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Bang for the buck: Toward a rapid assessment of urban public transit from multiple perspectives in North America

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ABSTRACT

We present a rapid assessment – using simple metrics based on publicly available data– of how effectively public transit agencies achieve key outcomes, and reconcile trade-offs among these outcomes, from the perspective of transit users, society and the agencies, in the largest 14 cities in North America with a population greater than three million. We assess the trade-offs among service quality, incorporating accessibility, service frequency, and comfort (which are important for transit users); transit ridership per capita (reflecting the society perspective); financial viability from the agency perspective; and affordability of fares for minimum-wage earners. We also assess the overall performance of transit in these cities, considering these perspectives in an integrated manner. Agencies vary widely in achieving and reconciling the above outcomes and trade-offs. Generally speaking, however, agencies that perform well (or badly) on one of these objectives and trade-offs also perform well (or badly) on the others, and in terms of overall transit performance. Finally, we discuss how our assessment may be improved upon, including in terms of better and more nuanced measures, in future work. We suggest that metrics be assessed uniformly and reported regularly across transit agencies, to track and reliably compare their performance over time; and that it would be desirable to understand how transit users and decision makers weigh the relative importance of key objectives, and to incorporate this understanding in assessments of transit performance.

1. The role of urban public transit from multiple perspectives

Urban public transit plays a vital role in society. In addition to providing an important service to commuters, particularly those who do not own personal vehicles, by enabling them to access employment and other essential services on a daily basis, public transit contributes to public goods, which benefit urban populations as a whole. There are important objectives and outcomes related to urban public transit from the perspective of transit riders, society at large, and the transit agencies themselves. Further, there can potentially be important interdependencies, conflicts and trade-offs between these objectives, both from the perspective of each of these groups, as well as across them.

As far as transit users are concerned, the outcomes that are crucially important are, on the one hand, service availability and accessibility; service frequency and reliability; security and safety; and comfort and convenience; and on the other hand, and just as importantly, affordability. In other words, transit riders desire high levels of service quality, in terms of the first three sets of outcomes, but that is also affordable. Whereas service availability depends on the frequency of service, on the hours of available service or service span, and on the accessibility to transit stops or stations (TCRP, 2013), transit accessibility is essentially the ease of reaching desired destinations where commuters can access jobs, health services, education, and so on, and depends both on transit service quality as well as land use planning, and how well land use is integrated with transit. And while transit riders may be choice riders, who use transit instead of driving a private vehicle, or transit-dependent riders who have no other option but to use transit (Krizek and El-Geneidy, 2007), comfort and convenience are important (dell'Olio, Ibeas, and Cecin, 2011; Diab, Badami, and El-Geneidy, 2015), and can affect satisfaction and usage for both types of riders (Eboli and Mazzulla, 2011; Verbich and El-Geneidy, 2016). Comfort can result from the seating (and standing space) availability, which in turn depend on passenger loading and service frequency. Also important in this regard are factors such as waiting and journey time,

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driver helpfulness, and reliability of the service. Indeed, a large body of evidence based on customer satisfaction surveys reiterates the importance of all of these factors for transit riders (Das and Pandit, 2016; de Oña, de Oña, Eboli, and Mazzulla, 2013; dell'Olio et al., 2011; TCRP, 2013). Finally: affordability of transit fares is crucial, particularly for riders who depend on transit. Indeed, a recent report on the working poor in New York found that fare affordability was the "biggest problem" of the subway system, ahead of delays and crowding (Stolper and Rankin, 2016). While studies have examined equity related to fare subsidies (Hodge, 1988; Serebrisky, Gómez-Lobo, Estupiñán, and Muñoz-Raskin, 2009), little research has focused on the financial affordability of public transit, which is an important aspect of public transit accessibility.

From a societal point of view, an important outcome is the extent to which public transit is able to carry people (APTA, 2016), and more particularly, the extent to which it is able to replace car trips, thereby contributing to reduced motor vehicular activity, air pollution, energy consumption, and improved road safety. Finally, from the viewpoint of transit agencies, it is important that transit contributes to the outcomes of importance to commuters and society at large, while also being financially viable. This is particularly important since public transit agencies in North America typically face significant funding shortages (DOT, 2013). Operating revenue for transit service is derived from a variety of sources, such as government funding, advertisement and other revenues, and importantly, fare revenues. Transit agencies rely a great deal on fares to maintain financial viability; fare revenues contribute up to a third of operating expenses in regions with populations greater than 200,000 people (TCRP, 2009). Besides, fares have outpaced inflation in the United States between 1989 and 1994 (TCRP, 1998). In Canada, limited federal funding means that for transit agencies, operating expenses are mostly covered through provincial funding and locally generated revenues and fares. For example, in Montreal, 41% of the 2016 operating budget (a little over CAD$ 1.5 billion) of the Société de transport de Montréal (STM) came from fares, while 34% came from local and regional governments, and nearly 23% is provided by the provincial government (STM, 2015).

Indeed, urban transit agencies face what might be considered a coverage-service quality-affordability-viability dilemma – that is, a tension exists between the ability of public transit agencies to, on the one hand, provide the coverage and level of service riders expect, and on the other hand, to maintain fares at an affordable level for them, while also being financially viable (Badami and Haider, 2007). Note in this regard that, because of their significant dependence on transit fares, coupled with their increasing expenditures, transit agencies might face intense pressure to increase fares, but fare increases may particularly burden low-income groups as they rely on public transit as their main mode of transport (APTA, 2007; Stolper and Rankin, 2016).

To summarize, multiple, inter-dependent, and often conflicting objectives and perspectives are involved in relation to public transit, and an intricate balance is needed to reconcile these objectives and perspectives. At the same time, it should be noted that public transit objectives valued by one group may also be important to other groups. So, for example, service quality and affordable fares are an important objective not only for passengers but also transit agencies, if they are to attract and retain transit users. Conversely, the financial viability of transit agencies is important not only from their perspective, but also for transit users, who may well be unaware of or unconcerned about this issue; since, after all, the agency's financial health – which might involve increased fares – is important for its ability to continue to provide quality service to commuters, and to contribute to other societal objectives over the long term.

1.1. Rationale, objectives and outline

It would be useful to assess how effectively public transit agencies, and more generally, urban transport systems, address and reconcile the various objectives that we have discussed, that are important to transit users, society and the agencies themselves. Our objective in this paper is to show how a rapid assessment may be conducted in this regard, based on publicly and freely available data reported by public transit agencies, for the largest 14 cities in North America with a population of more than three million inhabitants. In particular, we seek to investigate how effectively the public transit systems in our selected cities reconcile the trade-off between accessibility, service frequency, and comfort and convenience on the one hand, with affordability of fares on the other, which is important from the transit rider's perspective; and the trade-off between affordability of fares on the one hand, and financial viability on the other, which is important from the transit agency perspective.

Our study has the potential to allow transport planners, researchers, practitioners and interested members of civil society to assess and compare the performance of public transit agencies along multiple dimensions, and from multiple perspectives without the need for costly and proprietary surveys (Randall et al., 2007). However, it should be noted that this paper does not offer a comprehensive evaluation or benchmarking study of transit agencies per se.

In the following section, we discuss our methodology, including how we selected our peer cities and transit agencies for our study; how we constructed our measures to capture key outcomes from the perspective of transit riders, society, and transit agencies; and our data sources, and related issues and challenges. In the third section of the paper, we present and critically discuss our analysis of our results, and their significance and implications; this section includes a discussion of how we assessed trade-offs between key transit objectives from the above perspectives, in terms of our measures. In the final section, we discuss how our assessment may be improved upon and expanded in future work.

2. Methodology, data and issues

We limited our analysis to the largest North American cities, with metropolitan populations greater than three million inhabitants, and the main transit service providers in these cities. It is important to note that the population of the core cities themselves may be smaller. We also restricted our analysis to transit agencies that operate at least two modes, namely bus and rail, including light rail, heavy rail (metro or subway), and/or street rail (cable car, streetcar, etc.). Since the main concern of this study is urban transit, we excluded agencies providing commuter rail service only, and therefore, data pertaining to commuter rail for the agencies included in this study. In total, we analyzed data from 14 transit agencies, including two from Canada and 12 from the United States. Table 1 lists, in order of decreasing metropolitan population, the cities and transit agencies examined in this paper.

After selecting our peer agencies, we next turned to choosing measures to capture the key outcomes from the perspective of transit riders, transit agencies and society. In this regard, note that the multi-criteria decision making (MCDM) approach, which has been used to address a range of complex decision problems in a number of policy contexts, is ideally suited for characterizing and reconciling trade-offs and conflicts among multiple conflicting objectives from the perspective of multiple groups in society that are differentially affected by policy impacts. Particular attention is paid in MCDM to carefully developing measures by means of which to reflect, and to evaluate policy alternatives in terms of, key objectives and outcomes from the perspective of various groups (Keeney, 1988, 1992; Keeney and McDaniels, 1992, 1999). Measures are specified as precisely as possible, to capture the meaning of the related objectives; this task is especially challenging for social impacts as in the present case. Further, note that different measures for the same objective reflect different perspectives, convey different pictures of a given situation, and importantly, have different implications for policy choices and outcomes. While measures should precisely capture the meaning of related