**SPR 760: Literature Review Report (First Draft)**

**2/7/2014**

In this report, we review literature that relate to the construction of travel market baskets and the estimation and aggregation of travel costs. This review serves to provide background and guidance for the two objectives of this project: developing robust definitions of the transportation market baskets to be used in the calculation of the Transportation Cost Index (TCI); and to develop robust methods for calculating and aggregating multi-modal travel cost to access each defined market basket (auto, public transit, walk, bike) and by different household market segments.

**Transportation Market Basket**

The term market basket refers to a fixed list of items used specifically to track the progress of inflation in an economy or specific market. The most common type of market basket is the basket of consumer goods, used to define the Consumer Price Index (CPI). This is intended to track the prices of consumer goods and services, i.e., it is a sample of goods and services, offered at the consumer market. The consumer basket is the base for the definition of the Consumer Price Index (CPI). we closely examined the methodology involved with estimating the CPI. The CPI was developed by the Bureau of Labor Statistics (BLS) in 1919 to characterize the rapid increases in necessary cost-of-living adjustments (COLA) during World War I (BLS, 2007). Three of the main CPI series include CPI for All Urban Consumers (CPI-U), Chained CPI for All Urban Consumers (C-CPI-U) and CPI for Urban Wage Earners and Clerical Workers (CPI-W). The underlying framework that describes the construction of the CPI is similar to the conceptual framework employed for the TCI: “*What is the cost, at this month’s market prices, of achieving the standard of living actually attained in the base period?”* The BLS distinguishes between an *unconditional* and a *conditional* form of cost-of-living indices. An *unconditional* index would reflect changes in non-price factors such as changes in “crime rates, weather conditions, and health status” in addition to price-related changes. However, the CPIs estimated by BLS are limited to *conditional* cost-of-living changes that include “only the price of market goods and services or government-provided goods for which explicit user charges are assessed”.

Reiff and Gregor (2005) developed definitions of market baskets of travel destinations based on the model components and data in the travel demand model in their Transportation Plan Performance Measures study. For each trip purpose in the travel model, they first define a reference market area as a TAZ within the urban area and a set of zones located around the TAZ that represents a large number of destinations. The cumulative attractiveness of destinations within the reference market area measured with components of the destination choice model is the reference market basket The reference market area may be identified through the use of expert judgment or through a structured analytical process. While a TAZ within urban area and its surrounding zones may work well for as reference market area for a small urban area, it may not be robust in application to a large metropolitan area, a likely limitation that we will explore in SPR 760.

Since then, Diana and Mokhtarian (2009) have defined “modal baskets” as an individual’s transportation modal mix, but we are unable to identify additional research relating to the development of transportation market baskets either on an individual level or based on a geographical region.

The main objective of developing TCIs is for policy makers and stakeholders to be able to understand the distribution of transportation costs for different trip purposes in a specific geographic location. In keeping with this main objective, it is reasonable for the transportation market basket to follow the CPI methodology of including only *conditional* transportation costs which are explicitly charged to the users of transportation.

**Transportation Costs**

Transportation costs are characterized in the economic literature as trade-offs of scarce resources, such as money, time or land. These costs can be categorized into internal costs (also known as private or user costs) and external costs, which can be aggregated to equal the total social cost (Litman and Doherty, 2009). Both internal and external costs can then be subdivided into variable costs (incremental costs that are usually associated with level of consumption or miles traveled) and fixed costs (costs that are not affected by level of consumption). Internal costs of transportation typically involve costs that are directly incurred by the user or consumer of transportation, whereas external costs of transportation involve costs that are imposed on other travelers (e.g., congestion costs or crash damages) or others who may not be involved in the provision or consumption of transportation (e.g., air pollution or noise pollution). Litman and Doherty (2009) further point out issues associated with choosing a discount rate for future costs, incorporating variability and uncertainty, and the complications associated with ‘conservative’ cost estimates that only include easily quantifiable costs (such as fuel costs or travel time) and ignore intangible ones (such as environmental impacts of various emissions or social disparities).

Once a travel market basket is defined for a certain trip purpose, transportation costs associated with the transportation market baskets may include costs that are associated directly with travelers who undertake the trip, both internal and external. Researchers such as Bhat (1995; 1998a; 1998b; 2000), Hensher (1994), Anas (1981; 2007), Kahn et al. (1981), Train and McFadden (1978), Train (1980;), Gillen (1977), Louviere (1988), Louviere and Hensher (1982), Zhao et al. (2013) and Pinjari et al. (2011) have extensively studied transportation choice. User costs of transportation, costs of alternative (substitute) modes and travel time (and other related time spent) have been found to be primary determinants of transportation choice.

Reiff and Gregor (2005) derive travel costs from “access utilities” calculated for the destination choice model. The access utilities measure the perceived “costs” of traveling between TAZs by trip purpose, income group and travel mode. The model-derived costs are converted into monetary units and are aggregated across travel modes and averaged across the market place for the TAZ. The cost by travel mode is then combined into one representative cost to be averaged across each TAZ market place.

In addition to model-derived cost calculation, we examine the transportation cost literature summarized by Litman and Doherty (2009) from 1975 to 2012.

For travelers who drive private motor vehicles, their transportation cost includes marginal internal costs and marginal external costs. Marginal internal costs can be defined as the costs to the traveler for each mile traveled, such as vehicle operating costs (i.e. fuel costs), vehicle depreciation costs, time costs and parking fees; marginal external costs includes social costs (i.e. congestion, land use alterations, safety/accidents, public infrastructure and energy) and environmental costs (i.e. air pollution, water pollution, noise & vibration pollution and greenhouse gas/climate change) (Keeler et al., 1975; Hanson, 1992; MacKenzie et al., 1992; Lee, 1995; Delucchi, 1996; Sansom et al., 2001; Quinet, 2004; Jakob et al., 2006; Clarke and Prentice, 2009; Smith et al., 2009; Becker et al., 2012).

Public transportation includes options such as bus, light rail, heavy rail and streetcars. Public transportation marginal internal costs include the same costs as those for motor vehicles, except that vehicle operating costs and depreciation costs are substituted by public transit fares; and marginal external costs also include social costs (i.e. public infrastructure and accidents) and environmental costs depending on the situation (Keeler et al., 1975; Miller and Moffet, 1993; Black et al., 1996; Decoria-Souza and Jensen-Fisher, 1997; Ellwanger, 2000; NZMOT, 2005).

Active transportation modes such as walking and bicycling incur marginal internal costs such time costs, bicycle operating cost and health impacts due to environmental exposure or accidents, but do not include the marginal external costs associated with motorized travel such as air pollution or greenhouse gas emissions (COWI, 2009; Land Transport New Zealand, 2006). Oja et al. (2011) found strong fitness benefits and moderate benefits in reducing cardiovascular risk factors (inconclusive benefits for others) in a review of studies on the health benefits of cycling, while Wanner et al. (2012) found limited evidence that active transport leads to higher levels of physical activity and lower body weight after screening more than 14,000 references and reviewing 36 unique studies.

It is important to note that the geographic scope, time period evaluated, traffic conditions (i.e. urban/rural, peak/non-peak or overall) and chosen discount rate may significantly influence the magnitude of these costs. Smith et al. (2009) examined several modes of transportation including private car, bus, rail and active modes such as walking and cycling to characterize costs and benefits for the New Zealand Transport Agency, and conducted case studies of urban areas in New Zealand, Australia and the United Kingdom. The authors’ conclusion echoes “context specific” nature of transportation costs and provision.

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