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Spatial access to pedestrians and retail sales in Seoul, Korea

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ABSTRACT

The retail sector plays a significant role in urban economic development, smart growth policies with mixed land use, and retail desert issues. In addition, urban policies and designs for pedestrian-friendly urban settings have become a dominant paradigm to reshape urban environments. As retail sales depend considerably on the volume of neighborhood pedestrians, the link between pedestrian mobility and retail sales has been a key issue in studies, designs, and economic development of urban areas. Despite the importance of the topic, few empirical studies have examined how pedestrian volumes along street networks affect retail prosperity in urban spaces. Hence, this study investigates the effect of accessibility and centrality to walking volume on retail sales in Seoul by considering pedestrian volumes and street network configuration concurrently. Multilevel regression models confirm that spatial access to pedestrians has differing effects on retail sales according to the type of retail sector. Specifically, a higher accessibility to and visibility of retail stores for walkers tend to improve the sales performance of all retail types. Further, the sales of the Medical Services and Education sectors are remarkably sensitive to the combined effects of pedestrian and street configuration, unlike those of the three other sectors, namely Food, Retail, and Services.

1. Introduction

The retail sector plays a significant role in urban economics and spatial structures, smart growth policies with mixed land use, and retail desert issues. Several studies have confirmed that the development and decline of retail activities change local economic well-being, spatial land-use patterns, and urban mobility (Glaeser, Kolko, & Saiz, 2001; Lang, 2003). On the other hand, as cities face chronic and serious urban issues such as traffic congestion, energy overconsumption, environmental pollution, and climate change, mixed land use has become an effective tool to facilitate the access to different land use and to promote walking as an alternative to automobiles (Handy, 2005; Song & Knaap, 2004). Further, the existence of retail deserts implies less access to retail stores in low-income and socially disadvantaged areas (Schuetz, Kolko, & Meltzer, 2012). As public goods, retail stores constitute local amenities for residents and workers. Less access to retail stores generates severe social equity issues for the elderly, low-income groups, and disabled consumers (Guy, 2006). Accessibility to retail stores is a key measure of the adequacy of retail services and must be considered in urban policies and designs that address retail deserts.

Creating walkable cities has been an important urban issue because such cities offer certain advantages such as lower automobile usage, more opportunities for local shopping and social cohesion, and improved health for citizens (Kang, 2015). Many urban researchers, planners, and designers have focused on the determinants of walkability and pedestrian-friendly cities (Talen & Koschinsky, 2013). Recently implemented urban policies and designs for such cities have provided a highly favorable urban setting for retail sales. While developing policies to address retail development and walkability, it is necessary to understand the spatial relationship between retail economic performance and pedestrian volume.

The endogeneity issues between pedestrian volumes and total retail sales have been debated as an indicator of the urban economic fabric. Although the relationship between the two is interactive, and not unidirectional, most studies focus on the effects of pedestrian flows and walking environments on retail locations and sales owing to the importance and power of walking behavior and environments in shaping a city (New York Department of Transportation, 2013; Sullivan & Adcock, 2002). Further, a few policy studies have also confirmed that higher walking activity and better walking conditions increase retail sales in the neighborhood (Litman, 2014). Studies on the relationship between walking environments and retail economic performance implicitly assume that

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more pedestrian-friendly environments attract more walkers, generating higher retail sales. However, researchers are yet to arrive at a consensus that better walking conditions always increase pedestrian volumes. Two recent studies on walking in Seoul found different effects of walking environments on walking from those suggested by previous studies (Kang, 2015; Sung, Go, & Choi, 2013). Thus, empirical studies need to control for walking activities and walking conditions concurrently.

A literature review reveals that few studies have investigated the different effects of walking activities and walking conditions, controlling for other relevant variables. This study is unique in that it attempts to analyze the effects of accessibility and centrality to pedestrians on retail sales, controlling for walking conditions and urban environments.

As emphasized previously, walking, as an activity, and walkability, as a condition for walking, are different issues (Litman, 2003). Higher walkability does not always generate more walking. Thus, we review the relevant literature on both walkability and walking. Many studies estimate the effects of walkability on economic value in areas such as property value, personal health and income, mixed urban development, and retail sales. Recent studies have shown that a walkable urban setting is associated with higher property value (Sohn, Moudon, & Lee, 2012). Further, a higher Walk Score, which is a measure of walkability, increases the value of residential and commercial property (Cortright, 2009; Pivo & Fisher, 2011). Other effects of walkable neighborhoods on economic value involve the foreclosure risk of households with more cars and a lower access to public transport (Moudon et al., 2006; Rauterkus, Thrall, & Hangen, 2010). Furthermore, a walkable urban setting leads to higher mixed land use and housing development (Ellen & Voicu, 2005; Tatian, Kingsley, Parilla, & Pendall, 2012). The section titled "Description of Variables" introduces the specific conditions for walking according to prior studies.

While a few studies investigate the relationship between walkable streets and the spatial variation of retail sales, most focus on the association between street configuration and retail location for profit maximization. A walker-oriented street network configuration with lesser automobile usage generates spatial variation in retail turnover (Hass-Klau, 1993). As the location and economic performance of retail stores depend on local pedestrian volume along street networks, the effects are different between large and small stores. On the other hand, a higher proximity to retail stores and owning bikes promote walking and cycling behavior (Krizek & Johnson, 2006). As pedestrian access to retail stores is important for the economic performance of local businesses, downtown development plans utilize pedestrian-friendly urban structures (Robertson, 1993). Such urban structures tend to increase people's willingness to walk to retail stores (Schneider, 2015). A few studies have analyzed how pedestrian-friendly urban structures in the United States alter retail sales. New York City's Department of New York Department of Transportation (2013) confirmed that a project for pedestrian-friendly streets increased retail sales in the relevant area according to a comparison of retail performance between impacted and non-impacted zones. Further, Leinberger and Alfonzo (2012) show that walkable neighborhoods generate higher retail sales and rent by attracting more pedestrians.

Other studies relevant to retail location have confirmed that higher centrality and connectivity along street networks substantially explain the spatial distribution of retail activities (Scoppa & Peponis, 2015). Specifically, higher betweenness centrality is associated with more clustering of retail and service activities (Porta et al., 2009). The response of retail location to street configuration varies by retail type. Among retail stores, specialty stores and department stores considerably preferred to have a more accessible location (Wang, Chen, Xiu, & Zhang, 2014). Another study verified that locations with busier streets and higher building density were favorable for retail and food stores (Sevtsuk, 2014). The local contexts generate different connections between spatial patterns of retail and street network structure. While retail stores in older cities tend to cluster in main roads and streets, the stores in newly planned towns are more likely to spread across planned areas (Omer & Goldblatt, 2015).

We need to examine the relationship between walking activities and retail sales, controlling for walking conditions and other factors, for several reasons. First, city leaders and citizens increasingly recognize the influence of pedestrian behavior and environments on direct and indirect benefits of higher urban mobility, transportation cost savings, efficient land use, neighborhood livability, better public health, local economic development, and social equity. Second, creating pedestrian-friendly environments for urban revitalization and sequentially increasing walking activities have local impacts on not only residents and local businesses but on a city as a whole. Thus, it is critical to measure the positive and negative effects of creating effective urban designs for pedestrians and to predict the outcomes of relevant urban policies and designs. Finally, as an indicator of local economic vitality, retail sales clearly respond to changes in pedestrian volume and a walkable street configuration.

To summarize, while numerous studies show that walkability has a positive effect on neighborhood property value, personal health, individual income, urban development, and retail sales, few studies investigate how walking activities combined with the street configuration determines the health of local businesses. This unexplored hypothesis is empirically testable because walkable cities and local economic vitality have been central issues to urban policy and design. Further, few studies have tested the combined effects of pedestrian volume and street network configuration on retail revenue by types.

This study aims to fill this gap in the literature by analyzing the combined effects of pedestrian volume and street configuration. Furthermore, we compare the various effects of spatial accessibility and centrality to walking volume on retail sales in Seoul and test five unique spatial accessibility and centrality effects. To study the combined effects of walking volume and street network layout, we apply the spatial accessibility and centrality indices to identify the differing effects on retail sales under a single research framework. Moreover, we analyze the different effects of the five indices on retail sales according to the type of retail sector. Few studies have attempted to separately analyze the effects of walking activities and walking conditions on local business performance. This study controls for walking volume and walking conditions in one model to isolate the effects of pedestrian volume on retail sales.

The rest of this paper has four sections. The first section addresses the study area and data sources used for the econometric tests. The second section provides the motivation behind measuring spatial accessibility and centrality and details about variables in the multilevel regression models. The third section interprets the model results, focusing on how spatial accessibility and centrality to pedestrians affect retail sales. The final section summarizes the results and suggests policy implications.

2. Study context and data sources

Seoul's main economic sector evolved from secondary to tertiary since the 1970s. The 2011 industry data show that the tertiary sector accounted for 88.9% of Seoul's industry. In the tertiary industry, wholesale and retail, accommodation, and food and beverages have become dominant industries. In 2011, wholesale and retail accounted for 32.0%; accommodations and food and beverage, 17.7%; transportation, 13.6%; other services, 10.3%; and