Chapter 2
Implications of Activity Classification Aggregation in Urban Freight Trip Generation Linear Models

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ABSTRACT

This chapter studies the implication of aggregating establishments by categories with different levels of detail for modeling FTG. To this effect, the chapter conducts an assessment of freight trip generation (FTG) patterns homogeneity inside activity-based grouping. The method implemented is econometric in nature, which allows the assessment of the statistical significance of variables representing commercial activity sectors and sub-sectors. The results show that for some sectors the traditional high-level aggregation includes sub-sectors with homogenous FTG patterns and thus produces appropriate models; in some other cases (e.g., retail, manufacturing), the sub-sectors have different FTG patterns and thus more detailed data is needed to calibrate accurate models. This research can be used to enhance the efficiency of data collection, as it identifies some sub-sectors that need larger efforts for data collection, and some other categories where FTG homogeneity allows for less detailed data collection without hampering the quality of the models.

INTRODUCTION

Urban freight demand models are an important tool for urban planners and transportation authorities to assess local needs, design appropriate infrastructure, and define policy interventions. The increasing relevance of this subject in an urbanized world has attracted the interest from both researchers and practitioners with various frameworks and applications. In general, these models start with a demand

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generation stage which include freight generation (FG) and freight trip generation (FTG). FG models measure the freight flows (e.g., tons, volume) that result from the commercial interaction between a shipper and a receiver, and provide an excellent insight to understand economic interactions and the demand for goods movement. FTG models measure the amount of freight-related trips that result from the demand for goods and the logistics decisions of shippers and receivers. FTG includes both freight trip attraction (FTA) mainly resulting from the reception of deliveries by an establishment, and freight trip production (FTP) mainly resulting from shipments sent-out by an establishment (Holguín-Veras et al. 2012). This paper focuses on FTG models because enhancing these models will produce more immediate benefits for well-informed decision making and for more accurate local needs assessment and infrastructure planning.

As urban freight traffic is a direct consequence of commercial activities taking place at the establishment level, it is important to collect primary data at this level and estimate statistical models to capture establishments' freight traffic patterns. FTG models can estimate current freight traffic patterns as well as forecast future freight traffic based on planned commercial activity. One salient characteristic of FTG models is, thus, their reliance on commercial activity categorization.

There are a number of publications in the literature focusing on FTG models (Iding, Meester et al. 2002, Beagan et al. 2007, Holguín-Veras et al. 2011, 2012, 2013, Lawson et al. 2012, Alho and de Abreu e Silva 2014, González-Feliu, Cedillo-Campo et al. 2014, Ducret and Gonzalez-Feliu 2015, Aditjandra, Galatioto et al. 2016, Gonzalez-Feliu, et al., 2016; Sánchez-Díaz et al. 2016a,b; de Oliveira et al., 2017; Gonzalez-Feliu, 2018), most of them use either land-use or industry classifications to group establishment that perform similar commercial activities and estimate either constant rates per employee (Iding et al. 2002, Beagan et al. 2007, Holguín-Veras et al. 2011, 2013) or econometric models for each group (Holguín-Veras, Jaller et al. 2011, González-Feliu, Cedillo-Campo et al. 2014, Ducret and Gonzalez-Feliu 2015, Sánchez-Díaz, Holguín-Veras et al. 2016). In general, the classification systems are borrowed from the ones used by National offices to produce economics statistics. These classification systems use a digit-based nomenclature—where a larger number of digits in the code denotes a more disaggregated category with a more specific activity—that provides the framework for collecting and presenting extensive statistical data according to the economic activity used in other fields of economic statistics (e.g., production, employment) (Eurostat 2016). Similarly, when used for modeling purposes these classifications have different levels of detail and entail different modeling implications. Models estimated with more aggregated categories have less detail, high risk of heterogeneity within the modeling group, but require less data; while models estimated with more disaggregated categories have a higher level of detail but require a substantial amount of data (Holguín-Veras, Jaller et al. 2011).

The criteria used to group establishments under a certain aggregation level are often based on the premise that businesses with similar commercial activity have similar FTG patterns, and on practical reasons, such as, the convenience to use secondary data sources available at higher aggregation levels. Recent works address the impacts of aggregation level on model's quality, either for linear (Gonzalez-Feliu et al., 2016) and nonlinear (Sanchez-Diaz et al., 2016a) models. Those works state on the importance to further analyzing heterogeneity and a first exploratory analysis is provided in Sanchez-Diaz et al. (2016).

This chapter proposes an econometric approach to assess the implications of using different aggregation levels within each industry for FTG modeling. Since linear models are the most common and easy to understand, as well as to decompose in sub-models, we focus here only on linear models. The results from this study will be instrumental to design more efficient data collection frameworks, because the results will allow to identify industry sub-sectors that require higher level of detail and thus more data,