. Some commentators in the popular press have suggested that the scheme is thus a failure; however we would argue that the obligation on the Authority is to now review the actual charge level in line with the objective of reducing traffic congestion. If there is a looming failure, it might be attributed to a failure to revise the cordon-based charge.

political resistance to full support by all political parties (Eliasson and Jonsson 2011). Hårsman and Quigley (2010) analysed Stockholm’s congestion charging referendum data, and found that the voting results are strongly correlated with political party preferences. Given this, the growing political support would also increase the acceptance level of congestion charging.

International impacts also influence political plans to introduce road pricing reform. For example, the Danish Minister of Taxation announced in December 2012 that all plans to reform the Danish car tax system have been called off. The initial plan was based on the Dutch model, charging drivers a fee based on when, where and how far they drive. The Netherlands however, abandoned the plan as a result of a change of government, which resulted in the Danish Minister deciding that Denmark did not want to take the lead in a pay-by-kilometre scheme. According to the Minister, a fee on driving will not be introduced for another 10-12 years at the earliest.

The broader literature shows that the media can have a significant influence on voting choice (see e.g., De Vreese and Semetko 2004 for empirical evidence on the Danish 2000 euro referendum). The growing media support seems to also play a role in shaping the public’s attitudes towards congestion charging (see also Hensher and Bliemer 2012). For example, in Stockholm, the percentage of newspaper articles with a positive opinion on congestion charging surged from three percent in the autumn of 2005 (before the charging trial) to 42 percent in the spring of 2006 (during the trial) (Winslott-Hiselius *et al.* 2009). The growing positive media image coincided with the improving support of the public.

Using open-ended survey questions about respondents’ reasons for approval or rejection of 36 environmental referenda from 1983 to 2004 in Switzerland, Bornstein and Thalmann (2008) classified 14,633 voters into five categories: (1) cue-takers (4.1 percent of total respondents), (2) ideologues (27.8 percent), (3) selfish voters (10.9 percent), (4) myopic voters (30.3 percent), and (5) anticipatory voters (26.9 percent). Their voting characteristics are summarised in Table 3. Using a logistic hierarchical regression model, Bornstein and Thalmann found that selfish voters, cue-takers and myopic voters are more likely to reject the environmental proposals.

Table 3: Voting characteristics

Cue-takers	Ideologues	Selfish voters	Myopic voters	Anticipatory voters
Shortcuts to decision making, heuristic cues, imitation of better-informed citizens, following party’s or government’s vote recommendation	Simplistic and/or moral reasoning with ideological backdrop, usage of slogans, no concern for costs of proposals with regard to national economic conditions or public sector budget	Pocketbook voters, concerns for personal economic prospects and financial situation, personal cost-benefit analysis, and prevalence of self-interest	Sociotropic voters, comparing costs and benefits of proposals for a short timeframe with regard to national economic condition, past economic experiences decisive for vote	Prospective sociotropic voters, evaluating consequences of proposal on future living conditions, and immediate and long-term economic future crucial for choice

Source: Bornstein and Thalmann (2008)

Bornstein and Thalmann’s findings can be used to add some insights to explain the changing attitudes towards congestion charging over time. Given that selfish voters are driven by their own perceived benefits, they may reject congestion charging before it is even implemented. However, evidence shows that congestion charging schemes have delivered significant benefits (see e.g., Eliasson 2009). Therefore, selfish voters may change their opinions and

vote for congestion charging after they experienced these benefits. For myopic voters, their past experiences are crucial to their votes. With the build-up of positive experiences after the implementation of congestion charging, myopic voters are also expected to develop more positive attitudes towards charges. Given that cue-takers tend to follow their supported political party's recommendation, they would become more in favour of congestion charging if their political party became more supportive.

A Major Criticism of Referendum Voting

Although a referendum allows direct democracy, it imposes considerable informational demands on voters; although this depends on the extent of education prior to the vote. In the political research literature, Christin *et al.* (2002) found that poorly informed voters tend to adopt a 'status quo solution' and hence reject new and untested proposals, or imitate better-informed voters. In the context of environmental referendum voting, Bornstein and Thalmann (2008) concluded that voters without the ability to make reasoned decisions would adopt shortcuts or heuristics in decision making, such as following their 'gut feeling', or following recommendations provided by their supported political party or environmental organisation. The role of the media is of particular importance given that this is a common source of information.

It is typically a major challenge for many voters to obtain a clear picture of all elements of a congestion charging scheme when voting in a referendum, given that congestion charging, even in its simplest form, can be perceived as a complicated travel demand management instrument in terms of a charge level, a regime (cordon or the entire network, fixed, distance-based or time of day), and a revenue allocation plan. Gaunt *et al.* (2007) revealed that respondents with a misconception were more negative towards the proposed scheme, and concluded that: "the public's limited understanding of the scheme increased the strength of the opposing vote" (p. 85). Edinburgh's scheme was rejected by nearly 75 percent of voters, despite that it would have the great potential to reduce congestion, with the traffic model predicting a 30 percent reduction in the number of vehicles entering the city centre on a typical weekday (Allen *et al.* 2006).

Santos and Fraser (2006) suggested that the final decision with respect to introducing congestion charging should not be made subject to a referendum.¹⁵ Although the Mayor in London was elected with a manifesto that contained a proposal on congestion charging, and re-elected three years later, it is not clear that a referendum would have supported the London scheme, given the subsequent evidence in other UK jurisdictions; however the Stockholm experience suggests otherwise. Christin *et al.* (2002, p. 759) concluded that "given that a perfectly informed decision is only to be expected among a rare few voters, the question arises whether referendums are of any use". In both Christin *et al.* (2002 and Santos and Fraser (2006), however, they failed to recognise the potential merits of a trial period, as evidenced by the Stockholm trial that occurred after they published their studies.

¹⁵ The then Mayor of London, Ken Livingstone, introduced the London charging scheme into the City of London without a referendum. However, this might be difficult for other cities, given that the key reason that Livingstone was able to do so is that the London mayor has the power of introducing road user charging on her/his own authority under the Greater London Authority Act 1999 (see: www.legislation.gov.uk/ukpga/1999/29/contents).

Conclusions

To date we have two successful congestion charging referenda (Stockholm and Milan), which have *ex post* shown significantly higher support for the schemes as time passes. What is very clear from the evidence presented in previous sections, based on actual schemes and in research studies, is that gaining buy in *ex ante* for road pricing reform in general and congestion charging schemes in particular, is a highly desirable (albeit necessary but not sufficient) phase in the full implementation plan. The maturity of the debate, represented in part by the degree of awareness and familiarity with the case for road pricing reform, appears to be a critical lynchpin in establishing confidence in whether a referendum would achieve the desired outcome. This can be achieved in many ways, varying from a trial through to political commitment at the ballot box that promotes the benefits, including funding of alternatives (e.g. London with a sizeable increase in bus capacity).

Two important reasons suggesting why the majority of congestion charging proposals were voted against in referenda are uncertainty associated with the effectiveness of congestion charging and the lack of information on congestion charging. Despite the low support level, historically, in referendum voting, empirical evidence collected from the few existing congestion charging schemes shows that the public do tend to be more supportive after a charging scheme is implemented. Improved attitudes and hence increased support, arise from the objective truth (i.e., the experienced positive consequences of congestion charging) and the psychological effect of cognitive dissonance (i.e., becoming gradually more in favour of an inevitable event).

Based on the Stockholm and Milan experience, this paper promotes the idea of a two-step approach to overcoming resistance to road pricing reform and gaining a majority support: (1) during the design stage, forecasting models should be developed to predict the likely changes under the proposed charging scheme, and these potential changes and benefits need to be well informed to the public; (2) during the implementation stage, a trial should be introduced prior to a referendum (or even a commitment to change if the trial is successful), and the outcomes need to be regularly evaluated and supplied to the media in terms of the reductions in traffic levels, the minutes of increased free-flow time and decreased congestion time, the amount of fuel saved for commuting trips, the amount of reduced pollutions, and improved public transport service levels. These processes are expected to assist the public in gaining a fuller picture of the relative merits of congestion charging.

The acceptability of a congestion charging scheme is often linked to the allocation of the revenue raised, especially to public transport. It does appear, however, from the Stockholm experience in particular, that a trial that demonstrates real benefits in terms of travel time reductions makes the need to commit funds to specific investments such as improved public transport less relevant. Such pre-commitments in the London situation where there was no trial, but a convincing promotion of full hypothecation to improved public transport (after accounting for administration costs) appear to have been critical to a successful outcome. However, evidence elsewhere suggests that voters have little faith in governments actually honouring their promises to allocate such funds for road pricing reform (e.g., Manville and King 2012) and Figure 6 below from the Sydney study (Hensher *et al.* 2012), suggesting that there remains cause for concern about the extent to which revenue allocation can always be assumed to be used as a sufficient carrot to get over the line in a referendum. A trial like Stockholm might suggest a much better strategy.

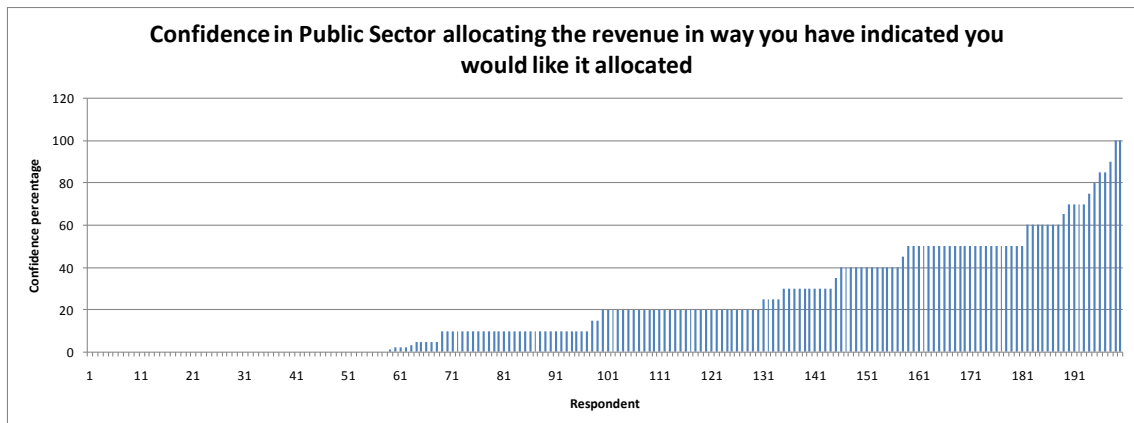


Figure 6: Confidence in revenue actually being allocated in Sydney

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