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Transportation Expenditure Frontier Models in Jakarta Metropolitan Area

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Abstract

The aim of this study is to explore how the household spends the money for transportation as well as how life stages and related household attributes contributed to transportation fee expenditures in Jakarta Metropolitan Area. The substantial characteristics of household attributes among life stage categories are taken into consideration. The analysis was performed using Stochastic Frontier Model, and the concept of production frontier is adopted to estimate transportation expenditure frontier (TEF). TEFs are treated as unobserved production frontier that influences the actual transportation fee expenditure observed in transportation survey. By utilizing data sets provided by Study on Integrated Transportation Master Plan (SITRAMP, 2004) in Jakarta, households which include person who commute to the target area were extracted. TEFs were estimated for each household life stage category in order to investigate the different constraints of them. From the comparison analysis of TEFs, it was shown that considerable differences in average of TEFs among them in particular larger amount of TEFs is found for single-person and families only with adults. These results mean that the TEF is influenced by household attributes and life environments.

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Keywords: stochastic frontier model; transportation fee expenditure; life stage; household attributes

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1. Introduction

In fact, as most of metropolitan area is suffering from urbanization, Jakarta underwent substantial changes in the recent decades. With the darting of economic growth lead to rapid urbanization, metropolitan areas expanded outwards with the suburb absorbing much of the influx population. Jakarta probably the largest metropolitan area in South Asia region, as known as Jakarta Metropolitan Area (hereafter the “JMA”), is the capital region of Indonesia. The JMA has the largest population and economy of the nation. According to Bureau of Statistic (BPS, 2010) the gross regional domestic product (GDRP) is estimated approximately at US\$ 118.7 billion or equal to 19 percent of the gross domestic product (GDP). Furthermore, the population of the JMA has 10% of population of the nation. The population of the region has increased 1.6 times in 20 years; from 17 million in 1990 to 28 million in 2010 (JUTPI, 2012).

Along with development of motorization, promising economic growth and aftermath of rapid urbanization, people’s lifestyles are more and more spending time on the journeys. Spending more time on travelling has significant effect on consuming travel cost for their routine travels. It is ongoing debate that the changes of society, technology, incomes, attitudes, social demographic, and household structure have been hypothesized having significant influence on travel time expenditure. Prior studies for instances Predergast et al. (1981), Gunn (1981), and Toole-holt et al. (2005) explored travel time consumed by person per day, per year and different ages of people. They noted that middle ages (between 21 and 64) spent more time on travelling than those who are earlier or above retirement ages. Yet, compared to travel time expenditure, transportation fee expenditure is much less discussed in the literatures. In fact, transportation cost has significant influence on how household spends the money for their transportation. Almost all past works have been done to examine travel expenditure based on aggregate studies. The descriptive analysis and simple linear regression are often used to verify the stability of travel expenditures. Additionally, Zahavi et al. (1980) indicated that an average car owning household spends about 10-11% of its income on their travel. While, an average non car owning household spent about 3-5% of their income on travel. They found that travel expenditure rise with increasing motorization. Gunn (1981) investigated the percentage of expenditure spent on the transportation among different time of the year constraints. Transportation expenditure tended to be higher in the second and third quarter of the year compared to those in first and four quarters. Moreover, Tanner (1980) stated that generalized travel expenditure per person has increased over the years, and appreciably faster than their real income. Perhaps more recently, Moktarian and Chen (2004) studied on travel time and travel money based on aggregate levels. They concluded that individual travel time expenditures is strongly related to individual and household characteristics, attribute of activities and destinations, or even the characteristics of residential areas. Coincidence to the concept of Moktarian and Chen (2004), Banarjee et al. (2006) used the household attributes to explore the travel time expenditure by utilizing national household travel survey in United States, India and Switzerland. They found that comparison of average travel time frontier across the international contexts showed quite differences values.

In sum, household attributes are being recognised to have significant influences to the characteristics and behaviour of travellers in particular related to the travel expenditure. Therefore, this study intends to clarify how the household spend the money for transportation as well as how life stages and related potential attributes contributed to transportation expenditures. The substantial characteristics of household attributes among life stage categories are taken into consideration. The analysis was performed using Stochastic Frontier Model, and the concept of production frontier is adopted to estimate transportation expenditure frontier. The remainder of this paper is organized into several sections that serially depict the model development, data sets, aggregation and profiles, modelling result, discussion and conclusions.

2. Model Development

Stochastic frontier models (SFMs) were originally introduced by Aigner et al. (1977) thence SFMs have become a popular in the econometrics field. In its original of SFMs can fit stochastic production or cost frontier models. In this study, the concept of a production frontier is adopted and so-called transportation expenditure frontier (TEF). TEF represents of the maximum amount of money which is an individual willing to allocate in a month for their transportations. By considering unobserved transportation expenditure is always greater than or equal to the

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