



Spatial microsimulation modelling for retail market analysis at the small-area level

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Abstract

The purpose of this study is to construct a spatial microsimulation model known as the spatial microsimulation approach for retail market analysis (SMARMA) in order to analyse the retail market at the small-area level in Kusatsu City, Shiga Prefecture, Japan. In this study, we focus on examining the following issues. First, we attempt to create synthetic household microdata from a consumer questionnaire survey using both reweighting and imputation approaches. Second, we present the manner in which the results of the spatial microsimulation model are used for market analysis with regard to grocery stores. Market shares, turnover ranking and detailed consumer characteristics for selected stores are examined. In particular, the spatial distributions of households and their shopping behaviour are discussed in order to identify variations in consumer characteristics. As a result, this study shows that a spatial microsimulation model can generate detailed and reliable synthetic microdata from a consumer questionnaire survey. Besides, it is confirmed that this model is a highly relevant approach for implementing market analysis at the small-area level.

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1. Introduction

In recent decades a wide variety of data sets on the demographic, socioeconomic, lifestyle and shopping characteristics of consumers have been increasingly available for understanding local market conditions. For example, point of sale (POS) data are collected by retailers to record the purchasing details of customers. Census statistics and geodemographic data (in systems such as ACORN and MOSAIC) provide detailed information about residents at the small-area level. Retailers or other public/private bodies have also conducted a large number of questionnaire surveys. Each of these consumer databases contains a large number of samples and detailed attributes. However, the use of such databases alone is often not adequate to capture complex consumer's shopping patterns. The survey data sets often suffer from some limitations involving questionnaire items, geographical details and representativeness of samples (Webber & Longley, 2003). As Grimshaw (1994) points out, data depth, which indicates the degree of data detail, and data breadth, which indicates the availability of data, cannot often be satisfied at the same time. To overcome this situation, we need to develop an efficient method for linking different data sources so that we may attain more comprehensive and reliable understanding of local market conditions. This study presents a spatial microsimulation approach for retail market analysis to respond to this particular challenge.

Microsimulation is an analytical simulation framework based on individuals and households (including firms and organisations). First, it creates a large sample database. Thereafter, the distributional impacts of socioeconomic policies that affect each individual differently can be evaluated. Spatial microsimulation modelling is particularly useful for investigating the geographical inequality of socioeconomic policy impacts on households in different locations. The use of spatial microsimulation modelling for retail market analysis in this paper is disaggregated into two parts.

The first task is to generate detailed and reliable household microdata with locational information for retail market analysis by combining a consumer questionnaire survey with other regional statistical tables. Consumer questionnaire surveys are often administrated by retailers and other research companies. However, these surveys have certain limitations. For example, due to cost limitations for surveys and issues relating to confidentiality, such questionnaires are samples only and are frequently not adequate for capturing complex consumer behaviour. Even census surveys may be inadequate for certain purposes. For example, information on income and expenditure is not available at the small-area level, although there exists a demand for such income information in both the commercial sector and the academic community (Birkin & Clarke, 1989). In many cases, questionnaire surveys also contain sampling biases due to the selective nature of the responses. Since such data do not represent the total population, it may cause the overestimation or underestimation of certain segments of individuals. It is therefore necessary to adjust for such biases before implementing any spatial analysis. Using a spatial microsimulation approach, we attempt to tackle these issues and therefore enhance the utility of sampled microdata. In particular, we assess whether household microdata can be constructed synthetically using a questionnaire survey conducted in a particular area rather than from a large publicly available microdata set.

The second task is to examine the merits of a spatial microsimulation model for implementing detailed market analyses and marketing strategies. Recently, local marketing strategies such as geomarketing and micromarketing have been adopted by leading

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