Chapter 6

Understanding Trip Misreporting Behavior Using Global Positioning System–Assisted Household Travel Survey

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ABSTRACT

Trip misreporting has been a persistent and well-known problem with household travel surveys. Global Positioning System (GPS)-based prompted-recall method provides the opportunity to capture reliable and accurate travel information from the respondents. By comparing the GPS sample with the diary sample, this chapter investigates the pattern and magnitude of trip misreporting behavior, with a focus on shopping and discretionary tours within 15-minutes trip distance. Econometric models are developed to account for trip misreporting in tour frequency models by introducing a sample-indicator variable. The interaction effects of the sample-indicator variable with various personal and household variables are tested, which reflect the influences of these personal and household attributes on trip misreporting behavior. A number of personal and household characteristics showed significant impacts on misreporting, including driver license status, race, person type, household type, household income, and number of household vehicles.

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INTRODUCTION

Trip misreporting has been a persistent and well-known problem with household travel surveys. Various factors could result in misreported trips, such as memory decay, unwillingness to report, travel time round up, and failure to report because the trips were deemed too short, too unimportant, or non-motorized, etc. A simple comparison of ground counts and household travel survey indicated 17% underreporting for single-family residential use (Miller et al., 2006). Various methods have been utilized to derive correction factors to account for trip misreporting. Since the late 1990’s, Global Positioning System (GPS) technology has been used to supplement traditional diary-based travel surveys, for its promising features in capturing travel data with better accuracy and reliability. Earlier applications started with in-vehicle GPS deployment (Austin, 1997; California, 2001; Atlanta, 2001; Los Angeles, 2001, and St. Louis, 2002), which focused on vehicle level trip underreporting. Recently, personal wearable GPS-based surveys become more prevalent (Sydney, 2005; Chicago, 2007; Cincinnati, 2009; Atlanta, 2011; New York, 2011, and Cleveland, 2012).

Although several regions have deployed GPS-based travel surveys, and much literature has studied trip misreporting behavior, it is not always obvious in terms of the best approaches to quantifying the presence and the level of trip misreporting. Earlier studies faced the challenges in retrieving and deriving accurate and meaningful information from the GPS data, some due to the limitations of GPS technologies, such as cold start, signal acquisition, and multipath errors, others due to the complexity of travel movements, including trip ends identification, travel mode and purpose derivation, and joint travel, etc. Different data processing algorithms and measures for trip misreporting may lead to well different results.

In light of the above issues, GPS-based prompted-recall method has become more popular in the context of household travel surveys. Wilhelm et al., (2012) provided a brief overview of the evolution of GPS-based prompted recall surveys, beginning as early as 1997 in Lexington, Kentucky. This method is a hybrid approach that supplements the passively logged GPS data with respondent inputs for verification and gathering of additional details (travel purpose, mode, fares, and traveling companion, etc.). This approach avoids data imputation and other technicality issues, and provides more reliable, accurate and meaningful information.

Taking advantage of survey data obtained through such an approach (GPS-based prompted-recall), this chapter presents a study in exploring trip misreporting behavior. This study focuses on investigating the pattern and magnitude of trip underreporting behavior, and exploring the approaches to incorporating trip misreporting into travel demand modeling. While most existing studies focused on either the survey design and data issues (Bricka et al., 2009; Greaves et al., 2010; Marchal et al., 2011; Stopher & Shen, 2011; Wargelin et al., 2012), or employed simple correction factors at aggregate level, this research goes further in the effort to address misreporting behavior in the demand modeling process. Econometric models are explored in this research to a) examine the contributing factors for trip misreporting at disaggregate level, and b) incorporate trip misreporting directly in trip generation step which enhances the accuracy and performance of the model.

LITERATURE REVIEW

Table 1 summarizes a scan of relevant primarily US studies in trip misreporting, which is built on a report developed by Bricka and Bhat (2006a), with substantial updates that incorporated more recent studies. The table shows the year of the survey, household sample size, whether the GPS survey was vehicle based or person based, and the reported trip misreporting results if available. It