



**Public attitudes and acceptance of
policy measures for reducing urban
air pollution: A non-systematic review**

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Introduction

Although the air quality of European cities has improved significantly in recent decades, most European citizens are exposed to levels of air pollution with adverse effects on health (European Environmental Agency, 2013; World Health Organization, 2013).

Urban air pollution is the result of the presence of particulate matter and gases derived from various sources, such as the combustion engines of vehicles, the burning of fuels for the production of energy, industrial activities such as the construction or manufacture of cement, the erosion of pavement by traffic and abrasion of brakes and tires (Querol et al., 2012, World Health Organization, 2013). The negative impact of air pollution on the health of the population has been widely documented (WHO, 2013): the presence in the air of particles in suspension (PM), ozone (O₃) and nitrogen dioxide (NO₂) is associated with numerous health risks, mainly respiratory and cardiovascular diseases (Kampa and Castanas, 2008). All this entails a considerable number of premature deaths, as well as a considerable economic cost.

The management of air pollution poses significant challenges for cities across Europe, from the implementation of environmental monitoring programs, to the design and implementation of policies and interventions to minimize the impacts of contaminants on the health of the population (Krzyzanowski et al., 2005). In the European context, despite the problems of air pollution experienced by most cities, few local governments have introduced substantial and permanent measures (such as congestion charges, traffic calming measures or traffic bans in certain areas of the city) aimed at mitigating the health effects of traffic-related pollution. One of the main obstacles to the introduction of these measures in the urban areas is, as in other countries, the lack of public acceptance, which makes local policy makers reluctant to try new measures (Allen, Gaunt, and Rye, 2006; Eliasson and Jonsson, 2011; Schade and Schlag, 2003).

Research into the field of public acceptance of interventions to reduce air pollution shows the difficulty of reconciling the search for public acceptance with the effectiveness of the measures. The most accepted policies, such as those aimed at improving public transport (Nilsson and Küller, 2000, Schade, Jens and Schlag, 2000), are generally insufficient to reduce air pollution, compared to the regulatory or economic measures (Thorpe, Hills, and Jaensirisak, 2000). At the same time, certain coercive measures may be necessary because of their effectiveness, but they are difficult to implement because of the potential public opposition and the political difficulty of putting them into practice (Gärling and Schuitema, 2007, Steg and Schuitema, 2007).

A conclusion of the studies carried out on public attitudes towards mitigation and travel management measures is that the acceptance of these measures varies significantly between individuals, profiles of individuals and sociopolitical contexts. The same measure can generate a positive reaction in one city and be rejected in another, as shown by the different public reaction to the congestion rate in Edinburgh and Stockholm (Beck, Rose, and Hensher, 2013). The levels of acceptance of air pollution reduction measures can vary even among cities within the same country (Zheng et al.,

2014). Public acceptance also varies according to factors related to the individual, such as sociodemographic characteristics, the degree of familiarity and knowledge that the individual has about the measures, the perception of benefits and risks associated with the measure, the political and environmental attitudes, the beliefs about the severity of the problem of congestion and pollution in the city, etc. (Eriksson, Garvill and Nordlund , 2008; Jagers, Matti and Nilsson , 2017).

Although public rejection of certain interventions may be unavoidable (Gärling and Schuitema , 2007), fostering acceptance among different audiences is a fundamental responsibility of local administrations in a democratic society. In the context of the congestion charge in Edinburgh, for instance, bus users, a priori the main beneficiaries of the introduction of the tax, barely voted in the referendum and when they did, they largely rejected its implementation (Allen et al. , 2006). This was due, in part, to the lack of effort by the local administration to communicate on the benefits of the measure to bus users (Allen et al., 2006). In addition to normative and democratic considerations, the absence of public acceptance of a political measure to reduce urban traffic can have practical consequences, such as reducing the effectiveness of this measure. As suggested by Jia et al. (2016), the public rejection of the prohibition to circulate according to the license plates can generate that the individuals do not reduce the use of the car in the expected degree. Public rejection can also force changes in the measures implemented, as in the case of the congestion rate introduced in Lyon, where public rejection forced changes in the implementation of the rate (Raux and Souche, 2004).

Overview of the literature on public attitudes towards policy measures for reducing urban air pollution and traffic congestion

Most of the research into the public acceptance of interventions for the reduction of urban air pollution has focused on congestion charges (urban tolls that tax drivers access to the central area of the city), in the context of the regulation of traffic congestion (Rienstra, Rietveld, and Verhoef, 1999). Some examples of early studies are those of Jones (1992) or Schlag and Teubel (1997). More recent examples of research are those of Eliasson and Jonsson, 2011; Jagers et al., 2017; Nilsson et al., 2016. The investigation on public acceptance of measures to pacify traffic is more limited. Although several studies have evaluated the social impact, especially the perception of safety, after the implementation of traffic calming measures (see McAdam, 2015 for a review), there are very few studies on the public acceptance of measures such as reducing the traffic speed in the city, the increase of lanes for bicycle use or the creation of pedestrian zones.

Public acceptance can be defined as the expression of support, agreement or as the favorable reaction of members of the general public towards a proposed or existing measure. A distinction that is often made in some studies is between acceptability, the prospective judgment about measures that are going to be introduced in the future, and acceptance, as the attitude of individuals, including their behavioral reactions, towards the intervention after the introduction of the measure.

In general, studies of public acceptance have had two fundamental objectives. First, to describe the levels of public acceptance of specific pollution mitigation measures (e.g. traffic demand management measures) while comparing levels of acceptance between different interventions (e.g. measures to increase the public transport versus congestion charges). Secondly, the research has sought to determine the personal, attitudinal and contextual factors that influence the acceptance of specific measures.

Below, we review some of the fundamental studies on public acceptance of pollution reduction measures. Special attention is given to research on the determinants of acceptance.

Levels of acceptance of different policy measures

A first set of studies are those aimed at comparing the levels of public acceptance of different interventions. Bartley (1995), for example, compares, based on a survey in several European cities, the acceptance of four measures to reduce pollution: improving public transport, restricting driving possibilities, parking policies and congestion rates. The results show that improving public transport and restricting traffic are the most accepted measures, while parking policies and the congestion rate are considered, on average, as not acceptable.

Schlag and Schade (2000) find similar results in six cities under study. In almost all cities analyzed, improved public transport systems overflow parking or park & ride and restricting access are measures with higher levels of acceptance, while congestion charges are the lowest levels of public support. Rienstra et al. (1999) analyze the level of public support for different measures related to safety, environmental impact and congestion in transport. The results show that the level of public support is greater for security measures and lower for congestion charges. Again, the introduction of transport alternatives receives a high degree of support, while the measures that set prices for access are less accepted.

Factors associated with acceptance

Much of the research in the public acceptance of measures to reduce pollution and urban traffic have been aimed at investigating the influential factors in the acceptance of measures to manage traffic demand (TDM, traffic demand management). The different factors influencing the acceptance analyzed can be classified into: a) attributes of the reduction measure; b) familiarity; c) sociodemographic aspects; d) perception of the problem; e) beliefs about the measure and its implementation; f) previous orientations and related beliefs; g) identity and political ideology; h) other factors.

Attributes of the reduction measure

According to Steg and Schuitema (2007), the attributes of the political measure are important in the acceptance. As we have seen, research in this field indicates that policies aimed at improving public transport are accepted to a greater extent than regulatory or economic measures (Nilsson and Küller, 2000, Schlag, 2000). Studies seem to show that non-coercive measures (pull measures) are considered more acceptable

by the public in comparison with coercive measures (push measures), possibly because the latter reduce personal freedom. The public also tends to assume that coercive measures are ineffective, unfair and unacceptable (Rienstra et al., 1999, Steg and Vlek, 1997), while non-coercive measures are generally perceived as effective, fair and acceptable (Eriksson et al., 2006; Joireman et al., 2001; Rienstra et al., 1999).

Studies such as that of Steg and Schuitema (2007) have reviewed the specific characteristics of economic policies and their influence on public acceptance. Specifically, the authors mention three characteristics that may influence acceptance: a) the level of changes in prices; b) the degree to which the changes in the price are differentiated, by time, place, types of users, etc.; and c) the way in which the income derived from the rate is distributed. These three characteristics would influence the degree of acceptance of a measure of a congestion charge. There is little research on the specific characteristics of other pollution reduction measures and their impact on acceptance.

Familiarity

An extended hypothesis in public acceptance research of traffic management measures is that public familiarity with the measures leads to greater acceptability (Jones, 2003, Eliasson and Jonsson 2011). That is, the levels of acceptance increase once the measure has been established and citizens have become familiar with it. The empirical evidence in different cities seems to confirm the hypothesis of familiarity; as shown by the studies by Tretvik (2003) in Norway, by Schade and Baum (2007) in London, by Winslott-Hiselius et al. (2009) and Brundell-Freij and Jonsson (2009) in Stockholm or Jagers et al. (2017) in Gothenburg. There are several reasons why public acceptance increases when individuals become familiar with a measure to reduce air pollution (Eliasson and Jonsson, 2011). In the first place, it may happen that the positive effects of the measure (e.g. congestion rate) are greater than expected by the public. Second, that the measure produces less negative impacts on the individual behaviors initially envisaged by the individuals. In both cases, the hypothesis is that familiarity would produce a change in the beliefs of individuals about the measure, so that its effects are perceived as more positive. Other studies, such as Börjesson, Eliasson and Hamilton (2016), however, conclude that the fundamental reason for the change in attitude after the implementation of a measure is the *status quo bias*, by which individuals accept the inevitable, rather than the changes in perception, that is, in the beliefs and attitudes of individuals about the measure.

But there is evidence that the familiarity hypothesis does not occur in all contexts and that the post-acceptance of a measure such as the congestion charge is not always greater than its pre-acceptability. A study in Copenhagen, for example, found no difference between pre-acceptability and post-acceptance of a toll (Gehlert and Nielsen, 2007). In Lyon, the authorities had to modify the applied rates and reduce the area affected by the rate due to opposition from residents once the measure was introduced (Raux and Souche, 2004). As Jia et al. (2016) suggest, the post-acceptance of

traffic management measures depends on different factors and familiarity with the measure does not always guarantee its acceptance.

Sociodemographic aspects

Acceptance levels vary, also, depending on various sociodemographic variables such as sex, age, income, the fact of owning or not own car and the usual mode of transport. The study by Schade and Schlag (2003), for example, found that from different sociodemographic variables analyzed, only socioeconomic status was weakly associated with the acceptance of pricing strategies for car use in the city. Allen et al. (2006), for example, in the context of the referendum on the introduction of a congestion charge in Edinburgh, found that residents who owned a car mostly rejected the measure. Contrary to expectations, the authors found that bus users also opposed, to a large extent, the introduction of the congestion charge.

The dependence on the use of the car is one of the variables most associated with the acceptance of congestion rates. Eliasson and Jonsson (2011), for example, observe a level of support for the congestion rate of 78% among those who do not have a car compared to 56% among those who own their own car. In addition, the level of support is reduced to 46% among those who use the car frequently, compared to 76% among those who use it occasionally or never.

Eliasson and Jonsson (2011), in their analysis of attitudes and levels of public acceptance of the congestion charge in Stockholm, conclude that the educational level and sex of the individual are associated with acceptance, but in a weak way. Women seem to accept to a lesser extent the congestion rate, as well as the residents of the center, compared to the residents in the outer neighborhoods. For most sociodemographic variables, according to the authors, the effect on acceptance disappears when controlling variables such as car dependence or attitudes towards the environment.

More recent studies like that of Börjesson et al. (2016) find a significant effect of education, income and gender in acceptance, being the people with higher educational level, with higher income and males who report a higher level of support for the measure. Harsman and Quigley (2010) also find that individuals living in the center of the city of Stockholm favored the imposition of a congestion charge to a greater extent.

Perception of the problem

Another factor associated with the public acceptance of measures to reduce pollution is the perception of the seriousness of the problem of traffic congestion and air pollution. The hypothesis is that considering that there are serious problems of traffic and pollution is a necessary precondition to accept a measure to reduce pollution (Steg and Vlek, 1997). However, the evidence on the relationship between the perception of the problem and acceptance is inconsistent (Schade and Schlag, 2003). While some studies have found a relationship between the perception of the problem and acceptance

(Rienstra et al., 1999; Jia et al., 2016), other studies show that, on some occasions, individuals who perceive traffic congestion as a serious problem reject the congestion charge to a greater extent than individuals who perceive a pollution problem primarily (Schade, 1999). Therefore, it seems necessary to distinguish between the perception of problems related to traffic, such as traffic jams, and the perception of problems related to the environment, such as air pollution.

Another interesting idea is the distinction between the perception of traffic as a personal problem or as a social problem. Some studies (Rienstra et al., 1999) show that, as in other areas, the evaluation of a situation as a social problem, and not so much the degree of personal involvement by the problem, leads to greater support for measures to solve that problem.

Beliefs about the impacts of the measure

The attitude towards a measure of air pollution reduction is constituted by a set of beliefs, evaluative judgments and associated affect. Research in public acceptance shows that various beliefs related to the perception of effectiveness of the measure, the perception of costs and benefits of the measure, the expected consequences or the perception of the way in which the measure has been implemented have a fundamental role in the configuration of the attitude.

The perception of benefits and costs associated with a measure to reduce pollution and, especially, the perception of effectiveness of the measure, is considered one of the main determinants of attitude (Eliasson and Jonsson, 2011). The belief that a measure can have personal or social benefits as well as the experience of the benefits of a measure can cause a more positive attitude towards it (Eliasson and Jonsson, 2011, Rienstra et al., 1999). However, there may be also a connection in the other direction: those individuals with a positive initial attitude toward the measure are more likely to believe that the measure has more benefits. The relationship between beliefs about the effects of a measure and the evaluation of it is likely to be, rather, bidirectional.

The benefits and costs associated with a measure to reduce pollution are diverse. The perception of them differs between some individuals and others. Eliasson and Jonsson (2011), for example, distinguish between the perception of personal effects, related to the daily life of the individual, such as the effects on personal freedom, cost, ease of transportation, security, etc. and perception of systemic or social effects, that is, on the whole of society, such as improving environmental quality or improving traffic. From a survey study on acceptance and attitudes towards a congestion rate in Stockholm, the authors conclude that the perception of both types of effects is associated with acceptability.

Loukopoulos et al. (2005), for example, in a study on public attitudes towards various policy measures to reduce car use in Sweden, examined the public beliefs about the consequences in three areas: the quality of the environment, accessibility by car and transport public and travel costs. The results of the study show that beliefs about the

consequences of the introduction of a measure allow explaining an important part of the variation in the attitude towards the measure.

Perceptions and expectations about the effects of a measure are also associated to behavioural intentions. In a study on the public acceptance of the Edinburgh congestion charge, Allen et al. (2006) show that expectations about the benefits of the measure, in particular, expectations about the potential to reduce traffic congestion in the city and to improve public transportation were significantly associated with voting for or against the implementation of the measure. Those individuals who reported more positive expectations about the consequences of the measure voted to a greater extent in favor of the measure. Likewise, those individuals who had mistaken beliefs about the details of the charge, such as the price and frequency of the rate, voted to a greater extent against the rate.

Schade and Schlag (2003) also found that the perception that a measure has negative impacts for people with low incomes, which is an unfair measure or that limits personal freedom, is usually associated with lower acceptability.

Perception of how the measure has been implemented

The effect of beliefs associated with the legitimacy of a policy measure to reduce pollution has been investigated in different studies. Jakobsson, Fujii, and Gärling (2000), for example, show that the acceptance of a measure to introduce prices for car use is determined, in large part, by the perceptions about whether the price increase is fair or unfair, as well as by the beliefs about whether the charge infringes personal freedom or not. Along with the self-interest, that is, the fact of being personally affected by the measure, both perceptions, on the justice of the charge and its effects on freedom, were decisive in the acceptance of the measure.

In a recent study, Jagers et al. (2017) examine the role of various types of beliefs in the pre and post implementation of a congestion rate in the city of Gothenburg. Specifically, the authors examine the effect of beliefs on the degree to which the measure reduces personal freedom, the perception of justice of the measure, confidence in the political system and the legitimacy of the implementation process. Of all the beliefs analyzed, the perception of justice was the variable most associated with acceptance, so that those individuals who considered the measure to be fairer tended to accept the measure to a greater extent. The perception of the legitimacy of the process and the perception of effects on personal freedom were also significantly associated with acceptance.

Orientations and previous beliefs

The attitude towards a measure to reduce air pollution is also influenced by a set of previous orientations and beliefs of individuals and not only by their preferences and their perception of costs and benefits of the measure. The attitude towards a mitigation measure is based, in general, on a limited experience, so it tends to be less stable and, therefore, more influenced by associations with other attitudinal aspects (Eliasson ,

2014). In particular, research on public acceptance seems to show that the acceptance of a mitigation measure is also influenced by issues such as the environmental attitudes of individuals, their general attitude towards taxes or their wider personal norms.

Eliasson and Jonsson (2011), for example, conclude that attitudes towards the environment are, together with beliefs about the effectiveness of the measure, one of the factors most associated with the acceptance of a rate to reduce traffic congestion. Based on a survey with residents in the city of Stockholm, the study shows how attitudes towards the environment are strongly correlated with support for the congestion rate, so that those individuals most concerned about the quality of the environment report support stronger to the measure.

Similar results were found by Eriksson et al. (2008) in a study of public acceptance of different traffic management measures in Sweden. A pro-environmental orientation was associated with the perception of the seriousness of the problem of urban pollution, the perception that the measure is effective and fair and, consequently, its acceptability. The study by Eriksson et al. (2008) also shows a significant relationship between personal norms to reduce the negative environmental effects of car use and the acceptance of different measures to reduce the use of the car.

Attitudes toward interventions to reduce air pollution may also be associated with attitudes towards public interventions in general, such as attitudes towards taxes or beliefs about the ability of public administration to distribute scarce resources fairly. As shown by Hamilton et al. (2014), negative attitudes towards taxes are associated with negative attitudes toward congestion charges.

Identity and political ideology

The role of political identity in public acceptance of pollution reduction measures has received less attention in research. However, it is expected that the support or rejection of a measure, proposed by a specific political party is related to the ideology and the political vote of the individual. Harsman and Quigley (2010), for example, based on data from the referendum in Stockholm to approve the congestion charge, show that political ideology is associated with support and rejection of the congestion charge. Specifically, with data from the electoral districts, the authors find a linear relationship between the percentage of vote to the political party opposed to the measure and opposition to the imposition of the rate. Other studies, such as that of Yusuf, O'Connell and Anuar (2014), however, have not found a significant relationship between political ideology and acceptance of a congestion rate.

Framing effects

The attitude towards measures to reduce urban air pollution may change over time, because the attitudes of individuals to questions about which they have little direct experience or very strong emotions, tend to be unstable (Eliasson, 2014). This can be especially true if the measures (e.g., congestion rates) are reformulated in the public debate, interpreted or "sold" differently. As Börjesson et al. (2016) suggest, a

congestion rate can have a very different general public reception if it is framed as a fiscal policy, as a security issue or as an environmental policy, given that the weight of self-interest and certain prior attitudinal variables can alter the acceptance.

The framing of a measure can also act as a modulating variable in the relationship between environmental beliefs and the acceptability of a measure. If a public intervention is framed as a pro-environmental measure and not as an efficient transport, it is likely that those with pro-environmental values favor the introduction of the measure. The effect of the frame on acceptance can also vary significantly between different individuals and audiences. As studies on political ideology and attitudes toward energy efficiency have shown, political ideology can modulate the effect of certain frames. For example, as the study by Gromet, Kunreuther and Larrick (2013) shows, conservative individuals are less likely to buy a more expensive but more energy efficient bulb if it is labeled with a pro-environmental message that is not labeled with this message. There are few studies on the effect of the frame on the acceptance of the measures, although some authors have underlined its potential importance (Eliasson , 2014, Börjesson et al. , 2016) .

Status quo bias

The preferences and attitudes of individuals towards a political measure to reduce pollution are not static, but tend to change over time, due, among other issues, to familiarity and the bias of the status quo (Börjesson et al., 2016). The *status quo bias* refers to situations in which preferences for a policy are lower before implementation than after its implementation. This may be the result of aversion to loss, cognitive dissonance (the inevitable is accepted) or resistance to change itself, regardless of the losses or gains (Börjesson et al., 2016). Various studies have suggested that the status quo bias is behind the increase in support for congestion charges once they are introduced (Börjesson et al., 2016; Eliasson, 2014) or they seem inevitable (Schade and Baum, 2007). The status quo bias, it is considered, can result in an aversion to innovate in policies against pollution.

In a study on the acceptance of a highway toll, Schade and Baum (2007) show that knowledge of the probability of the introduction of a measure significantly influences the evaluation of this measure. Therefore, when individuals consider that a political measure, such as a congestion charge, is likely to be introduced, their evaluation of this measure is more favorable than when they consider that the measure will not be introduced (because there is a lot of controversy and resistance, because it faces technical problems, etc.). The authors consider that individuals tend to face unavoidable measures, that is, those that do not have decision-making power, improving their evaluation of them with the objective of maintaining a consonant belief system.

Börjesson et al. (2016) conclude that the positive changes experienced in public attitudes after the implementation of the congestion charge in Gothenburg were, largely, the result of the status quo bias and not of a change in the perception of the effects of the measure. According to the authors, individuals simply reject the

introduction of a pollution reduction measure because it implies a change. However, once the policy is in place, the support increases because it is in place.

Conclusion

Research on public attitudes and acceptance of policy measures to reduce urban air pollution has investigated the distribution of public acceptance across time and geographical contexts as well as the factors influencing individuals' judgements about the policies. Research consistently shows that attitudes vary significantly according to the type of the measure, the socio-political context, the level of familiarity with the measure, measure-related specific attitudes and prior attitudes, perceptions of fairness and legitimacy, sociodemographics, problem perception, the framing of the measure, the status quo bias and political ideology.

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