



# Relationships between the online and in-store shopping frequency of Davis, California residents



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## ABSTRACT

The growth of online shopping will likely impact rates of in-store shopping, signaling potentially significant ramifications for shopping-related vehicle travel. To better understand this relationship, we studied shoppers in Davis, California using a comprehensive survey dataset to explore the effect of personal characteristics, attitudes, perceptions, and the built environment on the frequencies of shopping online and within three distinct shopping settings. Overall, results showed that attitudes and perceptions played an important role in the shopping decision. The ordered response models of shopping frequency also revealed that the shopping motivations for each setting differed. Most notably, many of the factors influencing the frequency of shopping outside Davis had the opposite effect on shopping within Davis. Joint copula models subsequently suggested that online shopping had a complementary relationship with in-store shopping frequency, even after controlling for demographic variables and attitudes. Rather than reducing shopping travel, it appears that online shopping is associated with higher in-store shopping rates.

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## 1. Introduction

Online shopping has grown rapidly in recent years, progressing from what was once a niche activity to an influential driver in the retail marketplace. Although traditional stores still dominate retail market share, online retail sales were approximately \$300 billion in the United States in 2014, more than an order of magnitude higher than in 2000 (U.S. Census Bureau 2015). The growth of online shopping is likely to impact rates of shopping travel, which could have significant ramifications for vehicle congestion and emissions. The 2009 National Household Travel Survey (NHTS) revealed that shopping activities were responsible for approximately 20% of all household trips and 15% of vehicle miles traveled in the United States (Santos et al., 2011). Given the substantial share of vehicle travel resulting from shopping trips, it is critical to understand the relationship between online and in-store shopping.

There is also growing evidence that online shopping encourages shopping travel (Farang et al., 2007; Cao et al., 2012; Zhou and Wang, 2014), but more research is needed to verify this assumption for different study areas and populations. Because earlier studies have generally considered all in-store shopping trips equally, it is unclear whether these effects vary

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depending on the location or type of in-store shopping. A reasonable hypothesis, for example, is that online shopping is more likely to substitute for shopping trips requiring longer travel distances. Few studies have considered these kinds of differential spatial effects on online shopping behavior and conclusions are inconsistent (Cao, 2009).

To explore these issues, we use a flexible copula-based approach to model the shopping behavior of Davis, California residents. The findings provide new insight into the differences in factors influencing shopping behavior by setting, and the interactions between online and in-store shopping.

## 2. Literature review

### 2.1. Online shopping determinants

During the last decade, various research efforts have examined the factors influencing online shopping behavior. A recent study employing the same Davis dataset used in the present paper revealed that after controlling for other sociodemographic variables, age and income were the primary factors influencing online shopping likelihood (Lee et al., 2015). These findings were generally consistent with other research, which has revealed that online shoppers tend to be younger, more highly educated, and have higher incomes (Soopramanien and Robertson, 2007; To et al., 2007; Hashim et al., 2009; Burkolter and Kluge, 2011; Cao et al., 2012). Lee et al. (2015) also found that online shoppers tended to have a more favorable perception of technology and a greater preference for active travel modes.

Findings from the literature show conflicting results for the effect of gender on online shopping. Some researchers have found that women are more frequent online shoppers than men (Ren and Kwan, 2009; Sener and Reeder, 2012), though men tend to have more positive attitudes towards online shopping (Hasan, 2010; Passyn et al., 2011). Other researchers have reported minimal to no gender effect. For example, the findings of Lee et al. (2015) supported the notion that men tend to have slightly more favorable opinions of online shopping than women, but were no more likely to shop online, as was also found by Lian and Yen (2014).

Urban residents tend to have a higher online shopping likelihood (Pérez-Hernández and Sánchez-Mangas, 2011; Sener and Reeder, 2012), but few studies have comprehensively investigated built environment effects on online shopping. Ren and Kwan (2009) related the number of nearby shopping opportunities, the proportion of the population that is white, and population density to online shopping frequency, but the impact of these effects was minimal. Krizek et al. (2005) also tested several built environment measures to predict online shopping frequency in several large U.S. urban areas, but none were significant. Similarly, Lee et al. (2015) did not detect any relationship between online shopping likelihood and shopping center accessibility.

The decision to shop online or in a store will also depend on the type of product being purchased. For example, consumers are more willing to purchase books online than shoes or food, though traditional stores still tend to be favored across most product categories (Kacen et al., 2013). While non-physical items such as airline e-tickets or software downloads strongly favor the online shopping environment, other products may favor one or the other depending on the trade-offs between convenience, price, selection, and service (Levin et al., 2005). Given that purchasing and product research do not necessarily require a trip to the store, online shopping can reduce the travel burden on consumers. The benefits of online shopping must also be weighed against its disadvantages, such as shipping costs, shipping wait times, and the inability to inspect products in-person. In general, the most frequently purchased products online are non-daily discretionary items such as books, CDs, travel, clothing, and electronics (To et al., 2007; Ren and Kwan, 2009). Everyday maintenance items, like groceries or gasoline, are primarily purchased offline. In particular, perishable goods or products requiring immediate possession will favor in-store purchase, as will products benefitting from being evaluated in-person.

### 2.2. Online shopping and travel

Online shopping can influence shopping travel through one of three mechanisms: substitution, complementarity, or modification (Mokhtarian, 2002). A net substitution effect would imply that some portion of in-store shopping trips was replaced by online purchases, reducing overall travel. Conversely, a complementarity effect would occur if online shopping encourages additional shopping-related travel, for example if online purchasers exploited online shopping time or money savings to conduct additional shopping trips, or if locating an item online led to a trip to the store to examine and test it or to purchase accessories, or if an item bought online would not have been purchased otherwise (but generated delivery travel). Modification indicates that some aspect of the shopping trip was altered, without affecting the decision to make the trip itself. A shopper might modify a trip by making it at a different time of day or deciding to visit a different store. A fourth possibility is that of no (net) impact, or neutrality. To be sure, store shopping can also influence online shopping in much the same way: it may substitute for purchasing an item online, it may lead to related online purchases (as when a “free rider” [Couclelis, 2004] or “showroomer” [Rapp et al., 2015] views and tests a product in the store but then purchases it online, or when the main item is bought in a store but accessories are purchased online), it may modify online shopping behavior, or it may have no impact.

Of course, substitution, complementarity, and modification do not act unilaterally. Weltevreden and van Rietbergen (2009) analyzed shoppers in the Netherlands, finding evidence for both substitution and complementarity. Approximately

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