

# Equity issues and public transport fares: a broad-brush theoretical analysis

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## Introduction

Local public transport represents a public policy or a public service (both if provided directly by state-owned companies and private-owned companies) where usually cost recovering is shared between the users (but free public transport could be provided) and the state, thanks to the presence of subsidies (but subsidy could be eliminated at all). Due to this reason, it is not possible to provide an equity analysis of public transport fare structure if the twin dimension of subsidization is neglected. As a consequence, the discussion in the present work starts from both the fare dimension and the subsidy dimension, also considering the existing trade – offs.

The definition of a fare structure for the use of some kinds of goods is often defined only considering efficiency issues, and neglecting the related distributive issues. In fact, it is always possible to define a (or some) social group(s) who win(s) thanks to the introduction of a certain scheme, a (or some) social group(s) who lose(s) after the introduction of the same scheme and a (or some) social group(s) who is neutral. At the same time, distributive effects have a territorial dimension, mainly in term of increase or reduction of urban sprawl, but also in terms of better or worst accessibility. So, the analysis of distributive effects is a relevant and not negligible aspect in a dynamic process of definition of every kind of public policy.

The present work is mainly aimed to the discussion of the distributive effects of different public transport fare structures. The dimension of equity is then central, while the dimension of (productive) efficiency is here largely neglected, providing only the necessary reminders to a full discussion. Under this approach, the paper is not interested in cost recovering issues and in the definition of an efficient level of costs; the dimension of the productive efficiency will be discussed as a background, strictly necessary only under first step considerations. In other words, it is possible to say that a traditional utilitarianistic approach is here abandoned.

Nevertheless, it is necessary to remember how, in general, public transport fares schemes are introduced according to efficiency and cost recovering aims; by time, they are often modified in order to satisfy different political (short run) aims, assuming a not-controlled “shape” (no longer consistent whit the original aims), losing, this way, their original function. So, the original efficiency background can be eliminated trough a political decision: the (productive) efficiency question can be solved trough different techniques (for example, economic regulation)<sup>1</sup>. There are no reason, in fact, not to consider possible fare schemes only designed under distributive issues (as it could happen for services provided as universal service). The limit condition is, obviously, a free transport system for all or some groups of users, although negative fares (i.e.: subsidies to users) could be discussed.

This work is mainly aimed to a discussion of the urban public transport sector, but when possible some references to other relevant public expenditure sector will be introduced, in particular in terms of possible parallelism, starting from policy analysis issues. In fact, some policy analysis-based analytical categories can be usefully introduced for a discussion of public transport fares, underlining how some results can be reached both starting from sectorial policies than starting from general welfare policies (in particular, discussing of selected social groups)<sup>2</sup>.

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<sup>1</sup> Note how efficiency issues are also directly linked to the sources for grants; in fact, under a derived finance scheme with earmarked transfers (as it is for public transport subsidies), an improve in efficiency means a reduction in transfers of grants (which cost is not supported by the receiver), that is, in general, a reduction of the total transfer from upper administrative levels.

<sup>2</sup> In particular, it is possible to argue how specific welfare aims for some social groups can be reached through sectorial policies, general policies or combinations of both.

Distributive effects are here discussed in terms of horizontal equity, vertical equity and territorial equity, showing the effects of different fare structures. More in detail, paragraph one provides the literature review; paragraph two discusses some hypothesis of the analysis and some related critical questions; paragraph three introduces some definitions of equity and shortly discusses them. At the end, paragraph four provides some theoretical results, preparing the field for some policy recommendations.

## Literature review

Equity issues of public transport fares are not a common topic in the economic research. Whilst during the last years several studies have been carried out about distributive issues of road pricing, the situation is completely different for public transport fares. Although several authors introduce equity analysis, they are often a secondary point in efficiency analysis. Moreover, the few equity based analysis, as, for example, Bristow's work (Bristow, 1990) are developed focusing mainly on income distribution.

A few works approach these issues starting from philosophical and political theories: Trinder, Hay, Dignan, Else and Skorupsky firstly identify some concepts for a equity analysis deriving them from the relevant literature, secondly relate concepts to the transport sector (Trinder et al, 1991); their work is more an exception than a new field, as it does not generate a relevant scientific debate. It is so necessary to refer to general works in economics and philosophy to introduce a non-utilitarianism based point of view of the topic.

Some arguments about equity classifications can be found in Litman (Litman, 2004) and in the PATS project deliverables 4 (PATS, 2000), that partially replace Litman's approach. In particular, on one side, Litman introduce the main categories of horizontal and vertical equity (split in two sub categories), providing transport-oriented definitions; on the other side, PATS deliverable 4 introduce the third category of territorial equity<sup>3</sup>. Litman also provide a short application showing the effects of transport subsidies on different social groups (driver, non-driver, all residents, with differentiations based on income), even if his analysis seems to be more private-transport oriented<sup>4</sup>. Litman's conclusions confirm the results of previous studies, as equity effects can be progressive with regards to income and they are largely dependent on revenue distribution.

The definition of different social groups is a question not completely discussed in the existing literature. In particular, excluding the introduced Litman's work, there are no studies aimed to a full definition of social groups for equity analysis.

Relations between public transport fare structure and equity represent a quite unknown research fields. Some introductory works can be dated to 1970s and 1980s. Gutknecht (Gutknecht, 1974) carries out a description of different fare structures, with an analysis of several alternatives, including free transport and the empirical results of some applications of this policy. In the same year, Harrison and Douglas discuss the distribution of benefits resulting from different fares policies, providing the first overview of the phenomena, under a narrative approach (Harrison & Douglas, 1974). Cervero (Cervero, 1981) discusses several alternative pricing strategies in terms of efficiency and equity, under a narrative and empirical approach, referring to Californian case studies. As result of his analysis, Cervero assumes an interesting sceptical position about redistributive issues, suggesting eliminating all the distributive issues from public transport fares, charging services at marginal cost. If income distribution has to be reached this way, according to Cervero, distance-based fares seems to offer equity benefits. As short final point, discussing about the success of fare structure reforms, Cervero links fare structure and lobbies (considering also employers in transport firm as a relevant group), showing how there are relevant distortion due to lobbying activities. The discussion about fare structure is completed by some papers about travelcards: White (White, 1981) introduces the new research field, that will be carried on both under a theoretical way by Doxey (Doxey, 1984) and by Carbajo (Carbajo, 1988), and under an empirical point of view through several case – study papers.

Evans (Evans, 1985) and Gwilliam (Gwilliam, 1987) first introduce the question of the territorial allocation of subsidies-earmarked funds between different territorial areas, when they are collected at the national level. According to Evans, transport needs assessment should be based on unequal level of services because the level of services is usually different if rural and urban areas are compared.

Crampton (Crampton, 1984) discusses the question of the appropriate level of subsidy to urban public transport. His argument is relevant in order to achieve some distributional issues (distribution of income), as potentially useful against subsidy on radial lines. Under a narrative approach, and referring to the use of conventional cost – benefit analysis to evaluate subsidy policies, he shows some not previously debated distributional issues. In particular, he analyses the impact of public transport subsidies on the urban employment structure. Crampton's argument assumes commercial and retailing activity to dominate the central business district in most cities; so, in these cities, the radial urban public transport network is primarily oriented towards 'delivering' the retailing and commercial labour force to areas where car parking is difficult<sup>5</sup>. Manufacturing areas, in contrast, whether they

<sup>3</sup> A critical discussion of these categories is provided in this paper.

<sup>4</sup> In particular, because of the choice of social groups.

<sup>5</sup> As addendum to Crampton's analysis, not how: the car parking cost dimension of the problem is more complex, as it implies the willingness to pay function; car parking could also be forbidden as political choice.

are on the more traditional fringe of central zones, or in more recent suburbanized industrial concentrations, will generally consist of lower-density employment, will be somewhat less amenable to public transport service, and will be more likely to provide car parking for employees. If such generalization can be accepted, the major commercial/retailing employers in the central business district are expected to be the major net beneficiaries of rate-financed public transport subsidies (apart from the users themselves of course); some of the benefit is got in terms of a more accessible labour force. Opposite, car-commuters themselves and the major employers of car-commuters are expected to be the principal net losers, as they receive less of the benefit. On the same mainstream, and under the same land use hypothesis, Ponti (Ponti, 2002) links car-commuters and public transport-commuters to income levels, showing some perverse distributive effects.

## Some hypothesis

To get a more defined theoretical and practical dimension for the work, some working hypotheses need to be introduced. The following hypotheses are aimed to simplify the analysis, limiting the temporal horizon to the short run only. Obviously, a second-step analysis should remove or should make less strict the hypothesis, in order to consider long-run effects. Moreover, note how although the following hypotheses allow simplifying the analysis, they seem to be realistic, as many public administrations are not able (or allowed) to modify, in the short run, the amount of the expenditure in public transport subsidies (due both to the earmarking of central state transfers and to the political needs of satisfying also other lobbies' aims). A short-run-only analysis represents a strong limit to the general validity of the work, but it seems to be acceptable at least according to a public choice approach, where short-run effects are relevant in order to satisfy politician's egoistic aims<sup>6</sup>.

In particular, the analysis is built under the main hypothesis that the total available amount for public expenditure in public transport subsidy is given and fixed<sup>7</sup>; so, it discusses how to reach equitable distributions (according to some definitions) of this total amount, working on the fare structure. Obviously, the definition of a different fare structure can lead to changes in fare box revenues, with the need of a change in the total amount of subsidy<sup>8</sup>. But the decision about how much to subsidize has impact also on other areas of public expenditure (if there is a constraint to the total public expenditure), giving consequences on other public policies in terms of available funds and, more in general, in terms of equity<sup>9</sup>. As a consequence, as corollary of the introduced hypothesis, the new fare structure has to generate at least the same fare – box revenue than the previous one. Similarly, the problem of the allocation of extra amount of subsidy for some reasons available is neglected. In synthesis, the analysis carried out in the paper recognizes that the decision on how much to subsidize public transport has impacts for other areas of public expenditure, but it concerns only how best, in equity terms, to use public transport subsidy once the quantitative subsidy decision has been taken.

If present analysis considers the total amount of subsidies a given constraint, similarly, as second hypothesis, provided service is considered as given and not modifiable. In other words, as fare box revenues and given subsidy are supposed to cover all the operative cost (average cost or marginal cost<sup>10</sup>) there are no possibilities to modify the service and the network if changes should lead to operative costs and required total subsidy increases. Obviously, as single fare amount is a continuous variable, infinite fare structures are possible also in a scenario where the subsidy-constraint is given.

It is quite interesting to note how extra fare-box revenues, due to a new fare structure, could generate extra-resources for improvements of services, if not used to reduce the total amount of subsidy. Both the choices of providing extra services and the choice to reduce the subsidy can generate equity problems. On one side, these

<sup>6</sup> The paragraph could suggest the reader a politicians' aims oriented focus of the analysis. Opposite, politicians' aims are only one of the possible involved dimensions, and a possible not-irrelevant result is the possibility to compare the real policy with the promised policy (according to their definition of equity).

<sup>7</sup> The total amount of subsidy can be considered fixed at the local level, at the national level or at both the levels, with different consequences in terms of funds available and distributive issues. In the present paper, total subsidies for an area are considered as fixed, neglecting the funds origin.

<sup>8</sup> This is a strong hypothesis that is necessary to avoid an uncontrollable explosion of the dimensions involved in the analysis. In fact, if public expenditure trade – offs between different sectors are taken in account, the conceptual model (see the following paragraphs) of the analysis should consider all these sectors, at least, as a not isolated external world, leading to an intra-sector and inter-sector equity analysis. As a consequence, the analysis could be developed, in a second stage, to consider the effects of variations in the total amount of subsidies but note how this has the same meaning of a long run evaluation of public transport subsidization policies versus other sector policies.

<sup>9</sup> If the total amount of public funds changes, new equity analysis in these sectors must be carried out in order to define how to reach new equitable use of the public expenditure.

<sup>10</sup> The introduction of fare levels aimed to cover the average cost or the marginal cost is a mere political question, but it generates different consequences in terms of equity. A discussion of these effects is here neglected; similarly, a discussion about who should pay the infrastructures (in particular, when local passenger, national passenger and cargo services share the infrastructure) is neglected.

new services could lead to equitable or not equitable situation, according to the criterion used to provide (where and when) the new services. In fact, an efficiency-based criterion (new services where the extra revenues are collected) cannot be used if the fare structure is only equity issues-based, as the extra revenues could be generated on routes/services where improvements could not be needed<sup>11</sup>. This problem could also be red a problem of cost-opportunity between an equitable<sup>12</sup> and an efficient allocation of new services. On the other side, the reduction of the total amount of subsidy generates a new subsidy share out between social groups, in general different from the planned one.

The third hypothesis concerns the private transport sphere. Discussing about equity, public transport – private transport relationship can be summarized in the following main points: public transport and private transport are substitutive goods; private transport is often strongly taxed, sometimes subsidizing public transport trough earmarked taxation, while public transport is deeply subsidized; external costs of private transport impact on some public transport users (in particular, in the case of road congestion). In particular, changes in private transport users' perceived costs lead to a modal shift, changing the composition of public transport users group; obviously, a change in the composition of some groups implies changes in the equity effects. So, the hypothesis of invariance of taxation on private transport is introduced.

It is well known how some costs of the private mode is given by the market, and could be defined by external elements (in particular, the cost of fuel). Fluctuations of these costs cannot be eliminated: so, they are simply neglected in the present analysis<sup>13</sup>. Consequently, the first modal shift cause is the change in public transport fare structure and, successively if there are congestion phenomena, the effect of the reduction in travel time due to the first modal shift (at least up to when a new network equilibrium is reached), but whit opposite direction. Similarly, if the modal shift leads to a reduction of the available subsidy, new equity effects could arise (but the problem is more complicated, due to contemporary changes in fare-box revenues); again, this case is neglected in a first-stage analysis.

## Equity review

“It must [...] be underlined that there is not a theory of equity but multiple meanings of the concept, resulting from the history of the human societies, or proposed by various social and human sciences, in particular philosophy or economics” (PATS, 2000).

Equity can both defined and classified in more possible ways. The present paragraph introduces some theories about equity, defining several possible entry-keys for the analysis. A first possible classification starts from different economics and philosophical general theories, such as utilitarianism, egalitarianism, libertarianism, Rawls' theory of justice, etc.. A second possible more economically based classification, more interested in social groups and different generations, divides equity in horizontal equity, vertical equity and territorial equity. The paragraph provides a short review of the second group only. Note how the first and the second classification are not in contrast between them.

## A preliminary consideration on efficiency and equity

According to the general purpose of the paper and to the introduced mainstream, productive efficiency cannot be considered an aim of the fare structure; as consequence, it should be discussed as a (at least, partially) separated problem. In particular, in (economically) regulated context<sup>14</sup> productive efficiency is reached mainly through the assignation of the service to the more efficient company (or, in general, to the company asking the lower subsidy).

Consequently, under this approach, and under the hypothesis of extra capacity available<sup>15</sup> to adsorb increases in transport demand, the presence of subsidy should not lead to increase in operational costs or to decrease in productivity. If extra capacity is needed, the scheme becomes more complicated, as the extra capacity must be

<sup>11</sup> But the judgement can be different output considering horizontal equity or vertical equity, as introduced in the next paragraphs.

<sup>12</sup> But equity could need to be redefined to solve this problem, as this problem is different respect to the original problem of the definition of an equitable fare structure.

<sup>13</sup> In other words, here is made the assumption that the average of the users' perceived cost is fixed. Although this hypothesis looks to be realistic in a long run scenario (where average figures predominate), it could fail in a short run scenario

<sup>14</sup> The discussion of non-regulated context seems to be meaningless; the decision of not to regulate the sector is a political decision only and there are no reason to transfer to the users the costs of the inefficiency that should be allocated to taxpayers.

<sup>15</sup> Obviously, the extra capacity availability is a strong assumption, but it is realistic in several cases, as public transport offer is designed to adsorb and satisfy all the peak-hour demand (note how this is also a political decision in planned context). Anyway, this hypothesis allows simplifying the analysis and could be eliminated in a second-stage analysis.

provided by the same transport operator at the same subsidy, by the same operator but contracting the subsidy, by a new operator or by the incumbent after a new competitive bidding. The provision of extra capacity could have different distributive effects if it implies subsidies increase or redistribution.

Allocative efficiency is, opposite, a particular possible aim of the fare structure. In general, it can be considered a particular case of equity<sup>16</sup>: a fare structure designed to reach the allocative optimum means an implicit definition of equity by the public decision-maker. In other words, if public transport fares are aimed to reach allocative efficiency, it is possible to state that the system is built up under an utilitarian approach.

## Horizontal equity

Good definitions of horizontal equity are provided by Litman and PATS (PATS, 2002). Horizontal equity is concerned with the fairness of impact allocation between individuals and groups considered comparable in ability and need. Horizontal equity implies that consumers should ‘get what they pay for and pay for what they get’, unless a subsidy is specifically justified. It is often cited when communities compete for transportation resources, such as state or federal funding, and is the basis for cost allocation studies that compare how the costs imposed by different vehicle classes compare with their user payments. (Litman, 2004)

In synthesis, horizontal equity can be discussed at two different stages. On one side, a first relation can be read inside the overall group of every mode users (for example, users of private mode vs. users of public modes); on the other side, a second level of analysis concerns the users of a specific mode when identical fares are charged in presence of differently provided services *coeteris paribus*. Moreover, in general, public transport fares are not built up under criteria of horizontal equity. Users often do not pay for what they get; this mainly depends both from political (due to state failures) and economic reason (due to market failures).

## Vertical Equity With Regard to Income and Social Class

Both Litman and PATS provides a definition of vertical equity with regard to income and social class

This form of equity is related to the [Rawlsian] ‘difference principle’. It consists in judging the result of the policies in the view of the welfare of the most disadvantaged, which is necessary to maximise. Its translation in terms of transport policy implies to consider the travel conditions of the most socially penalised individuals or groups. Given that the realisation of the social rights implies the right to transport [...] and that very often social and space segregation go hand in hand, the application of this principle consists in taking care that the situation of the poorest categories (e.g. criterion of income) [...] (PATS, 2000)

According to these definitions, public agencies responsible for public transport fares should define fare schemes aimed to provide the maximum benefit (at the minimum cost) to the poorest social groups<sup>17</sup>, as compensation for general inequalities in income distribution. Once more, public transport fares are not built up in order to satisfy criteria of vertical equity with regard to income, neither in the case of reduced fares for specific social groups<sup>18</sup>.

In other words, according to vertical equity, the action on fare schemes of a sector (or of all the sectors) is a way to achieve better condition of social equity (according to the political set of preferences of the public decision-maker), through welfare and financial transfers between social groups with different income level. Obviously, the desirable level of vertical equity cannot be reached only through interventions in the transport sector, as the transport sector is not an isolated economic system.

## Vertical Equity with Regard to Mobility Need and Ability and Territorial Equity

A definition of vertical equity with regard to mobility need and ability is provided by Litman.

This is a measure of how well an individual’s transportation needs are met compared with others in their community. It assumes that everyone should enjoy at least a basic level of access, even if people with special needs require extra resources. Applying this concept requires establishing a standard of basic mobility. This tends to focus on two issues: access for people with disabilities, and support for transit and special mobility services. (Litman, 2004)

According to PATS (PATS, 2002), territorial equity<sup>19</sup> is strictly linked to Rawls’ principle of liberty (Rawls, 2000), according which “citizens” (Arnsperger & Von Parijs, 2000) are given a defined list of fundamental liberties. In this case, it can be referred to the right of full accessibility from the territory to goods and services

<sup>16</sup> See the next paragraph for a full discussion.

<sup>17</sup> Coming back again to market failures. Moreover, this implies a not always verified imperfection in the progressive levels of the taxation system; if the taxation system would be perfectly progressive (according to a defined system of political aims), there would be no needs to provide an extra income distribution.

<sup>18</sup> Consider, for example, concessionary fares for elder people. The concession is usually given according to the age and not to the income; so, high income elder people can benefit of concessionary fares paid through general taxation, achieving perverse distributive effects.

<sup>19</sup> Note how territorial equity is introduced by PATS deliverable 2 (PATS, 2002) but not by Litman (Litman, 2004).

and, in the same way, to accessibility of people and good to the territory. According to this approach, the concept of territorial equity could coincide (at least, partially) with the vertical equity with regard to mobility need and ability.

In this meaning, territorial equity falls in the more general issue of the universal service. In other words, on one side, a public service should be available everywhere to everyone who can afford to pay; on the other side, a public service should be provided to the poorest social groups under affordable (for them) financial schemes. In particular, referring to transport, universal service can be defined as the availability everywhere to the poorest social groups of some transport services, as collective transport or roads, at an affordable charge. Once more, this is a typical distributive problem.

### **Independence of territorial equity**

If territorial equity can be assimilated to universal service, it is once more a problem of income distribution between different social groups, which are not necessarily users of the service. As a consequence, this is still a problem of vertical equity, where differences in income can be read in terms of different locational choices, which are function also, but not exclusively, of the income (Erba, 2004).

Urban sprawl phenomena can be considered a consequence of land rent phenomena. In fact, the hypothesis that the more sprawled locational choices are usually a consequence of lower rent charges or lower purchase prices can be introduced<sup>20</sup>. Under these hypotheses, sprawled locations can be lead back to low income social groups. Consequently, to provide (collective) transport services to people in sprawled and remote areas is equivalent to provide transport services to low income social classes<sup>21</sup>.

In this theoretical scheme, the question of providing transport services in area characterized by the presence of second houses (usually owned by high-income people) or where rich landlords live is still not answered. There are no social arguments to provide subsidized services to these social groups or to these areas, but, according to the principle of liberty, the access to the territory must be guaranteed. The solution can be found in providing transport services charged at the average cost (in this way, users pay all the costs). If the same services are used by different income social groups, subsidy to users for low income people can be introduced, achieving back vertical equity.

Territorial equity is also criticised in relation with horizontal equity; in fact, it can also be read as a particular case of horizontal equity. Consider two regions with identical average income level and distribution, but where different transport services are provided and subsidized thanks to taxation (with identical tax collection schemes in the two regions) and with identical fares. This situation is not equitable because horizontal equity requires that users, with identical income, pay in relation to the provided services.

### **Fare structure**

Several different fare structures are possible. The traditional first level differentiation is between flat fares and distance based-fares. Both the structures present advantages and disadvantages.

#### **Flat fares**

Flat fares consist in non-differentiated fares with respect to the journey length or the travel times. This kind of structure is common in continental Europe (big) metropolitan areas, while it is not common in the United Kingdom. As compared to distant based fares this kind of fare probably increases the cost of the travel for short distance journey and decreases the cost for long distance journey, it advantages long distance travellers, while disadvantages short distance travel, and could lead to a modal shift to other modes for short distance travellers<sup>22</sup>. Nevertheless, flat fares could appear acceptable in simple<sup>23</sup> transport and fare systems where the average journey

<sup>20</sup> The present hypothesis is not always valid, as different city-shapes are possible. In particular, UK cities often differ from Continental Europe cities and, in particular, Italian cities; low-income social groups are, in fact, often located in the inner area in the UK cities, while they are located in the outer areas in Continental Europe.

<sup>21</sup> Note how, due to the fact that land rent phenomena a consequence of a market distortion, its effects cannot be discussed in a model based on perfect market. Opposite, the coincidence between territorial equity and vertical equity presupposes the presence of perfect market (but markets are distorted, in particular by income distribution and building constraints).

<sup>22</sup> The symmetric effect of modal shift to public transport for long distance travel is probably less relevant, due to the relative less elasticity of the demand curve with respect to fares for relative decrease in fare compared with the same elasticity for relative increase in fare. In other words, the elasticity could be asymmetric, even if few empirical evidences are available. In fact, according to Balcombe, "there is little convincing evidence of this asymmetry" (Balcombe, 2004).

<sup>23</sup> The definition of a system as simple could be not scientific. For the aim of the discussion a system can be considered simple when few connections are possible (connections, interchanges and waiting times can modify the discussion on equity, as it is shown in the analysis).

length is equal to the most frequent journey length. Free public transport represents a borderline case of flat fares.

Flat fares cannot be defended in terms of equity. Firstly, the presence of cross subsidy between short distance travellers and long distance travellers is against the idea of horizontal equity. Secondly, a flat fare can be considered a lump-sum fare or, the same way, a regressive fare, and, for this reason, not equitable in terms of vertical equity. Traveller's behaviour can influence the equity analysis: if low-income social users make long journeys only, a flat fare can reach an equitable (vertical equity) structure, allowing a re-distribution of income.

It is not clear if such a structure could be considered equitable in terms of territorial equity<sup>24</sup>. On one side, in fact, a flat fare structure could guarantee full accessibility from and to the more remote areas but, on the other side, if low-income groups are located in these areas, the fare could be too high, defining a situation of social exclusion. It appears to be, once more, a question of vertical equity. Flat fares could also incentive urban sprawl, providing a combination of low travel cost and more accessible low price real estates; if the intra-household income distribution allows someone of the family to use private transport, the increased urban sprawl implies an increase in traffic congestion and in air pollution, with a negative impact on other private transport users and not-transport-users. So, these two last social categories subsidize public transport getting back a worst "living" condition<sup>25</sup>.

### Distance-based fares

Distance based fares allow linking the journey fare to the travelled distance, according to a "pay as you go" structure; the price per kilometre can decrease, in some schemes, with the increase of the travel length, while, in other schemes, it is linearly proportional to the travel length. They are usually of three kinds: kilometric fares, stage fares and zonal fares. Although some differences in equity effects, in a first-round analysis these different kinds give identical effects.

Kilometric fares reflect directly the travelled distance, as the basic unit of calculation is the fare for travelled kilometre. Stage fares are based on the so-called unit stage, which is a section of route with one or more stops; on the same route, stages can have different lengths, to meet commercial or cost recovering needs. Zonal fares are similar to stage fares, but a route or a network is divided in zones, which one includes more than one stop; travels involving one zone only are charged under a flat fare rule, but the use of more than one service is allowed<sup>26</sup>.

Distance-based fares seem to be more equitable than flat fares, but some critical points can be carried out. In terms of vertical equity, they allow low-income people to travel on short distance (according to their willingness to pay), but could reduce travel opportunity for long distance journeys; if long distance journeys for low-income groups are a social objective, less than linear schemes (fare per kilometre decreases with the increase of kilometre travelled) can lead to satisfy this aim. Inter-zonal or inter-stage travels are also critical: the cost of travel per kilometre can increase dramatically if relatively short distance travels<sup>27</sup> involve the cross of the border between zones of stages; this situation can be considered a particular case of cross subsidisation between users (short inter-zonal journey users subsidizes long inter-zonal journey users), and then not equitable in terms of horizontal equity.

As said, distance-based fares increase, compared to flat fares, the cost for long distance rides. This could contest the principle of liberty for low-income social groups if such a fare structure is implemented for rural or sprawled areas if low-income groups are located in these areas. Opposite, when different land-use structures are discussed and high-income social groups are located in sprawled or rural areas, such a fare structure seems to be more vertically equitable; nevertheless, vertical equity remains critical if a relevant share of subsidy is necessary to cover operative costs.

Territorial equity seems to be partially affected if distance based fares structures are applied to areas where all the zones are comparable. The question, once more, is closed to horizontal and vertical equity issues. In fact, on one side, distance based fares make, *coeteris paribus*, less accessible remote area. On the other side, they allow to reduce subsidies for rural areas routes, making possible to assign more relevant share of public funds to areas with higher densities; this way, subsidy level per inhabitants or per passenger can be equilibrated and balanced between different areas.

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<sup>24</sup> Confirming how this analytical category is critical.

<sup>25</sup> Note how the introduced classification for equity describes with difficulties these kinds of non-equitable situations.

<sup>26</sup> Kilometric fares or stage fares for journeys including more than one service can also be defined, but the structure becomes more complicated due to the necessity of introduce weights for the waiting time or for the reduction in comfort given by the interchange.

<sup>27</sup> Short distance travels compared to the dimension of the zone or of the stage.

## Conclusions

The preliminary theoretical analysis shows how the topic is characterized by a strong inter-relation between economic, land use and policy issues. As a consequence, the political decision should be derived considering all these dimensions, even though also political aims have a (not always transparent) role. Moreover, results should be validated through empirical evidences, also in order to define the “weight” of this policy in respect with other policy.

According to this mainstream, further steps of the research are possible. In particular, territorial effects can be more underlined, leaving from a traditional utilitarianism-based approach, to compare it with other philosophical and political theories. At the same time, some hypothesis can be removed to widen the validity of the analysis.

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