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Using three-factor theory to identify improvement priorities for express and local bus services: An application of regression with dummy variables in the Twin Cities

Xinyi Wu[a], Jason Cao[a,*], Joel Huting[b]

[a] Humphrey School of Public Affairs, University of Minnesota, Twin Cities, United States
[b] Metro Transit, Minneapolis, United States

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ABSTRACT

To overcome the limitations of importance-performance analysis, this study employs the three-factor theory to identify transit service attributes that critically impact overall satisfaction of express and local bus riders. Specifically, Using the 2014 Transit Rider Survey in the Twin Cities, we examine how the performance of service attributes rewards and penalizes riders' overall satisfaction with express and local buses, and classify these attributes into three factors based on their respective contributions to overall satisfaction. We then integrate the factor structure with their average performances to identify improvement priorities. We found that both the importance of service attributes to the overall satisfaction and the improvement priorities differ between express and local buses. Among the tested attributes, "vehicles are comfortable", "total travel time is reasonable", and "reliability" should be addressed first for both local and express buses.

1. Introduction

Customer satisfaction serves as an important indicator of the quality of service in many industries (Aniley and Negi, 2010). In the realm of public transportation, rider satisfaction can inform transit agencies of their service qualities. Identifying key attributes affecting rider satisfaction provides transit agencies targeted strategies to improve the quality of transit service (Cao et al., 2016). Therefore, many scholars use rider satisfaction surveys to study transit service (van Lierop and El-Geneidy, 2016, Eboli and Mazzulla, 2015, Guirao et al., 2016).

Because of its simplicity, importance-performance analysis (IPA)—also referred to as quadrant analysis—is widely used to identify service improvement priorities based on customer satisfaction surveys (CSS). Not surprisingly, many scholars and transit agencies have employed the approach to analyze rider satisfaction surveys (Weinstein, 2000, Figler et al., 2011, Shen et al., 2016). However, IPA has limitations. A prominent one is that it is built upon the assumption that the relationship between the performance of individual attributes and their influence on overall satisfaction with transit is linear and symmetric. This limitation can be addressed by the three-factor theory, which classifies transit attributes into basic, performance, and exciting factors. In particular, basic factors affect rider satisfaction only when they perform poorly; exciting factors have effects only when their performance is high; and performance factors have a linear effect. This three-factor structure relaxes the linear and symmetric assumption and delineates the hierarchy of improvement priorities (Busacca and Padula, 2005, Matzler et al., 2004). Previous studies in other fields have

* Corresponding author.
E-mail addresses: wuxx1088@umn.edu (X. Wu), cao@umn.edu (J. Cao), joel.huting@metrotransit.org (J. Huting).

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successfully illustrated the feasibility of using the three-factor theory to determine the relative importance of different attributes from users' perspective (Füller and Matzler, 2008, Busacca and Padula, 2005). However, its application in the field of transit customer service is scarce.

Furthermore, some studies have explored rider satisfaction with one type of transit services such as heavy rail transit (Shen et al., 2016, Yanık et al., 2017) and bus rapid transit (Deng and Nelson, 2012). On the other hand, some studies mixed two or more types of transit service (Wan et al., 2016). For example, when analyzing rider satisfaction surveys, Figler et al. (2011) treated bus riders and train riders of Chicago Transit Authority homogeneously and then offered managerial implications for transit agencies. However, this practice tends to overlook the difference between different types of transit. When designing a transit system, transit agencies generally set up different service parameters for different types of transit, which are targeted to different riders. That is, the actual service characteristics tend to be different between different services, such as bus vs. train, express vs. local service. Moreover, because various types of transit serve different markets of riders, these riders may have different priorities for service attributes and different perceptions of the same service attribute (Wan et al., 2016). Therefore, it is necessary to differentiate transit types when we use rider satisfaction surveys to study quality of transit service. In this study, we will examine riders' perceptions of express and local bus services in separate models and identify improvement priorities for each kind of service.

Using the 2014 Transit Rider Survey in the Minneapolis-St. Paul (Twin Cities) metropolitan area, this study employs the three-factor theory to answer the following research questions: (1) Do transit service attributes have varying (linear vs. nonlinear) influences on overall satisfaction? (2) How does the classification of the attributes differ by local and express buses? (3) Do express and local buses have different improvement priorities?

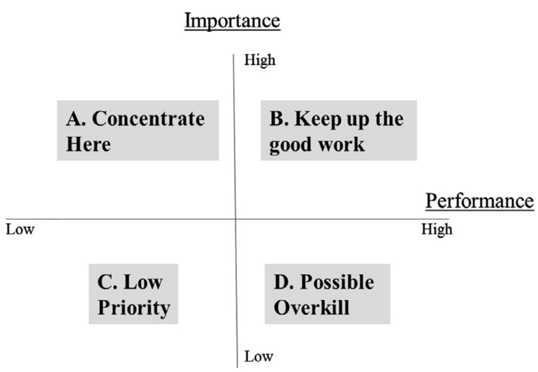
The paper is organized as follows. In Section 2, we review analysis approaches of customer satisfaction of public transit; in Section 3, we introduce the data and the analysis method; in Section 4, we present and discuss our modeling results; and in Section 5, we summarize the key findings and make recommendations for future research.

2. From IPA to three factor theory: a literature review

Public transit plays an important role in reducing auto-dependence and its consequences such as traffic congestion and carbon emissions (FTA, 2016) since a successful transit system can effectively shift auto trips to transit (de Oña et al., 2013). In order to maintain and increase the ridership, it is important for transit agencies to study rider satisfaction and to improve influential service attributes (Cao et al., 2016).

Previous studies employed a variety of methods to investigate the satisfaction of transit users using rider satisfaction surveys. In a review article, de Oña & de Oña (2014) classified these methods into two types based on how the service quality is measured: disaggregated models, which measure service attributes individually; and aggregated models, which aggregate individual attributes to construct an overall service quality index (SQI) or a customer satisfaction index (CSI). Among the disaggregated methods, IPA has been widely used to examine transit rider satisfaction. Martilla and James (1977) firstly devised this method. They grouped service attributes into four quadrants based on the performance and importance of each attribute (Fig. 1). The classification of service attributes in the grid further determines improvement priorities. If an attribute has high importance but low performance, it should be prioritized for improvement (Quadrant A). If an attribute has high importance and high performance, it is classified into Quadrant B and service providers should keep up the good work. If an attribute has low importance and low performance, it has a low priority (Quadrant C). Finally, if an attribute has low importance but high performance, it could be a possible overkill (Quadrant D). Using this technique, many studies have analyzed transit service attributes by cross-tabulating the importance and performance of each service attribute (Shen et al., 2016, Weinstein, 2000, Figler et al., 2011, Stradling et al., 2007).

The key of IPA is to group all service attributes by their performance and importance. Since the performance is usually measured directly in the CSS, the choice of importance becomes a distinction between different types of IPA studies. Some researchers use "derived importance", (i.e., estimated importance based on the coefficients of statistical models), while others used "stated importance" (i.e., respondents' explicit statements on the importance of each attribute in the CSS). Here we present a few example



Source: Adapted from Martilla & James (1977).

Fig. 1. Importance-performance grid (IPA matrix).