

Analysing the demand for different traffic scenarios in inner cities - A useful tool in local planning?

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Background and methodological considerations

This paper has been produced as part of the research theme “Optimal balance between access by private car and the environment in town and cities”. The background to the project is the increasing use of cars in towns and cities, which has been a major problem for town planners and politicians during the whole post-war period. The increasing use of private cars threatens the safety of other road users, especially pedestrians and cyclists. It is also related to a reduction in the number of people using public transport systems which, as a consequence, forces the operators to raise fares, run fewer routes, reduce frequencies and so on. There is no doubt that the increasing volume of motorised traffic has negative impacts on the environment in towns and cities. Important, but analytically difficult, values such as “beauty, comfort, and safety” are under constant pressure from the space-consuming private car in urban settings. The underlying objective for the entire research project is to investigate if the documented development in this area is in line with the public interest, or if there is an imbalance between the actual outcome and the inhabitants’ preferences.

The central issue concerns the balance between the benefits to an individual of car-access and the public benefit of a good urban environment. There is no functioning market where this balance can be effectively settled because “urban environment” is an example of a public good that can not be purchased in desired quantities on a traditional market. Problems of non-rivalry in consumption and free riders hamper the functioning of the market as an efficient mechanism for allocating scarce resources. The isolated behaviour of an individual, or a household, has a negligible impact on the total outcome, which in turn influences the behaviour in certain directions.

An individual, or a household, may find it very attractive to use the car frequently, due to its advantages in terms of carrying capacity and travelling speed, over walking, cycling or public transport. The private car facilitates transportation over large distances, directly monitored by the individuals own decisions concerning departure times, routes, frequencies and so on. The car facilitates, for instance, the transportation of heavy carrier bags between stores and homes.

However, the efficiency of an individual’s use of the car is dependent on other car-users decisions. The ideal situation, from the point of view of a particular household, can only be reached if everyone else chooses not to use the private car as a means of transportation. The possibility to use the car in an efficient manner, on an individual level, is threatened by increases in the total usage of cars in urban areas. Congested streets, noise and emissions also reduce the general attractiveness of inner cities and residential areas, with negative consequences for

commercial activities such as stores, restaurants, bars, cafés, and for “beauty, comfort, and safety” etc. There is no mechanism a single individual can use to alter the situation in a more favourable direction, due to the absence of functioning markets. The revealed preferences, manifested in the actual car usage, can, at least in principle, result in a situation that is demanded only by a minority of the individuals. This discussion can perhaps be seen as an application of the well-known theorem “the tragedy of the commons”, as far as urban traffic and local environmental consequences are concerned.

In order to prevent major costs occurring due to the possibly presence of market failures, town planning and other policy measures have to work as a proxy for an ideal consumer acting on a well-functioning market. Town planning should, at least ideally, function as an institutional regulation capable of mitigating the problems associated with market failures. Therefore, it is necessary in order to foster right decisions, that the planning measures and policies are based on relevant research and knowledge. The rationale for this study is to contribute new knowledge to this problematic, but nevertheless, important and interesting research field.

This can be achieved in several ways. One alternative can be labelled “social engineering” and involves identification, quantification and evaluation of different environmental factors in an expanded cost-benefit framework, where different methods can be used in the analysis, especially when evaluating. There are, however, major obstacles to be overcome when applying a traditional cost-benefit framework to these research questions. “An attractive inner city” is a very complex commodity with several attributes and qualities, difficult to decompose and value separately, which is necessary when performing cost-benefit calculations. Without rejecting the possibility of using traditional cost-benefit methods entirely, one must accept the severe problems associated with the approach in this particular case.

There is also the political alternative of asking people directly through a referendum, which in a sense would make the research discussed in this paper somewhat superfluous. The actual approach chosen in this project is a survey by means of questionnaires, the purpose of which is to determine the preference structure of individuals regarding different urban designs, with respect to the balance between individual car-access and the public benefits of a decrease in motor traffic.

By allowing individuals to choose between different scenarios “packages” of environmental effects and transport benefits are in focus, thereby, at least in the ideal case, bypassing the decomposition problem following the traditional cost-benefit approach. If this approach is successful it can be used as an alternative to costly referendums and the results can be interpreted in economic terms and give the same information as a traditional cost-benefit calculation. All approaches, following traditional economic theory, must in an analytical sense be founded on the same balance between costs and benefits that would have been reflected in the equilibrium conditions and solutions on an ideally functioning market.

The approach applied in the study is best suited for situations where the same individual confronts both costs and benefits as a result of different level of car access. The actual choice between different scenarios should in this case be the outcome of individuals balancing costs against benefits. This should be the factual situation for households living in residential areas in suburbs, and when the motor traffic in the inner city is in focus. Households living in the inner city can achieve

individual gains from an extensive car access but encounter costs caused by the increase in the total motor traffic volume, in the same manner as the suburban inhabitants in their residential areas. Moreover, the quality of the inner city environment concerns everyone in the actual city, including those who travel to the central business district for shopping, recreation and, of course, work purposes.

The approach adopted here is, however, not suited for analysing the problem of private car traffic in the residential areas located around the inner city. Motor traffic in this part of the city is to a large extent characterised by through traffic to and from the inner city. Therefore, it would be wrong to assume that winners and losers are the same individuals. Contingent Valuation Methods (CVM) and other approaches can be used in order to deal with the problem of evaluation in an analytical economic framework. The essential research problem to tackle is the optimal balance between ordinary traffic benefits “on the road” and environmental costs suffered by the households in the nearby surroundings. Studies using CVM have been carried out as part of the project, but the results will not be discussed in this paper.

The challenge confronting the research methodology is to construct and describe different scenarios correctly and in such way that the individuals answering the questionnaire can absorb and understand all the information given. This is extremely important when focusing on the differences between the various alternatives and the associated trade-off between individual car-access and the public benefits of a decrease in motor traffic.

Data acquisition

The research question is tackled by letting individuals choose among different scenarios concerning the design of inner cities, by means of a questionnaire. These scenarios are presented by using different, but complementary, techniques. Each scenario has a heading. The questionnaire used in the main study describes three different scenarios. Drawings and short paragraphs of one or two sentences illustrate the scenarios. The paragraphs are clustered in different groups. One group of paragraphs describes the main feature of the particular scenario and five groups with the subheadings car, car parking, bus, cycling and walking, respectively. The descriptions of the scenarios do not specify the possible investment costs associated with the transformation of streets, pavements, bicycling lanes etc., in order to achieve the actual traffic situation in each alternative. Many of the differences, however, can be realised by means of regulations with almost no investment costs at all, thereby justifying the attention on the particular economic costs and benefits following different levels of car usage, as discussed above.

By allowing the individuals express their attitudes towards different parts of the scenarios and answer questions concerning their socio-economic background and travelling behaviour, the analysis is further advanced.

The shaping of inner cities

The questionnaire used in the main study describes three different scenarios, or alternatives, with the following headings:

- A. Increase in motor traffic and street space for cars
- B. Lesser space for cars and road pricing
- C. Lower speed limits on smaller streets

The first alternative entails an accommodation of the design of inner cities to a greater use of private cars. Street capacity and parking facilities are expanded to cater for more cars. The amount of pedestrian streets remains at the present level but public transport experiences a falling number of passengers, which will decrease the quality of the supplied services. Bicyclists will find it more difficult to travel safely in increasingly car-adapted surroundings.

The second alternative's major ingredient is a pricing system that imposes a charge on car usage in the inner city. The revenues are used to subsidise bus transport with lower fares as a result. Travelling by car decreases and travelling by public transport increases as a consequence of the system. Some streets and roads are converted to pedestrian streets and bicycle lanes.

The third alternative is a so-called "traffic calming" scenario. ("Traffic calming" will be used throughout the paper as a somewhat imprecise collective term for measures that calm down the motor traffic, including regulations, design of road and streets with narrowing and barriers, broader pavements and cycling lanes etc.) Private car traffic is limited by means of lower speed limits, more pedestrian pavements and bicycle lanes, and special lanes for public transport only. By calming the motor traffic other means of transportation increase their competitive capabilities and gain a larger share of the travellers, at the expense of the private car.



Figure 1 Drawings illustrating the scenario "Lower speed limits on smaller streets"

The following table shows in percentages the alternatives chosen by the interviewees in the survey:

Table 1 *The choice between different scenarios in inner cities, percentages*

Alternative	A	B	C	Blank
Result	16	20	49	14

Almost 70 percent of the individuals in the survey are in favour of more restrictions on private car usage, which will have positive consequences for walking, cycling, and travelling by public transport in the inner city. Around one fifth of those surveyed prefer the road pricing alternative, but nearly 50 percent of the individuals prefer reaching the targeted balance by imposing speed limits and other regulations, and by redesigning streets in the described way. Traffic calming should therefore be an easier alternative for local policy makers to choose than a strategy involving reducing private car usage by road pricing. The acceptance problem connected with pricing road and street capacity is well documented in the literature. Alternative C is the most popular choice among almost all categories of individuals in the research material. It is interesting to note that even among frequent car users, alternative C clearly stands out as the most popular scenario. This is not surprising considering the percentage in table 1 and the fact that a majority of households in developed western economies own one or more private cars.

There is, however, one group of individuals that prefer a continued accommodation of the inner city to a greater usage of cars, by increasing street capacity, parking facilities, regulation in favour of private cars etc. Car access is of course a very important characteristic of inner city quality for these individuals. The results suggest that around 15 percent of the population in Swedish cities embrace this preference regarding the design of inner cities. It can also be shown that a vast majority of these individuals do not live in the inner city.

Despite the fact that the alternative C is consistently the most favoured alternative, different explanatory factors can be used in order to focus on some crucial differences concerning the choice between the design alternatives. Factors such as gender, car ownership and/or car access, car usage, type and location of housing and travelling behaviour in general seem to influence the choice.

The following table displays, as an example, how the preferences expressed by men and women differ.

Table 2 *Choice of scenarios, differences between women and men, percentage shares*

Alternative	Women	Men
A	6	27
B	22	17
C	59	40
Blank	13	15
Sum	100	100

The largest relative difference concerns alternative A, popular among men, and alternative C, popular among women. Although there are differences between men and women, alternative C is clearly the most favourable scenario for both sexes. Similar patterns can be found when analysing the impact of other types of explanatory variables such as car access, type of housing and travelling behaviour.

Adjusting to local conditions in actual cities

The questionnaire discussed above can also be adjusted to more local conditions in cities. The initiatives for a more integrated town- and traffic planning such as Local Transport Plans in Great Britain and Plans de Déplacements Urbains in France, strongly emphasize the necessity of strategic visions for the development of cities and transport systems in general. It is of fundamental importance that these visions are based on the will of the public opinion. However, following the discussion above, it is not an easy task to formulate visions and, especially, let the inhabitants choose among different scenarios concerning the future development of the city and its transport system.

One possible way of accomplish this task is to use modified versions of the questionnaire presented above and perform similar investigations in the city in question. Conducting such studies give the local authorities the opportunity to link the general planning process and other planning measures to the demand, i.e. the will of the inhabitants. The approach developed in the research discussed in this paper present a relatively cost-effective method to supply the local authorities with information and knowledge about the state of the opinion and the relevant preference structures among the inhabitants. Traditional planning exhibitions and local debates in media often suffer from systematic biases from a statistical point of view, due to the majority's unpleasant habit to remain quiet. Modified versions of the questionnaires have been used by the Swedish middle-sized city of Sundsvall, supporting the work with new and more integrated master plans, with similar results as discussed in the previous section. (Svensson and Haraldsson, 2002)

General conclusions

The results of the study clearly show that, within the boundaries of the applied methodology, a majority of the individuals prefer scenarios where all kinds of road-users relatively safely coexist on streets and roads in towns and cities, and where this condition has been reached by traffic calming measures. Compared to the present situation in many Swedish towns and cities, this means a rather large reduction in car-traffic and parking in inner cities with corresponding improvements in safety and assigned capacity for pedestrians and cyclists. The results clearly indicate the importance of performing research in this field of inquiry. In general there is a strong tendency towards a preference for a mixed traffic situation, distinguished by the absence of a dominating means of transportation. The majority stresses the importance of guaranteeing the safety and comfort of pedestrians and bicyclists. The results show that traffic-calming measures have a great potential to limit car traffic in urban areas while road pricing and prohibitions will meet with greater resistance among public opinion, with consequences for the feasibility for the authorities to initiate different policies at local level.

One conclusion from the research so far that has to be investigated in future research is the relative unpopularity of road pricing compared to traffic calming measures, which in practice will have identical impacts on car usage in towns and cities overall. Road pricing is currently seen as the main solution to the congestion dilemma that plagues car crowded cities. The theory of optimal pricing of street capacity is well developed and founded on conventional, but controversial when it comes to practical applications, economic price theory. By pricing relevant externalities, such as congestion imposed on fellow road users, an effective allocation of scarce resources, e.g. street capacity, is facilitated. If these measures can be used in practice without unreasonable high costs for charging and monitoring, there seems to be much to gain by pricing road capacity in towns and cities.

Traffic calming, on the other hand, can be seen as a bundle of administrative, or even bureaucratic, policies associated with high investment costs necessary to alter the design of streets and roads. Furthermore, it seems impossible to achieve the same degree of precision and economic efficiency with traffic calming as compared with road pricing. Following this line of argument traffic calming can be labelled as a measure belonging to a command economy ideology, with its well-known inefficiencies, and road pricing its corollary: a decentralised market solution to the dilemma of congestion etc.

However, this line of argumentation may be over simplified. There are still many problems to solve before road-pricing systems can be widely used at a reasonable cost. Translating theoretically based recommendations and principles to applicable and practically working road pricing systems is still problematic and expensive. The investment costs required before any pricing system can be implemented is considerable and some technological problems have yet to be solved. But the acceptance and legitimisation problems seem to be the real stumbling blocks. With traffic calming, on the other hand, it is possible to combine reductions in traffic by private cars with considerable improvements for other users of the streets, such as pedestrians and bicyclists, with identical measures. Compared with road pricing, the combined effect of traffic calming has greater potential of producing a larger number of positive consequences for the urban environment. Furthermore, the potential to create improvements in “beauty, safety and comfort” with traffic calming measures is considerable, which is enhanced by the fact that traffic calming can avoid the acceptance problem more successfully than road pricing, as is indicated from the results in the study. It should be remembered that speed limits, pedestrian streets, bicycle lanes, driving lanes for public transport only etc., are common features in many towns and cities.

The tendency to view road pricing and traffic calming measures as diametrically opposed ideas can be questioned, following traditional reasoning in transport economics. Both road pricing and traffic calming measure entail a rise in the generalised cost imposed on the traffic by cars; road pricing by monetary payments and traffic calming by increases in travelling time, i.e. costs elements that can be treated identically in an analytical framework.

To sum up the discussion so far it is clear that further research is needed with the purpose of investigating and analysing the relevant preference structure concerning the balance between the benefits to an individual offered by unlimited car-access and the related consequences of the overall traffic by private cars. It can also be stated that both theoretical and applied research have to be carried out in order to integrate road pricing schemes and traffic calming measures, which

hopefully can contribute to more alternatives for local town planning and policy and, accordingly, a better urban environment. It can also be stated that we now possesses methodologies which can be used to gain knowledge about the demand for different designs of the transport system in cities. There is no reason anymore for local authorities to be in a severe state of uncertainty in this line of investigation.

Publications from the research theme:

Grudemo, S. (2000) *CVM-studie av minskad trafik på Trelleborgsvägen i Malmö*. Statens väg- och transportforskningsinstitut. VTI notat 31-2000.

Grudemo, S och T. Svensson. (2000) *Balans i avvägningen mellan biltillgänglighet och god miljö. Slutrapport*. Statens väg- och transportforskningsinstitut. VTI rapport 455.

Gustavsson, E. et al. (1995) *Avvägning mellan individuell nytta av biltillgänglighet och kollektiv nytta av biltrafikbegränsningar- en pilotstudie*. VTI notat 8-1995. Statens väg- och transportforskningsinstitut.(Pilot study)

Gustavsson, E. (2000) *God biltillgänglighet eller god miljö i centrum?* Statens väg- och transportforskningsinstitut. VTI meddelande 894.

Haraldsson, M. and T. Svensson (2001), *Car Accessibility in Inner Cities and Residential Areas- Discrete Choice analysis of Stated Preference Data*, sid.479-488 i "Trafikdage Aalborg Universitet 2001, Konferencerapport 2", Aalborg 2001.

Svensson, T. (2000), *Balancing car accessibility and good urban environment*, pp. 99-110 in "Discovering Local Transport Plans and Road Traffic Reduction- Proceedings of Seminar C held at the European Transport Conference, Homerton College, Cambridge, 11-13 September 2000. Volume P438. London 2000.

Svensson, T. (2000) *Biltillgänglighet och bilbegränsningar i innerstäder och bostadsområden*. Statens väg- och transportforskningsinstitut. VTI meddelande 893. 2000.

Svensson, T. (2000), *Achieving a balance between car accessibility and good urban environment*, sid. 689-700 i "Trafikdage på Aalborg Universitet 2000, Konferencerapport Bind 2", Aalborg 2000

Svensson, T. och M. Haraldsson (2002), *Invånarna i Sundsvall och trafiken i innerstaden – Resultat från en enkätundersökning*, VTI notat 20-2002, Statens väg- och transportforskningsinstitut.