Service quality, mode choice, and the cost of travel for morning commuters

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Service quality (limited here to the dimensions of service frequency and service reliability) is a major determinant of demand for public transit (Beirão and Sarsfield Cabral, 2007). Increasing service frequency decreases both the average waiting time and in-vehicle congestion, making the service more attractive for users. Conversely, a decrease in service reliability raises the average waiting time (Bowman and Turnquist, 1981). It has an ambiguous effect on in-vehicle congestion, however. It increases the variability of the passenger load factor, meaning that some vehicles will be more congested, and others less congested (Chen and Liu, 2011).

The role of service frequency on mode choice and the cost of travel is now well understood (Mohring, 1972; Tabuchi, 1993), including the famous ”Mohring effect”. Service reliability has, on the other hand, been the object of less attention in theoretical works. Several works consider the influence of service reliability on the choice of departure time and the cost of travel (Benezech and Coulombel, 2013; Bowman and Turnquist, 1981; Furth and Muller, 2006). However, these works consider neither the influence of service reliability on mode choice, nor the behavior of the public transit operator. Monchambert and de Palma (2014) shed some light on these issues: they compare the level of service reliability at the competitive equilibrium and at the social optimum, as well as the shares of the public and private modes. However, they do not consider service frequency in their study. Moreover, they also fail to consider the impact of service reliability on congestion.

This paper aims to provide a better understanding of the role of service quality in public transit on mode choice and the cost of travel. Staying in line with Tabuchi (1993), we consider a city where workers, who commute between a fixed residential area and the CBD, can choose between two modes: the private car or mass transit. The limited road capacity is represented through the standard bottleneck model. Mass transit operates with a schedule,
with a fixed frequency. The service is not perfectly reliable, however, hence a bounded random delay. The transit operator chooses the service quality and the fare that maximize its profit (monopoly assumption).

We will seek to derive the optimal fare and the service quality at the competitive equilibrium, and the resulting mode choice and welfare for the user. We will then compare it to the first best social optimum, and provide a discussion of the results.

References


