



Employer-based travel demand management program: Employer's choice and effectiveness



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ABSTRACT

The impact and effectiveness of employers' travel demand management (TDM) programs have often been investigated, but there is little research on employers' preference of TDM programs and the factors which influence their choices. This study aims to examine employers' choices of TDM program and the effectiveness based on a Seoul TDM database. Factors affecting employers' decisions on whether to participate in TDM programs and the degree of participation are identified based on regression models: binary logistic, ordinary least squares and Tobit regressions. In addition, an employers' TDM program choice model is developed using the approach of the multiple discrete continuous extreme value (MDCEV) model, as an employer can participate in multiple TDM programs, and their individual effectiveness is represented by continuous values of traffic impact fee discount rates. The developed models consistently indicate that facilities' characteristics such as owner type and facility size, along with locational characteristics (e.g., land use and accessibility to transit) are important in choosing a TDM program. In particular, the MDCEV model shows that employers' preferences for TDM programs vary significantly by employer and characteristics of the program.

1. Introduction

An important objective of transport policies in a city is to reduce citizens' car dependency, encouraging alternative modes of travel such as public transit, walk and bicycle. It has been shown that the mode shift from car to alternative modes can be achieved to a substantial degree by various travel demand management (TDM) strategies. Indeed, [James and Brög \(2001\)](#) showed that in South Perth, Australia, a TravelSmart® individualized marketing strategy to convert car trips to walking trips by inducing behavioral changes reduced car usage by 14%. Deployment of carsharing and public bicycle share programs are also considered effective in reducing car trips and car ownership ([Cervero and Tsai, 2004](#); [DeMaio, 2009](#)). Above all, measures focusing on employment sites and commute trips are of importance since they can mitigate peak time traffic congestion, which usually incurs tremendous social costs resulting from excessive travel time and wasteful fuel consumption. Transportation agencies have therefore conceived and implemented various worksite-based interventions in the form of incentives, disincentives and/or marketing ([Dill and Wardell, 2007](#)).

The worksite-based intervention, often called employer-based TDM, is an efficient tool in the effort to reduce car trips as it is relatively easy to

implement, control and track performance ([Hasnine et al., 2016](#)). TDM strategies encompass a wide variety of options including alternative work schedules, guaranteed ride home, shuttle services and vehicle-use restrictions. These strategies are often selectively implemented according to their suitability to the characteristics of the employer (e.g., municipal/local governments and business associations) and particular situations (e.g., geographic conditions, problems to be addressed and the decision-makers involved) ([Litman, 2003](#)). Thus, suitability evaluations under various contexts are inherently important as they can guide employers in the right direction when selecting strategies and implementation approaches. A number of studies point to this, empirically evaluating the effectiveness of TDM strategies ([Brockman and Fox, 2011](#); [Merom et al., 2005](#); [O'Fallon, 2010](#)). Together with these evaluations, an understanding of employers' behavior concerning TDM strategy adoptions can help policy makers identify and develop effective TDM strategies. However, it appears that the behavior of employers has rarely been investigated.

Seoul, South Korea's largest city, has also recognized the need for implementing employer-based TDM programs as traffic congestion becomes a serious social issue, increasing the risk of degrading the quality of life and the health of citizens. The employer-based TDM in Seoul is unique in that employers are incentivized by discounting annual traffic

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impact fees which are charged to facility owners based on the size (i.e., floor area) and type (e.g., commercial or educational) of facility (Ko, 2013). The size and type are generally believed to be the major determinants for traffic induced by the facility. Indeed, the traffic impact fee for a facility is computed by multiplying three factors: total floor area in square meters, facility type weight and unit fee. The facility type weight ranges between 0.47 (for factories) and 9.83 (for department stores). The traffic impact fees can be reduced, proportional to the amount of reduced vehicle traffic resulting from TDM program implementation, as a way to encourage employers to actively support TDM programs. Seoul Metropolitan Government (SMG) considers a set of TDM programs for the traffic impact fee discount and monitors program-by-program traffic reduction effects for target facilities. The monitored results are reflected in the amount of annual traffic impact fees determined, and the results are stored in a TDM database together with pertinent information on the facilities. This database is a valuable resource enabling researchers to investigate the characteristics of employers' TDM participation.

Based on the Seoul TDM database, this study aims to examine the characteristics of the employers' choice of TDM program and the effectiveness of the various programs. For this, two analyses are conducted. The first is to investigate factors affecting employers' decisions on whether or not to participate in a TDM program, and the extent of their participation. These investigations are implemented separately after developing three statistical models of binary logistic regression (for the choice of whether or not to participate), ordinary least square model and Tobit regression (for the degree of participation); a Tobit model is supplementarily considered, as the dependent variable (degree of program effectiveness) is non-negative. The second analysis is to identify the factors which affect an employer's choice of TDM program in a combined manner. For this, the multiple discrete continuous extreme value (MDCEV) model, formulated by Bhat (2005) to handle situations of multiple discreteness combined with a continuous dimension of choice is used, as one employer can participate in multiple TDM programs, and their individual effectiveness is represented by continuous values (i.e., traffic impact fee discount rates). The MDCEV models have been employed for modeling household vehicle fleet composition and usage (Bhat and Sen, 2006; Imani et al., 2014; You et al., 2014) and activity time-use behavior (Eluru et al., 2010; Pinjari and Bhat, 2010), but it has not yet been applied to TDM analysis. This study shows that a number of factors, including facility characteristics (e.g., type and size) and locational factors (e.g., land use and accessibility to transit) can affect the decision of TDM program participation and its effectiveness. More importantly, the program-by-program variations of the effect are identified by the MDCEV model. The results of the models developed are expected to enhance the understanding of employers' TDM participation decisions and TDM effectiveness, helping transportation agencies develop and implement effective TDM programs at worksites.

2. Literature review

A number of studies have shown that a variety of employer-based TDM strategies exist which are intended to stimulate a mode shift for commuting trips (Scheepers et al., 2014; Hasnine et al., 2016; Litman, 2003). One such strategy is a travel awareness campaign which seeks participants' behavioral changes through social marketing and advertising, as shown in "The Walk to Work Day" campaign implemented in Australia to encourage more walking. The effectiveness of the campaign was evaluated by Merom et al. (2005) based on pre- and post-campaign telephone surveys. They found that the participants in the campaign decreased their "car only" use and increased walking combined with public transport. Economic incentives can also act as a stimulus to mode shifts as illustrated by the parking cash-out program in California, USA. The program required employers of 50 or more persons who subsidize commuter parking to offer a cash allowance to employees who are not using their parking spaces due to mode shifts. Shoup (1997) pointed to

the effectiveness of the program based on case studies of eight firms: a decrease in the number of solo drivers and vehicle-miles traveled (VMT) for commuting by 17% and 12%, respectively.

Research has empirically proven that combined TDM measures (implementing several measures together) can lead to increased reductions in car use when compared to individual measures (Eriksson et al., 2010). In line with this, TDM measures of "carrot and stick" are often simultaneously implemented, as illustrated in the Transport Plan of the University of Bristol, UK (Brockman and Fox, 2011). TDM strategies in this plan included limiting parking spaces, increasing parking charges, improving facilities for walkers and cyclists, and providing carsharing and free university bus services. A before-after survey of university staff members revealed significant mode shifts after implementation of the measures: an increase in the proportion of respondents who walk to work from 19% to 30%, and who cycle to work from 7% to 12% (Brockman and Fox, 2011). Despite the fact that the university setting might produce improved outcomes due to the greater work flexibility of staff members and their better understanding of sustainable transportation, the combined TDM measures are advantageous in that they offer more options to replace the use of a car to get to work. Herzog et al. (2006) revealed that comprehensive employee commuter benefit packages, composed of financial incentives, services such as guaranteed ride home and carpool matching, and informational campaigns, resulted in a reduction of trips and VMT by about 15% for surveyed employees in the metro areas of Denver, Houston, San Francisco and Washington DC. These impacts were identified by a survey comparing a commuter group receiving the benefits with another which did not. Such campaign-type approaches are also often combined with physical intervention tools. For example, the "Bike Now" program implemented in New Zealand deployed combined TDM measures to overcome general misconceptions about cycling, while at the same time bicycle facilities were improved, resulting in shifts from car to bicycle by nearly half of the surveyed participants (based on a before-after survey targeting 27 workplaces) (O'Fallon, 2010).

The effectiveness of employer-based TDM programs can vary depending on the characteristics of the employer and/or employees. Zhou et al. (2012) found that employees from a large employer (the University of California, Los Angeles) had more opportunities for carpooling and thus drove alone less often even after factoring in residential location, annual income and commute time. The study also pointed out that different employee groups, usually marked by income levels, may favor different TDM programs. The importance of the income factor was stressed by Loukopoulus et al. (2004) where it was argued that car-user responses to TDM measures were mainly dictated by a cost-minimization principle. The association between income and TDM effectiveness was also noted in Hendricks (2005). In addition to the income effect, the study emphasized the importance of management support and proximity to good transit service for the success of TDM programs. Dill and Wardell (2007) demonstrated through the development of statistical models that worksite locational factors (street connectivity, whether it is located downtown, and accessibility to transit) were critical to the worksite's transit mode share as well as the effectiveness of TDM programs. The study also found a positive relationship between employer size (number of employees) and TDM effectiveness even for worksites with no rail access. These studies suggest that the consideration of the context in which employers are situated is important to understand TDM program's effectiveness and employers' TDM program choices.

With regard to the method of TDM program evaluation, many studies have relied on before-after surveys, identifying behavioral differences after intervention (Brockman and Fox, 2011; James and Brög, 2001; Merom et al., 2005; O'Fallon, 2010). In other instances, the target groups' mode choice changes (or characteristics) were compared with those of control groups (Herzog et al., 2006; Zhou et al., 2012). In addition to these applications of revealed preference (RP) data, stated preference (SP) surveys have been conducted for estimating the expected impact of proposed policies, providing opportunities to quantitatively compare a variety of potential policy options (Eriksson et al., 2010). Potential TDM strategies

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