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INTRODUCTION

Transport equity analysis

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This special issue on Equity and Transport argues that, while transport evaluation remains significant, equity assessment in transport planning is not sufficient and needs to be better understood and examined in terms of accessibility, mobility, and health effects. This broader focus is needed, among others, because of the emergence of the weaknesses of the current planning tools for transport infrastructures and services in incorporating equity considerations and the complexity in identifying the impacts of travel behaviours on society, environment, and equity (Lucas, Bates, Moore, & Carrasco, 2016).



We will briefly review recent work that touches the subjects of equity and transport as dynamic and multi-disciplinary, and summarise the contributions of the five papers of this special issue to the existing literature. This introduction will thus present basic approaches in transport planning that consider different types of access to transport services and everyday activities, addressing equity and social exclusion in transport.

Within this framework, the editorial of this special issue is oriented to:

- (1) Present current approaches used to explore the links between transport and distributional factors;
- (2) Develop new transport evaluation criteria accounting for equity in the social welfare function replacing travel time saving;
- (3) Identify key factors for shifting from the current utilitarianist paradigm which underlies the cost–benefit analysis to a wider approach based on needs of people;
- (4) Present five papers that contribute to the current debate on equity and transport.

Equity in transport: theoretical approaches and practices

With the growing social awareness worldwide, understanding the equity implications of transport policies and investments is becoming increasingly important. This poses a major challenge in the assessment and appraisal of transport projects and policies, in which equity issues are not seriously addressed. In fact, current evaluation methods in transport marginally account for equity issues, especially in Europe, and this topic is usually not dealt with in EU and local authorities' guidebooks for transport project evaluation. The latest work carried out by the European research network of Transport and Equity Analysis Cost Action (http://www.cost.eu/COST_Actions/tud/TU1209) is

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contributing to the body of research by bringing together new approaches to incorporate equity consideration in transport projects evaluation and decision-making. These approaches consist of defining equity in transport, developing travel behaviour models including equity indicators, and analysing socio-economic impacts, introducing them in appraisal tools as alternative transport evaluation criteria for estimating benefits and costs (e.g. by using accessibility instead of travel time).

The basic definition of equity used here is “the distribution of benefits and costs over members of society” (e.g. Boucher & Kelly, 1998; Miller, 1999). Based on this definition, three key components of equity in transport can be distinguished: (1) the benefits and costs that are being distributed; (2) the population groups over which benefits and costs are distributed; and (3) the distributive principle that determines whether a particular distribution is “morally proper” and “socially acceptable”.

The main challenge for the assessment of equity in the domain of transportation is to define and operationalise costs and benefits and the distributive principle. The definition and operationalisation of population groups are carried out in many domains of research and policy, including transportation. However, while the diverse impacts of transport policies and investments on different population groups have long been recognised, understanding and explicitly assessing these impacts as part of an equitable and inclusive perspective require further developments, given the increasing importance of better equity considerations in transportation as a result of various trends.

The high level of mobility has created land-use patterns that are difficult to navigate for non-motorised transport users (Geurs & van Wee, 2004). This issue has recently gained attention due to the ageing of the population and the related growth in the number of people who are no longer able to drive a car or use a bike (European Commission, 2011).

These last two issues, which have different impacts of different population groups, have contributed to the realisation that equity should play a constitutive role in transport provision, similarly to the role it plays in education and health care, where equity considerations form a part of everyday decision-making.

Equity in planning: framework, variables, and indicators

Transport systems appraisals are still mostly based on a utilitarian framework that neglects sub-populations who perhaps cannot afford the cost, or who have mobility issues preventing them from using a particular service. This issue is worsened when the selection of transport projects favours those people in higher income brackets who make more trips than their lower paid counterparts, and thus their benefits compose a higher weight in the aggregate cost–benefit analysis.

Equity in transport is thus aiming to include social and spatial factors in social welfare assessment by introducing the concept of accessibility to key activities (Levitas et al., 2007). Specifically, the aim is to replace the traditional measure of travel time savings that favour better-off societal groups who are travelling more, with accessibility gains measures that cater for more vulnerable social groups, without accounting for trips rate. As a result, the social welfare function will be more equitable (see Martens and Di Ciommo, 2017).

Within the utilitarian framework, based on individual utility and preferences, the horizontal equity (i.e. each individual is considered with the same weight) currently being employed is fallible. A vertical model of equity, also known as “social equity”, looks to provide services to those who need them but who may not be able to access or afford it, and one way to achieve this is through a shift from utilitarianism based on “preferences” to a new appraisal framework based on “needs”.

When transport infrastructure or services are designed for the impaired – whether mentally or physically – the benefits they bestow (perhaps ease of access, or a much simpler explanation of information) could be of use for all, or covering needs of at least an additional special group of population (i.e. elderly). The idea is to design a system for a specific group, but at the same time make it a universal system that all people can use. This will represent a paradigm shift where the universalism of the transport good supply will contrast the individualist preferences.

Inadequate transport contributes to social exclusion (Lucas, 2012), particularly for people who cumulate disadvantages, live in an automobile dependent community, are physically disabled, have low income, or are unable to own and drive a personal automobile (see Cornut and Madre, 2017). Moreover, it is similarly crucial to ensure that equity issues are taken into consideration at the planning stage, once you integrate the equity considerations, the system as a whole becomes better for everyone (i.e. the bottom-up inclusion).

The challenge for research into equity is not only to define benefits and costs, the distributive principle and the criteria for disaggregating the population groups but also operationalise them using models and indicators. Therefore, three types of indicators are proposed:

- Indicators that make it possible to assess how much benefits or costs are being received by different population groups.
- Indicators to disaggregate population groups from each other.
- Indicators to determine the equity of an observed distribution of a particular benefit or cost (e.g. transit subsidies or direct access to key activities).

Including equity into the transport project evaluation

Equity in transport is often not the core concern of mainstream project appraisal. On the contrary, equity is usually a small fraction, or a fringe, of appraisal approaches and actual practice, usually dealt by some sort of multi-criteria analysis given the difficulty of including it in cost–benefit analysis. Even when it is at the core of the appraisal, the utilitarian approach at the base of this evaluation disables a proper consideration of equity.

CBA is the most widely used method for the evaluation of transport projects (Browne & Ryan, 2011; Martens, 2011; Thomopoulos, Grant-Muller, & Tight, 2009; van Wee, 2011). In transportation, CBA is conducted from a societal point of view, so in this discussion, CBA really refers to social cost–benefit analysis, and it basically quantifies all costs and benefits related to a given project and express them in monetary terms. Converting and aggregating all benefits and costs to one measure (money) is the main advantage of CBA, making it easy to compare – as well as communicate – various alternatives.

However, CBA has a number of weaknesses. According to Thomopoulos et al. (2009), equity considerations are difficult to evaluate by the conventional CBA approach, as it does not differentiate among different beneficiaries of a project. To accommodate income distributional factors, Brent (1996) argues that CBA has to distinguish the group that receives the benefits from the group that incurs the costs. However, CBA only focuses on the effects of a given project on the aggregate level of welfare, but does not account for the effects on the levels of welfare of certain groups or areas. Another important limitation of CBA is that not all impacts, especially wider socio-economic impacts, can (easily) be monetised, while this may entail significant equity effects such as impacts on the environment or on health. In general, these impacts are either included in the CBA as a monetary value, after conducting some analysis of a WTP (willingness to pay) or WTA (willingness to accept compensation), or are not included in the CBA and assessed solely using a multi-criteria or qualitative appraisal, or are ignored all together. A problem might occur in the case of people with very low incomes. Because of their low income, their WTP, for example, for additional bus services, is probably low. Consequently, using the WTP in order to evaluate the pros and cons of options could be problematic. Therefore, CBA may be inappropriate for measuring distributional impacts given its focus on economic efficiency (Browne & Ryan, 2011; van Wee, 2011). Some CBA guidelines overcome this issue by using the so-called Equity Value of Time, imposing the same value of time for all population groups in converting time saving to monetary values. However, they do not account for the fact that people of higher socio-economic level make more trips, and thus benefit more from transport improvement, while the lower socio-economic groups may suffer from low accessibility (see Martens and Di Ciommo, 2017).

Another important issue is the choice of an appropriate discount rate to be used in the CBA, which may have a significant impact on projects' efficiency and on intergenerational equity effects (Di Ciommo, de la Hoz, & Guzman, 2014; Guzmán, Di Ciommo, & de la Hoz, 2013). A related issue is the life cycle used in CBA for the calculation of benefits. The life cycle affects the net present value of a given project, as most fixed costs will occur in the short term, whereas many of the benefits are likely to be realised in the longer term (Browne & Ryan, 2011). The time horizon often varies between countries (Odgaard, Kelly, & Laird, 2005). These critics are also relevant to the incorporation of equity considerations in transport appraisal (methods), as they will have different impacts on socio-economic groups and areas.

The scientific focus on equity has been spreading across academic disciplines, governmental agencies, industries, regions, and countries (Odgaard et al., 2005). In the context of equity in transport appraisal methods, the main objective of Transport and Equity Analysis Cost Action (http://www.cost.eu/COST_Actions/tud/TU1209) was to put transport equity evaluation on the agenda in its own right, and to bring together different disciplines and country guidelines, in order to incorporate state-of-the-art methodology into transport equity evaluation. This Special Issue aims to bring equity evaluation in urban transport from the fringe to the core and to contribute to equity in transport planning debate (Jones & Lucas, 2012).

In summary, this Special Issue publishes five papers for three main objectives:

- Promote the development of a research community around a topic marginally developed in transport.

- Cross the analysis of different data and evidence that can together throw light on this complex problem of equity.
- Present a multidisciplinary and international cooperation that will contribute to inform future policy in several areas such as transport, regional development, and urban development.

Recent development and literature review

Literature review of equity in transport states that mobility is important, but that the ultimate goal of transport policy and projects should be to improve access to transport, as a prerequisite for accessibility to key activities or focus on accessibility to key activities directly.

Accessibility to key activities, travel affordability, and access to transport

A major part of the literature on transport and equity focuses on (equal distribution of) accessibility, which is perceived as the ease of reaching a number of key activities and opportunities, for example, employment, education, health care and grocery shopping, related to (weighted) journey times by mode of transport (often car and public transport). Some scholars also add political activities, leisure activities and social networks as key activities. Most papers distinguish between levels of accessibility by place (for example, different neighbourhoods or urban versus suburban), often considering disadvantaged versus non-disadvantaged groups.

Social exclusion is often used as the framing of accessibility analysis, where most of the papers consider inaccessibility as a key component of social exclusion, as it limits the access to key life activities and opportunities.

Indicators

For measuring accessibility to key activities, two types of measures can be distinguished in the literature:

- Isochrones measures of accessibility used to determine the accessibility level each group has: the number of key activities and opportunities within 30 or 40 minutes of travel time, or by travel distance distinguished by car and by public transport system (often by buses) (Bocarejo & Oviedo, 2012).
- Gravity-based indicators used to measure accessibility, in some cases combined with focus groups/interviews: discounting the value of a destination the further it is located from the place of residence of a person, household, or population group (Cahill-Delmelle & Casas, 2012).

More recently, Kaplan, Popoks, Prato, and Ceder (2014) have developed a connectivity indicator to measure public transport accessibility, which captures most of the above components related to public transport.

These accessibility measures typically take into account only the time component of travel, and do not address the costs related to travel (and the barrier these costs may pose for some population groups to actually using the available transport system and

thus enjoy the measured level of accessibility. However, Di Ciommo and Lucas (2014) use a generalised cost measure that captures both travel time and travel costs in order to estimate the cost burden of Madrid's road pricing scheme on road users, distinguished by low- and high-income areas.

Many scholars argue that people-based accessibility measures are more appropriate than place-based measures for the assessment of equity, because they accommodate for interpersonal differences in accessibility by utilising multiple reference locations, addressing interpersonal variations in time and budget, and recognising trip-chaining behaviour (Neutens, Schwanen, Witlox, & De Maeyer, 2010).

Nahmias-Biran, Sharaby, and Shiftan (2014) and Nahmias-Biran, Martens, and Shiftan (2017) use a logsum measure of accessibility capturing the overall utility from all travel characteristics including time and cost, as well as individual characteristics, thus allowing different people to have different accessibilities for different choice situations, depending on his/her characteristics.

However, the accessibility measures that are typically used remain relatively simple:

- Apart from income and socio-economic status of neighbourhoods, only little attention is paid to different social groups and their needs. Recently, Di Ciommo, Pagliare, and Crescenzo (2016) have estimated needs of people related to a specific trip, mode, activities, and time of the day, characterising population groups in need of achieving specific activities at a specific time of the day. The results point out that unsatisfied needs are key indicators for identifying the distribution of "goods" (i.e. accessibility to transport and to activities). The literature is focused mostly on accessibility by car and public transport, while other modes of transport such as bicycling or walking are rarely considered (see Lee, Sener, & Jones, 2017).

Affordability is one of the main aspects that should be considered when formulating public policies in order to improve equity in transport. A number of papers have addressed this issue of affordability and the cost component of travel. Two types of affordability measures can be distinguished:

- Affordability measures that focus solely on actual, revealed, travel, thus contrasting with the accessibility papers described above which focus on accessibility as a potential.
- Affordability measures that relate to a minimum amount of travel which persons may or may not make.

The indicator used for assessing transport affordability is typically the amount of money individuals or households spend in order to access and use the transport system, compared to their monthly or annual income.

Many papers discuss the distribution of access to transport, whereby a distinction is made between access to the public transport system and access to private vehicles, particularly cars. Most of the papers distinguish between areas (urban versus suburban or different neighbourhoods) and between disadvantaged and non-disadvantaged groups. Lack of access to transport is considered to limit accessibility of key activities and opportunities, which increases the risk of social exclusion.

- Access to cars is often measured by the share of the population (individuals or households) who owns a car or a license, distinguished by population group.
- Access to public transport is often measured using a composite indicator, bringing together various indicators such as the number of available travel modes during the day, vehicle capacity, service frequency, number of reachable transit stops within a certain distance or travel time, the average trip distance or travel time, the number of transit lines (spatial coverage), and the total number of trips. All these indicators are sometimes combined using a regression model to create a composite indicator.
- Safety indicator – the discussion of access and usage of non-motorised modes addresses the fear of crime while travelling, as it can deter people from walking or using public transport.

Criteria for differentiating population groups and their travel behaviour impacts

Most disaggregations considered in the papers are according to income, car availability, age, gender, household composition, and place of residence:

Income and car availability

Most papers distinguish between high income and low income, as well as car owners and car-less individuals or households. People and households in the lowest income quintiles are less likely to have access to cars, rendering them more dependent on public transport, and in particular buses, walking, and transport provided by friends or family. Most papers indicate that unemployed, low-skilled, and single-parent households are likely to be in the lowest income quintiles and with no access to a car. Low income is also correlated with shorter commute distances, as for people with lower income, the long commutes is usually not worthwhile. Car dependency has been shown to be a key aspect of equity in transport (Nahminas Biran et al., this issue).

Many other variables are related to income and car ownership:

Age, as youth and the elderly (often 60+) who do not have driver's license are more dependent on public transport, although for the elderly this correlation is changing over time due to cohort effects.

Educational level, as less educated people move both less often and less far, compared with the highly educated. This correlation is mostly due to their lower level of car ownership. Furthermore, less educated people also tend to commute over shorter distances, in line with the fact that lower income levels do not make long commutes worthwhile.

Employment status is highly correlated with income and car ownership, as the unemployed and people in low-paid work means that they have less financial access to cars. Again, unemployed are also less likely to commute over large distances, as this is often not worthwhile in light of financial constraints.

Women are less likely to have a driving license or to own a car, especially in traditional communities, where they also may not have access to public transport, imposing a serious

social exclusion limitation on their activities. In addition, women generally have more tasks and primary responsibilities related to caring tasks and domestic work, which limits their possibilities to travel. The domestic responsibilities of women may not prevent them from travelling, but it shapes their travel needs in specific ways. The transport system is not always able to answer these specific needs, and consequently, women's possibilities are more limited. Also, personal safety while using public transport is a major consideration for women.

Household composition

Parents, and especially single parents with young children, are regarded as particularly disadvantaged due to caring tasks and related transport needs. Transportation of children to day care or school during commuting, which for people with low income usually takes place by public transport, is often a major obstacle to access activities due to scheduling constraints.

Place of residence (inaccessible areas/socio-economically deprived areas)

Many studies distinguish population groups in terms of place of residence, as accessibility of key destinations and access to transport are often strongly shaped by a person's residential location. Studies use different spatial scales, ranging from relatively large transport activity zones to neighbourhoods, census tracts, and even up to individual buildings. The spatial differentiation of the population is often combined with a difference in socio-economic status. Furthermore, analyses are often aggregated, comparing urban and suburban areas among each other, and sometimes also considering rural areas.

Minority ethnic groups

Ethnic minorities often have relatively low incomes. Partly because of this, they also have lower levels of car ownership and are therefore more dependent on public transport or walking (Lucas et al., 2016; McCray & Brais, 2007). Unsurprisingly, women in such groups encounter more social exclusion issues.

Physical impairment

Physical impairment, as well as long-term illness and health problems, may limit people's mobility and, hence, their access to transport and activities. Disability is often regarded as predominantly an experience of the elderly; certainly, the prevalence and severity of impair increase with age. However, physical impairment also affects younger age groups and can severely limit a person's ability to use particular types of transport and thus to access key activities.

Conclusions

This introductory literature review shows that there is not yet an appraisal method that adequately reflects transport equity issues, addressing the social impacts of transport

policies or projects. The widest used appraisal method – CBA – has different advantages and disadvantages, and can be used to appraise different policy types or projects. It appears that CBA is useful for estimating the costs and benefits associated with transport policies, but it is constrained by the difficulty in quantifying wider socio-economic impacts and to account for equity considerations.

Since CBA, by its very nature, favours transport improvements for highly mobile groups, Martens and Di Ciommo (2017) propose to replace travel time savings by the distribution of so-called accessibility gains as the key benefit of transport projects. According to Bristow and Nellthorp (2000) and Thomopoulos et al. (2009), there have been attempts to bring CBA and MCA, which can usually better account for equity issue, together in a single evaluation framework, but more research is needed in this field, certainly regarding the ability of CBA to assess the equity impacts of transport policies and projects.

The papers of this special issue contribute to improve understanding of the theories of justice and their potential implication for better incorporation of equity consideration in transport planning and project evaluation. The following set of papers review the various justice theories, and discuss how they can contribute to more equitable evaluation and planning of transport infrastructures and services.

Martens and Di Ciommo (2017) deal with the debate on the appraisal of transport projects that is a key issue for including equity in transport planning. After identifying various critical equity effects of using travel time savings in project appraisal, they explore whether the replacement of travel time savings by accessibility gains can address the identified equity effects. They conclude that this only holds for two of the five equity effects, while a third effect can be mitigated. The mere introduction of accessibility gains is in itself insufficient to address all equity effects related to the application of travel time savings within the cost–benefit analysis framework. CBA appraisal may not be appropriate to measure distributional impacts given its focus on the utilitarian approach. The paper suggests further research opening a paradigm which puts “needs” of people over individual “preferences”. The authors state that a review of theoretical approaches, such as utilitarianism, is needed. The following papers of Pereira, Schwanen, and Banister (2017) and Nahmias-Biran et al. (2017) address this topic.

Rafael Pereira et al. (2017) review key theories of justice: utilitarianism, libertarianism, intuitionism, Rawls’ egalitarianism, and the Capability Approach, discussing for each theory how it addresses key questions of justice: what should be distributed? On which moral principles should distribution patterns be based? And what is the fairest distribution pattern? They discuss each of these questions in relation to transport, and explore the implications of this theories for issues of transport disadvantage, social exclusion, and accessibility.

Based on their review, they propose a distributive justice perspective that stages a dialogue between theoretical works of John Rawls and Capability Approaches. They argue that such a dialogue could lay the foundation for an approach that would guarantee a sufficient level of accessibility, while also accounting for the potentially detrimental effects of transport projects on the environment, health, and safety conditions, in particular for disadvantaged population groups.

More specifically, they propose that distributive justice concerns over transport disadvantage and social exclusion should focus primarily on accessibility as a human capability. This means that a detailed analysis of distributional effects of transport policies should

consider minimum standards of accessibility to key destinations and the extent to which these policies respect individuals' rights, prioritise disadvantaged groups, reduce inequalities of opportunities, and mitigate transport externalities.

Their proposed framework gives support to the ideas of setting minimum standards of accessibility to key destinations which should be guaranteed by governmental social or transport policies, and limiting the highest levels of accessibility of social groups and transport modes only in those circumstances when a marginal improvement of accessibility at the upper levels would harm those groups at the bottom.

Nahmias-Biran et al. (2017) also discuss a number of justice theories and explore their possible consequences for transport project appraisal. They discuss two of the theories that also have been taken up by Pereira et al. (2017): Rawl's approach and the Capability Approach, but they do so from a somewhat different angle, thereby complementing the discussion by Pereira et al. (2017). They furthermore discuss Walzer's communitarian perspective on justice and its relevance for the domain of transport. In order to assess the possible relevance of these theories to transport, Nahmias-Biran et al. (2017) explore how the theories have been applied and extended in different domains, notably health care and education. They conclude that the Capability Approach is the most promising approach as a basis for transport project appraisal, in particular the version developed by Nussbaum, as it suggests a sufficiency standard for accessibility as a prerequisite for guaranteeing a sufficient level of basic capabilities.

Similar to Pereira et al. (2017), Nahmias-Biran et al. (2017) propose that transport appraisal should focus first and foremost on accessibility as the key benefit generated by any transportation project. They claim that the familiar concept of accessibility can adequately capture the notion of basic capability. Following the capability approach implies that accessibility measurement has to take into account the particularities of the person as much as the characteristics of the transport and land-use system. They follow Nussbaum's approach of setting minimum thresholds for key capabilities, and propose the use of a minimum threshold regarding accessibility. They subsequently propose the use of the "logsum", developed by Ben-Akiva and Bowman (1998), as a measure of accessibility that can best capture a person's level of capability.

Finally, the authors demonstrate through a simple case study how the Capability Approach can be expressed in a practical evaluation of transportation projects, and it is then compared with an application of the utilitarian approach currently underlying cost-benefit analysis. The case study shows that the capability approach works out to the advantage of disadvantaged population groups, with typically lower initial levels of accessibility, without the need to introduce equity values of time or any form of distributional weights. The flipside of this benefit is that the capability approach requires the delineation of a sufficiency threshold of accessibility, thereby merely relocating the moral debate that is inevitable – although mostly invisible – in transport project appraisal.

Lee et al. (2017) makes an effort to develop a framework to evaluate and respond to active transportation equity, in which she identifies inequities, and determines how to more fairly distribute costs and benefits. She also reviews various approaches to transportation equity, focusing on active modes. In this regard, she reviews social equity, spatial equity, combined social and spatial equity, procedural equity, and modal equity. This review is followed by a discussion of distributive justice and philosophies for the fair allocation of resources.

Lee et al. (2017) claims that alternative travel modes, such as walking, bicycling, and public transit, can help compensate imbalances in transportation cost and benefits among population groups, yet active transportation projects are often implemented without consideration of equity. She examines selected pedestrian and bicycle master plans from 13 major cities in the United States to evaluate the extent to which these major cities are considering equity in their active transportation planning. Based on her findings, a set of recommendations is proposed to aid researchers and planners to more meaningfully address active transportation equity concerns. The main recommendations are: to consider other transportation-disadvantaged groups beyond low-income and minority populations in equity analysis, to adopt new performance measures, to increase inter-agency coordination and the need for stronger guidance from the federal government, and to ensure more representation from transportation-disadvantaged groups in the public participation and decision-making process.

On a more practical level, Benoit Cornut and Jean-Loup Madre (2017) use two economic indicators of inequality applied to transport: The Gini index and the Q4/Q1 ratio, to investigate inequalities in car ownership, and use in the Paris metropolitan area as a case study. They examine the evolution of car ownership and use gaps between income groups and residential areas over time, while taking into account the spatial differentiation of the population according to the zone of residence within the metropolitan area. In this manner, they examine the influence of territory and population heterogeneity.

They view car availability and kilometres travelled as an implicit measure of households' accessibility to services and key activities. These indicators are used in combination as a proxy for the potential gap of accessibility related to income inequalities, which can induce problems in social inclusion.

As owning a car is not a privilege, but rather a necessity for many people especially in low-density areas, the authors show that there has been a growing equality in the distribution of car ownership and use through a converging behaviour in the Paris region. If the differences are not discriminating for the majority of the population, inequalities still remain mainly for low-income people. Behaviour of people in Q2, Q3, and Q4 has come progressively closer, while the behaviour of people in Q1 has lagged "behind", with fewer cars per adult and a lower annual mileage per household.

Overall, they show that different visions of equity are put forward by the two indicators they analysed. The Gini index expresses the gap with regard to perfect equality, thus refers to egalitarianism (horizontal equity). The Q4/Q1 ratio can be interpreted in terms of vertical equity since it expresses the gap between the two extreme groups of the standards of living distribution. It thus suggests possible efforts to improve the situation for low-income group and to narrow the gap between different groups of population.

In their analysis, the level of the Gini index is low, pointing out that the difference in car ownership and use distribution between income groups has been decreasing over time and has tended to level out. But the level of the Q4/Q1 ratio expresses that low-income people remain in need. As the problem of car accessibility or use with regard to income distribution concerns mainly a small part of the population, they conclude that vertical equity with specific decisions seems to be more appropriate for appraising social justice.

Overall, the collection of papers in this special issue provides a comprehensive review of the theoretical approaches for including equity in transport appraisal tools (Martens and Di Ciommo, 2017), of different justice theories (Pereira and Nahmias Biran et. al.) and the

application of these theories to transportation (Nahmias-Biran et al., 2017, Lee et al., 2017, and Cornut and Madre, 2017). The paper of Martens and Di Ciommo (2017), after proposing a substitution of the travel time saving by accessibility gains, concludes that the real problem is the utilitarian framework adopted in the CBA appraisal. This is followed by the theoretical review of Rafael Pereira et al. (2017) of various justice theories and their potential application in transportation that is continued by Nahmias-Biran et al. (2017) who also suggest a practical application. What follows is the review of Lee et al. (2017) with respect to actual planning of active modes of transportation, and the analysis of couple of indicators with regard to car ownership and use by Benoit Cornut and Jean-Loup Madre (2017). Overall, this special issue provides a wide range of definition, ideas, and examples of how to better apply justice theory in transportation planning and the benefits that derive from this. We trust that this collection of papers will advance both research and practice of equity analysis, and its consideration in transportation planning and project evaluation, and that it contributes to more equitable transportation planning.

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References

- Ben-Akiva, M. E., & Bowman, J. L. (1998). *Activity based travel demand model systems*. In P. Marcotte & S. Nguyen (Eds.), *Equilibrium and advanced transportation modelling* (pp. 27–46). New York: Springer.
- Bocarejo, S., & Oviedo, D. (2012). Transport accessibility and social inequities: A tool for identification of mobility needs and evaluation of transport investments. *Journal of Transport Geography*, 24, 142–154.
- Boucher, D., & Kelly, P. J. (1998). *Social justice: From Hume to Walzer*. Routledge: Psychology Press.
- Brent, R. J. (1996). *Applied cost-benefit analysis*. Cheltenham: Edward Elgar.
- Bristow, A. L., & Nellthorp, J. (2000). Transport project appraisal in the European Union. *Transport Policy*, 7(1), 51–60.
- Browne, D., & Ryan, L. (2011). Comparative analysis of evaluation techniques for transport policies. *Environmental Impact Assessment Review*, 31(3), 226–233.
- Cahill-Delmelle, E., & Casas, I. (2012). Evaluating the spatial equity of bus rapid transit-based accessibility patterns in a developing country: The case of Cali, Colombia. *Transport Policy*, 20(1), 36–46.
- Cornut, B., & Madre, J.-L. (2017). A longitudinal perspective on car ownership and use in relation with income inequalities in the Paris metropolitan area. *Transport Reviews*. doi:10.1080/01441647.2016.1245218

- Di Ciommo, F., de la Hoz, D., & Guzman, L. A. (2014, June 11–13). *Exploring users intertemporal preferences for measuring transport social equity effects*. Paper presented at the PANAM Conference, Santander, Spain.
- Di Ciommo, F., & Lucas, K. (2014). Evaluating the equity effects of road-pricing in the European urban context. *Applied Geography*, 54, 74–82.
- Di Ciommo, F., Pagliare, F., & Crescenzo, M. (2016). Needs-based method and accessibility index for assessing equity. The eastern Barcelona metropolitan case study, Nectar, Cluster 4 meeting, Toledo, October 2016.
- European Commission. (2011). *White paper on towards a competitive and resource-efficient transport system*.
- Geurs, K. T., & van Wee, B. (2004). Accessibility evaluation of land-use and transport strategies: Review and research directions. *Journal of Transport Geography*, 12(2), 127–140.
- Guzmán, L. A., Di Ciommo, F., & de la Hoz, D. (2013). Integration of congestion pricing and intertemporal preference rate in social welfare function. *Transportation Research Record: Journal of the Transportation Research Board*, 2346(1), 1–12.
- Jones, P., & Lucas, K. (2012). The social consequences of transport decision-making: Clarifying concepts, synthesising knowledge and assessing implications. *Journal of Transport Geography*, 21, 4–16.
- Kaplan, S., Popoks, D., Prato, C. G., & Ceder, A. A. (2014). Using connectivity for measuring equity in transit provision. *Journal of Transport Geography*, 37, 82–92.
- Lee, R. J., Sener, I. N., & Jones, S. N. (2017). Understanding the role of equity in active transportation planning in the United States. *Transport Reviews*. doi:10.1080/01441647.2016.1239660
- Levitas, R., Pantazis, C., Fahmy, E., Gordon, D., Lloyd, E., & Patsios, D. (2007). *The multi-dimensional analysis of social exclusion Department of Sociology and School for Social Policy*. Report by Townsend Centre for the International Study of Poverty and Bristol Institute for Public Affairs. Bristol: University of Bristol.
- Lucas, K. (2012). Transport and social exclusion: Where are we now? *Transport Policy*, 20, 105–113.
- Lucas, K., Bates, J., Moore, J., & Carrasco, J. A. (2016). Modelling the relationship between travel behaviours and social disadvantage. *Transportation Research Part A: Policy and Practice*, 85, 157–173.
- Martens, K. (2011). Substance precedes methodology: On cost-benefit analysis and equity. *Transportation*, 38(6), 959–974.
- Martens, K., & Di Ciommo, F. (2017). Travel time savings, accessibility gains and equity effects in cost-benefit analysis. *Transport Reviews*. doi:10.1080/01441647.2016.1276642
- McCray, T., & Brais, N. (2007). Exploring the role of transportation in social exclusion through the use of GIS to support qualitative data. *Networks and Spatial Economics (NETS)*, 7(4), 397–412.
- Miller, H. J. (1999). Measuring space-time accessibility benefits within transportation networks: Basic theory and computational procedures. *Geographical Analysis*, 31, 187–212.
- Nahmias-Biran, B., Martens, K., & Shiftan, Y. (2017). Integrating equity in transportation project assessment: A philosophical exploration and its practical implications. *Transport Reviews*. doi:10.1080/01441647.2017.1276604
- Nahmias-Biran, B., Sharaby, N., & Shiftan, Y. (2014). Equity aspects in transportation projects: Case study of transit fare change in Haifa. *International Journal of Sustainable Transportation*, 8(1), 69–83.
- Neutens, T., Schwanen, T., Witlox, F., & De Maeyer, P. (2010). Equity of urban service delivery: A comparison of different accessibility measures. *Environment and Planning A*, 42, 1613–1635.
- Odgaard, T., Kelly, C., & Laird, J. (2005). Current practice in project appraisal in Europe, HEATCO research project (Harmonised European Approaches for Transport Costing and Project Assessment).
- Pereira, R. H. M., Schwanen, T., & Banister, D. (2017). Distributive justice and equity in transportation. *Transport Reviews*. doi:10.1080/01441647.2016.1257660
- Thomopoulos, N., Grant-Muller, S., & Tight, M. R. (2009). Incorporating equity considerations in transport infrastructure evaluation: Current practice and a proposed methodology. *Evaluation and Program Planning*, 32(4), 351–359.
- van Wee, B. (2011). *Transport and ethics: Ethics and the evaluation of transport policies and projects*. Cheltenham: Edward Elgar.