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Offline social interactions and online shopping demand: Does the degree of social interactions matter?

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ABSTRACT

Offline social interactions and online shopping each have been studied extensively. Despite the importance of each construct, little is known about the effects of offline social interactions on online shopping. This study examines three research questions: (1) how offline social interactions affect online shopping in general, (2) how active and passive offline social interactions exert different influences on online shopping, and (3) how online shopping preferences moderate the influences from the two types of offline social interactions. Our empirical analyses provide three substantive findings. First, overall offline social interactions have a positive impact on online shopping demand. Second, while active offline social interactions have a positive informational influence on online shopping demand, passive offline social interactions have a negative normative influence on it. Third, online shopping preferences weaken both the positive informational and negative normative influences from both of offline social interactions. We also discuss theoretical and managerial implications.

1. Introduction

Consumers are influenced by their social interactions before making purchase decisions (Chen, Wang, & Xie, 2011; Godes & Mayzlin, 2009; Lee & Bell, 2013; Ong & Yap, 2017). Motivation for social interactions may be to reduce perceived risk and to make better purchases by getting information and sharing experience (Choi, Bell, & Lodish, 2012; Gu, Park, & Konana, 2012; Lee & Bell, 2013; Lewis, Brown, & Billings, 2017). Note that information from offline social interactions can be perceived to be more reliable, as they (as we define them here) are based on face-to-face interactions while online social interactions are based on device-mediated interactions (e.g., text-based chatting) (Ramirez & Wang, 2008). The online shopping channel, a device-mediated channel, carries relatively higher risk and uncertainty (Cho & Workman, 2015; Lee & Bell, 2013; Yaoyuneyong, Foster, & Flynn, 2014). Thus, purchasing high involvement products via the online shopping channel may exacerbate consumer perception of higher risk and uncertainty, which can result in a greater reliance on offline social interactions.

The impact of geographical variation on online shopping has been well established in the marketing arena (e.g., Choi, Hui, & Bell, 2010; Forman, Ghose, & Goldfarb, 2009). Spatial variation in online demand has correlated with socio-demographic characteristics (e.g., market demand, sales tax rates) because the attractiveness and experience of the online channel vary depending on the local environment in which consumers live (Choi & Bell, 2011; Forman et al., 2009). Certainly, channel preference is an important issue for online retailers. Formed by local information and shopping experiences, this represents the channel disposition of each region (Overby & Lee, 2006).

One impactful factor well recognized by online retailers is that of social interactions – not only online but offline as well. The impact of online social interactions on online shopping has been well studied (e.g., Katona, Zubcsek, & Sarvary, 2011; Manchanda, Packard, & Pattabhiramaiah, 2015; Wang, Baker, Wagner, & Wakefield, 2007; Zhang, Liu, & Chen, 2015); however, that of offline social interactions has not, partly because of the paucity of offline social interactions data in coordination with online shopping data. In fact, within the political and social science arenas, various kinds of offline social interactions have been found to exert different types of influence by the range of participation (Adler & Goggin, 2005; Centola & Macy, 2007; Gouldner, 1957; Merton, 1968; Reagans & Zuckerman, 2008; Susarla, Oh, & Tan, 2012; Wojcieszak, 2009). Such disaggregation of offline social interactions is not as well studied in the online shopping literature. Finally, previous research in online shopping has examined how online shopping preferences moderate influences from online factors associated with and contributing to online shopping (e.g., Broekhuizen,

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Hoekstra, & Jager, 2013; Jin & Park, 2006; Pappas, Pateli, Giannakos, & Chrissikopoulos, 2014). However, again due to data limitations, the moderating effect of online shopping preferences on offline social interactions, and in turn, online shopping has not been closely examined.

In spite of the increasing recognition of offline social interactions and its impact on online shopping, academic literature in this context is somewhat sparse. With the recent availability of suitable cross-channel data, offline social interactions have received increased, although limited, attention in marketing (e.g., Choi et al., 2010; Choi et al., 2012; Lee & Bell, 2013). Lee and Bell (2013), for example, use sales data from Bonobos.com, an online fashion retailer which encourages consumers to try on products at either their homes or pop-up stores and find that offline social capital helps reduce the uncertainty of online shopping. In fact, few studies in prior research, while demonstrating the importance of offline social interactions and online shopping preferences on online shopping demand, have put these three constructs together. Also, decomposing offline social interactions into types may provide a deeper understanding into the offline social interaction process. In the current study, we explain how the degree of offline social interactions, extended from prior social research, impacts consumers' decision regarding online shopping. We also consider the local variation in online shopping preference that operates through signals from prior experience.

This research thus contributes to extant studies by understanding the influence of offline social interactions on online shopping demand and the moderating role of online shopping preferences in these relationships. Specifically, we address the following three questions. First, do offline social interactions affect online shopping demand in general? Second, does the level of influence on online shopping vary depending on the nature of the offline social interactions? Third, how do online channel preferences moderate the main effects of offline social interactions? In order to empirically address these issues, we choose a product category in which offline social interactions play a crucial role in generating online demand. We thus obtain sales data from a leading Internet retailer selling baby products and merge it with market potential data as well as census data to account for regional demographics and market conditions.

Our empirical analyses provide the three important findings. First, overall offline social interactions do indeed have a positive influence on online shopping demand. Second, a closer study reveals that not all offline social interactions are the same, nor are all influences the same, and the nature of the impact will depend on both. Third, the moderating effects of online shopping preferences vary based on the nature of offline social interactions.

We organize the rest of the paper as follows. First, we discuss the background and hypotheses. We then describe the data and present our modeling framework. Next, we report and explain empirical results. Finally, we discuss implications and directions for future research.

2. Background

We focus our discussion on the three streams of literature we draw upon to develop our hypotheses. That is, we divide the discussion into the following three sections: 1) nature of offline social interactions, 2) offline social interactions and online shopping demand, and 3) moderating roles of online shopping preferences.

2.1. Nature of offline social interactions

Previous studies in the political and sociological sciences have grouped offline social interactions into categories (Adler & Goggin, 2005; Centola & Macy, 2007; Gouldner, 1957; Merton, 1968; Reagans & Zuckerman, 2008; Susarla et al., 2012; Wojcieszak, 2009). While these studies use different constructs and terminologies (active social interactions and passive social interactions for Adler & Goggin, 2005; long-tie social interactions and local-tie social interactions for Susarla et al., 2012; cosmopolitan social interactions and local social interactions for Reagans & Zuckerman, 2008; significant-tie social interactions and core-tie social interactions for Wojcieszak, 2009), they are essentially consistent in their conceptualization of offline social interactions.

Active social interactions (over a long tie) are explained by social activities over a public sphere (such as active participation in a political party or interest group) (Adler & Goggin, 2005;Centola & Macy, 2007; Gouldner, 1957; Merton, 1968; Reagans & Zuckerman, 2008). Adler and Goggin (2005) explain these interactions as characterized by a connection with 'a greater range of community'. These interactions often reflect an informational component of influence, especially for new activities (Muk, Chung, & Kim, 2014). This makes logical sense given that long ties, which such social interactions are mostly composed of, convey diverse, rich, and potentially new ideas that could not be obtained from local ties (Granovetter, 1973; McLeod et al., 1999; Wojcieszak, 2009).

In contrast, passive social interactions (over a local tie) encompass actions within a smaller, more private sphere (e.g., chat with local neighbors and close friends) (Centola & Macy, 2007; Gouldner, 1957; Merton, 1968; Reagans & Zuckerman, 2008). Members within such smaller groups try to avoid conflicts and maintain these few but strong relationships (Bikhchandani, Hirshleifer, & Welch, 1992). Interactions within such closely connected friends increase their attachment to the group and fearing social isolation from the group, they try to follow norms that are set within local ties. Following prior studies, these interactions have a normative influence.

Note that while such offline social interactions with informational and/or normative influence may carry significant implications for marketing (e.g., in terms of communication and advertising strategies), few studies have used them in the context of online shopping.

2.2. Offline social interactions and online shopping demand

The impact of online social interactions on online shopping is a well-researched area (e.g., Katona et al., 2011; Manchanda et al., 2015; Park & Kang, 2013; Wang et al., 2007; Zhang et al., 2015). Recent studies have shown that online social interactions have a positive impact on online sales and increase customer expenditure (Chen et al., 2011; Manchanda et al., 2015). Zhang et al. (2015) study the effects of online social interactions on online shopping performances beyond the first-time adoption. Nevertheless, extending the same implications to study the impact of offline social interactions may not be appropriate for several reasons. Firstly, offline social interactions may well provide greater reliability of information than online channels since they interact face-to-face. (Ramirez & Wang, 2008). Secondly, offline social interactions are often locally based opinion or experience exchanges - that is, information senders and recipients are within the same region (Lee & Bell, 2013). Such interactions may be potentially more powerful than social interactions via other sources (such as online reviews and Internet mediated interaction).

In other evidence of the distinctiveness of offline interactions, Choi et al. (2012) show that offline social interactions (relative to online social interactions) are more associated with online demand while Subrahmanyam, Reich, Waechter, and Espinoza (2008) show that offline and online social networks do not mirror each other. Furthermore, Choi et al. (2010) show that offline social interactions are more likely driven by geographical proximity among customers than by their demographic similarity. Given that consumers live offline and interact with offline friends even while shopping online, it becomes critical to understand the impact of offline social interactions. In fact, given the significant amount of research linking offline factors and their importance for online shopping (Choi & Bell, 2011; Forman et al., 2009; Kim, 2015) it is somewhat surprising that not more exploration has been conducted in this area.

The few studies in this area examine the effect of offline social interactions on online shopping trials (Lee & Bell, 2013) and the performance in attracting online customers across acquisition methods (Choi et al., 2012). Given the relatively early stage of research in this area, existing studies on the relationship between offline social interactions and online shopping demand mostly focus on the adoption of online shopping. Our research thus contributes to the related literature by studying how the online shopping demand for high involvement product categories varies by specific degree of offline social interactions.

2.3. Moderating roles of online shopping preferences

Preferences are formed by shopping experiences and information on several aspects such as shopping convenience, information availability, and price advantages (Cho & Workman, 2015). Preferences for online shopping increase as consumers learn of various characteristics (e.g., convenient shopping especially for bulky products, easy access to rich product information and low price) through their experiences and/or information from other sources (e.g., social networks) (Changchit, Cutshall, & Lee, 2014; Ko, Ko, & Chun, 2017; Overby & Lee, 2006; Parasuraman & Zinkhan, 2002; Verhoef, Neslin, & Vroomen, 2007). It has been shown, not surprisingly, that consumers with high online shopping preferences are more likely to purchase online (Brown, Pope, & Voges, 2003; Ranganathan & Jha, 2007).

Some studies find that online shopping preferences may even weaken influences from other potential factors. Thus, consumers with higher online shopping preferences tend to have a greater range of knowledge and more experience with online product purchases (Herhausen, Binder, Schoegel, & Herrmann, 2015; Menon & Kahn, 2002). Information from other factors (e.g., promotions, information from offline stores) may then become relatively redundant and therefore less effective in reducing shopping uncertainties and increasing shopping benefits. Thus, positive effects of informational factors may well be negatively moderated by online shopping preferences (e.g., Herhausen et al., 2015; Jin & Park, 2006). Similarly, consumers with higher online shopping preferences tend to perceive online shopping more positively (Forsythe & Shi, 2003; Herhausen et al., 2015; Montoya-Weiss, Voss, & Grewal, 2003). They may have experienced and/or heard about higher benefits and lower costs associated with online shopping from their friends. Therefore, perceptual factors (e.g., dissatisfaction with an online retailer, perceived risk in online shopping) that tend to build a negative perception towards online shopping can be weakened as online shopping preferences increase (Broekhuizen et al., 2013; Pappas et al., 2014).

Finally, of note is that previous studies show the role of online shopping preferences as a moderator for online factors driving online demand. Some of the studies explain this by introducing informational redundancy and others do so by explaining perceptional influence. However, the moderating role of online shopping preferences in the setting of offline social interactions and online shopping has not been explored. Our research contributes to prior studies by exploring how informational and normative influences from the two types of offline social interactions are moderated differently by online shopping preferences.

3. Hypotheses

A region with higher active offline social interactions implies that consumers living there are likely to interact with a greater number of people offline perhaps using public events or forums (see Section 2.2 above). Given that such long-tie (or weak-tie) connections demand less time or effort (per connection) (Centola & Macy, 2007; Granovetter, 1973), a majority of friends can be expected to represent long ties. As also discussed earlier, long-tie friends are more effective in offering new and rich information that might not be obtained through self-experience or local-tie interactions. Since active interdependency among local friends in a region creates a synergistic association with high uncertainty shopping decisions, information across long ties can help consumers increase awareness of online shopping and reduce the uncertainty associated with it. We thus posit the following:

H1. Active offline social interactions have a positive effect on online shopping demand.

Higher passive offline social interactions in a region imply that consumers living there are more likely to rely on local-tie friends with whom they have more intimate interactions, maintain congenial relationships and avoid conflicts (see Section 2.3). Consumers in such a region may perceive a threat of social isolation if they fail to maintain their small but strongly connected offline social networks (Bikhchandani et al., 1992). They thus try to follow social norms supported by their local ties. As local-tie friends tend to share information that is useful at their shared locations, such as price discounts at offline stores nearby, local shopping can be supported by social norms (i.e., positive normative influence). Since online shopping lacks the local aspect (that is, online shopping offers an electronic 'shopping space' that avoids locational implications), we can expect a negative normative influence on online shopping. Thus:

H2. Passive offline social interactions have a negative effect on online shopping demand.

In a region with higher online shopping preferences, consumers are more likely to be familiar with benefits of online shopping, such as lower price, broader product variety, and lower search costs (Herhausen et al., 2015; Menon & Kahn, 2002). Online shopping information obtained from active offline social interactions may therefore be somewhat redundant and thus less useful; this is in line with the studies on the moderating roles of online shopping preferences on informational factors (e.g., Herhausen et al., 2015; Jin & Park, 2006). We thus posit that the positive informational influence that active offline social interactions have on online shopping demand will be weakened in this region. Thus:

H3. The positive effect that active offline social interactions have on online shopping demand decreases as online shopping preferences increase.

That a region has higher online shopping preferences means that consumers living there are more interested in online shopping and perceive it more positively (Forsythe & Shi, 2003; Herhausen et al., 2015; Montoya-Weiss et al., 2003). Note that consumers are more likely to talk frequently and positively about subjects of common interest with their local-tie friends. In this region, online shopping is likely to be perceived more positively and discussed often over their local ties, and thus be more supported by social norms. The negative normative influence that passive offline social interactions have on online shopping demand is thus expected to be weakened in this region. This is theoretically in line with previous studies in that online shopping preferences weaken the negative influences that perceptional factors have on online shopping (e.g., Broekhuizen et al., 2013; Pappas et al., 2014). Thus:

H4. The negative effect that passive offline social interactions have on online shopping demand decreases as online shopping preferences increase.

4. Data

4.1. Online shopping demand for baby products

We obtain sales data from a leading Internet retailer selling baby products, BabyProducts.com.[1] The data spans from January 2008 to

[1] This online retailer remains anonymous due to confidentiality reasons.

April 2010. It includes information of zip-code level product sales and the number of shipping days during the data collection period. This data is well-suited for our study for three reasons. First, BabyProducts.com sells baby products for which the total demand (i.e., the sum of offline and online shopping demands) is quite stable. Choi and Bell (2011) show that the demand of baby products in a zip code does not much fluctuate as consumers cannot increase the usage volume of these products. Our results are thus relatively generalizable over periods, and can offer useful practical implications to companies. As we also control for baby population (representing total shopping demand) and offline shopping demand, our results reflect the effects of key variables on online shopping demand. (It should be noted that this would be difficult to claim had the demand not been fixed.)

Second, baby products are known to be a high involvement product category. Parents spend considerable time searching for product information and sharing experience with friends and neighbors to make right decisions and reduce risks when buying baby products. This category is therefore particularly appropriate for studying the effects of offline social interactions. Third, the risks associated with quality uncertainties tend to be higher with baby products given babies' sensitivities to certain chemicals or ingredients – difficult to evaluate without experiencing them. In order to lower such risks, consumers are even more likely to rely on information and suggestions from offline social networks.

4.2. Offline social interactions and online shopping preferences

We merge the above proprietary data with additional datasets to test our hypotheses. We purchase the *2011 Civic Activities Market Potential* and *2011 Internet Market Potential* from ESRI (Environmental Systems Research Institute). These market potential datasets include the information of offline social interactions and online shopping preferences, respectively. Much of prior research studied online shopping by investigating social interactions within the same (online purchasing) channel, mostly due to insufficient data. However, our study collects data for offline social interactions, which helps enrich the understanding of online shopping behavior. We also obtain information of online shopping preferences in order to determine their moderating effects between the impact of offline social interactions and online shopping demand.

4.3. Regional demographics and market conditions

We obtain the *2010 Census* data and *2009 ACS* (American Community Survey) data to control overall demographics of consumers' local environment (e.g., population density of children aged less than five years, percentage with college education) that can associate with online shopping demand (Choi & Bell, 2011). The local sales tax information is also collected to understand price advantages that Internet retailers have over their offline counterparts. Higher sales tax can result in higher offline shopping costs, which in turn leads to greater online demand (Choi & Bell, 2011). In order to control for the offline shopping demand for the baby product category, we also purchase the *2011 Baby Products Market Potential* data from ESRI.

5. Measures and model

5.1. Measures

The *online shopping demand* in zip code *z* of state *s* is computed as the sum of the sales of baby products in zip code *z*. The unit of measurement is dollar.

Offline social interactions are categorized by the nature of their sphere of interaction, in line with previous studies in the political and social sciences (Adler & Goggin, 2005; Centola & Macy, 2007; Gouldner, 1957; Merton, 1968; Reagans & Zuckerman, 2008; Susarla et al., 2012; Wojcieszak, 2009). Based on the definition and examples proposed by these studies, we measure *active offline social interactions* by averaging the following three market potential indices: (1) have been engaged in fund raising, (2) have participated in an environmental group, and (3) have contacted a politician in the last 12 months. *Passive offline social interactions* are measured by averaging the following three market potential indices: (1) have voted in federal/state/local election, (2) have been a member of a civic club, and (3) have attended to a public meeting on town or school affairs in the last 12 months.

The categorization and measurement of *offline social interactions* are highly reliable for the following two reasons. First, the Cronbach alpha's for *active offline social interactions* and *passive offline social interactions* are 0.851 and 0.823, respectively (see Montano & Taplin, 1991 suggesting a value of Cronbach alpha $>$ 0.65). Second, a factor analysis of the six indices for offline social interactions results in the expected indices being assigned to the factors.

We measure *online shopping preferences* by averaging the following two market potential indices: (1) online spending between $200 and $500, (2) online spending of more than $500 in 12 months. Of note is that we obtain qualitatively the same results with either (1) or (2).

Fig. 1 shows the geographical distribution of our key variables in Philadelphia County, Pennsylvania. (We use Philadelphia as an example – while we can plot a similar map for the entire geographical region, we use a smaller region to visually compare across regions.) Panels (A) and (B) depict *active offline social interactions* and *passive offline social interactions*. Panel (C) depicts *online shopping preferences* and (D), *online shopping demand*. First, the two types of offline social interactions, (A) and (B), do not seem highly correlated. We conjecture that active and passive offline social interactions may not represent the same construct and may be using different underlying mechanisms. Second, *active offline social interactions* (A) seem to have a moderate co-movement with *online shopping demand* (D), but *passive offline social interactions* (B) seem slightly and negatively associated with (D). We can thus speculate that the two types of offline social interactions can affect *online shopping demand* via different processes. Third, *online shopping preferences* (C) seem positively correlated with *online shopping demand* (D), which is in line with our intuition. The subsequent section formulates a model to test the relationships (e.g., H1, H2) observed here and further associations (e.g., H3, H4).

Following prior research, we include *controls* to account for variations in overall online social interactions, market conditions, and regional demographics (Choi & Bell, 2011; Taks, Littlejohn, Snelgrove, & Wood, 2016). First, as we model the effect of offline social interactions in driving online demand via a specific online site, we include its online referral proportion to control for overall online social interactions. Also, we control for observed heterogeneity in customer base size from that online site. Second, the local variations in market conditions are controlled for by offline shopping demand (market potential index of offline demand for the baby product category). Moreover, considering the effect of regional online shopping potential, we include online shopping features such as online price advantage (local sales tax rate) and online convenience advantage (indicator variable for within-a-day shipping) (Lee & Bell, 2013). Third, standard zip code level geodemographic variables that are expected to affect online demand include measures of age (population density of children aged less than five years), affluence (median house value), income (median household income with householder aged 25 to 44), education (percentage with college education) and diversity (diversity index).

Table 1 shows the list of variables constructed from the final dataset and their corresponding descriptive statistics.

5.2. Spatial correlation model

We develop and estimate two models – our main model incorporating *active* and *passive offline social interactions* and our

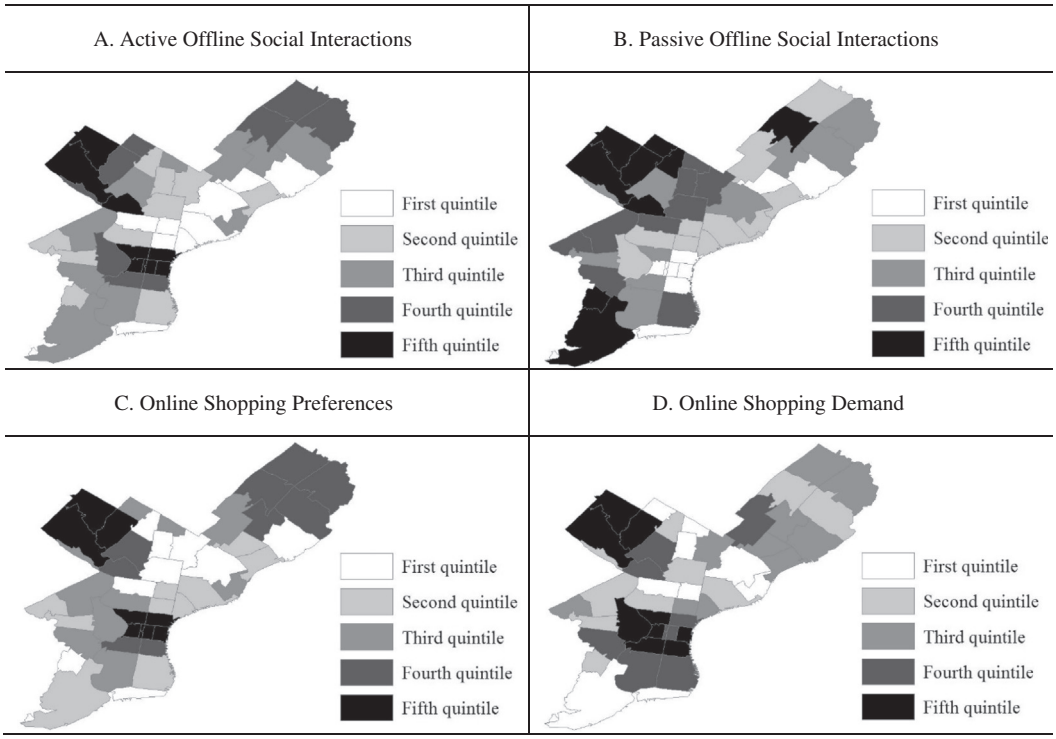

Fig. 1. Geographic distribution of the key variables (Philadelphia County).

Table 1
Descriptive statistics.

Variables	Mean	SD
Dependent variable		
Online shopping demand: sales (in dollars)	3,991.808	14,052.687
Independent variables		
Overall offline social interactions: market potential index	0.966	0.208
Active offline social interactions: market potential index	0.905	0.269
Passive offline social interactions: market potential index	1.026	0.201
Online shopping preference: market potential index	0.872	0.320
Control variables		
Overall online social interactions: Online referral proportion	0.030	0.105
Customer base size	7.856	24.096
Offline shopping demand: market potential index	0.783	0.218
Online price advantage: local sales tax rate (in %)	6.457	1.658
Online convenience advantage: indicator for within-a-day shipping	0.294	0.455
Population density of children aged less than five years	91.460	431.181
Median house value (in $1000)	178.661	153.418
Median household income with householder aged 25 to 44 (in $1000)	55.634	22.552
Percentage with college education	0.139	0.082
Diversity index	29.791	23.608

Note: The final dataset has 29,459 zip codes.

benchmark model using a non-differentiated *overall offline social interactions* term. In both models, as *online shopping demand* ($OnShopDemand_{z(s)}$) is highly right-skewed, we add one and log transform it. Of note is that our dependent variable has a significant and positive spatial autocorrelation coefficient (Moran's I = 0.039 with p-value < 0.001). We thus include a spatial autocorrelation term in both models to control for correlations in *online shopping demand* among contiguous (geographically adjacent) regions.

The benchmark model (Model 1) is:

$$\log(OnShopDemand_{z(s)}) = ß_{1,1} OverallOffSI_{z(s)} + ß_{1,2} OverallOffSI_{z(s)} \cdot OnShopPref_{z(s)} + ß_{1,0} + \gamma_1 Controls_{z(s)} + a_{1,z(s)} + \varepsilon_{1,z(s)}$$
$$Var(a_{1,z(s)}) = \sigma^2_{1,a}, \quad Cov(a_{1,z(s)}, a_{1,z'(s)}) = \exp(-d_{zz'})\sigma^2_{1,a},$$
$$Cov(a_{1,z(s)}, a_{1,z'(s')}) = 0,$$
$$Var(\varepsilon_{1,z(s)}) = \sigma^2_{1,e}, \quad Cov(\varepsilon_{1,z(s)}, \varepsilon_{1,z'(s)}) = 0, \quad Cov(\varepsilon_{1,z(s)}, \varepsilon_{1,z'(s')}) = 0 \tag{1}$$

$OverallOffSI_{z(s)}$ or *overall offline social interactions* is measured by averaging the six market indices used for measuring both active and passive offline social interactions. The effect of *overall offline social interactions* ($OverallOffSI_{z(s)}$) is measured by $\beta_{1,1}$. The moderating effect of *online shopping preferences* ($OnShopPref_{z(s)}$) is captured by $\beta_{1,2}$. $Controls_{z(s)}$ is a vector of control variables and γ_1 is the corresponding vector of parameters. The random effect, $a_{1,z(s)}$, captures the difference in baseline demand across states and is assumed to be spatially correlated within a state but not across states because laws and sales environment vary substantially across states. We assume that the random effect, $a_{1,z(s)}$, follows a normal distribution with a mean of 0 and a covariance matrix as above. The error term, $\varepsilon_{1,z(s)}$, is assumed to be independently and normally distributed with a mean of *0* and a variance of σ_ε^2.

The main model (Model 2) for this research is:

Table 2
Parameter estimates.

Parameters	Model 1[a]	Model 2[b]
Independent variables		
Overall offline social interactions	1.692*	
	(0.235)	
Active offline social interactions		9.649*
		(0.283)
Passive offline social interactions		− 5.485*
		(0.253)
Overall offline social interactions × online shopping preferences	− 3.412*	
	(0.212)	
Active offline social interactions × online shopping preferences		− 5.752*
		(0.222)
Passive offline social interactions × online shopping preferences		2.956*
		(0.283)
Online shopping preferences	5.775*	1.989*
	(0.245)	(0.266)
Control variables		
Overall online social interactions	2.752*	2.507*
	(0.165)	(0.162)
Customer base size	0.022*	0.023*
	(0.001)	(0.001)
Offline shopping demand	0.636*	1.132*
	(0.101)	(0.100)
Online price advantage	0.231*	0.231*
	(0.080)	(0.078)
Online convenience advantage	0.046	− 0.045
	(0.069)	(0.068)
Population density of children aged less than five years	0.165*	0.172*
	(0.046)	(0.045)
Median house value	0.236*	0.205*
	(0.025)	(0.025)
Median household income with householder aged 25–44	0.292*	0.780*
	(0.119)	(0.118)
Percentage with college education	1.093*	1.054*
	(0.037)	(0.037)
Diversity index	0.035*	0.031*
	(0.001)	(0.001)

Notes:
[a] The parameter estimates of $\beta_{1,0}, \sigma_{1,u}, \sigma_{1,\varepsilon}$ are − 4.195 (with S.E. = 0.541), 1.595 (with S.E. = 0.339), and 8.726 (with S.E. = 0.072) respectively in Model 1.
[b] The parameter estimates of $\beta_{2,0}, \sigma_{2,u}, \sigma_{2,\varepsilon}$ are − 3.594 (with S.E. = 0.529), 1.510 (with S.E. = 0.322), and 8.384 (with S.E. = 0.069) respectively in Model 2.
* Indicates significance at $p < 0.01$

$$\begin{aligned}\log(OnShopDemand_{z(s)}) = {} & \beta_{2,1} ActiveOffSI_{z(s)} + \beta_{2,2} PassiveOffSI_{z(s)} + \\ & \beta_{2,3} ActiveOffSI_{z(s)} \cdot OnShopPref_{z(s)} + \\ & \beta_{2,4} PassiveOffSI_{z(s)} \cdot OnShopPref_{z(s)} + \\ & \beta_{2,0} + \gamma_2 Controls_{z(s)} + a_{2,z(s)} + \varepsilon_{2,z(s)} \\ Var(a_{2,z(s)}) = \sigma^2_{2,a}, \quad & Cov(a_{2,z(s)}, a_{2,z'(s)}) = \exp(-d_{zz'})\sigma^2_{2,a}, \\ Cov(a_{2,z(s)}, a_{2,z'(s')}) = 0, & \\ Var(\varepsilon_{2,z(s)}) = \sigma^2_{2,\varepsilon}, \quad & Cov(\varepsilon_{2,z(s)}, \varepsilon_{2,z'(s)}) = 0, \quad Cov(\varepsilon_{2,z(s)}, \varepsilon_{2,z'(s')}) = 0\end{aligned} \tag{2}$$

The effects of *active offline social interactions* ($ActiveSI_{z(s)}$) and *passive offline social interactions* ($PassiveSI_{z(s)}$) are measured by $\beta_{2,1}$ and $\beta_{2,2}$. The parameters, $\beta_{2,3}$ and $\beta_{2,4}$, captures the moderating effects of $OnShopPref_{z(s)}$ on $ActiveSI_{z(s)}$ and $PassiveSI_{z(s)}$, respectively. γ_2 is the coefficient vector of $Controls_{z(s)}$. The random effect, $a_{2,z(s)}$, and the error term, $\varepsilon_{2,z(s)}$ are under the same assumption that we have for Eq. (1).

6. Empirical findings

Table 2 presents the empirical results of both the benchmark model (Model 1) and our main model (Model 2). The results from Model 1 explain the effect of overall offline social interactions and the moderating role of online shopping preferences. Model 2 then divides overall offline social interactions by the degree of participation, and the results from it are used to discuss our hypotheses and control variables.

6.1. The results of Model 1

As can be seen from Table 2, overall offline social interactions have a positive influence on online shopping demand ($\widehat{\beta}_{1,1} = 1.692$, $p < 0.001$), which is in line with the results from previous studies on offline social interactions and online shopping (e.g., Lee & Bell, 2013). We thus infer that in a region with higher offline social interactions, consumers have a higher likelihood of shopping online. The moderating effect of online shopping preferences on the relationship between overall offline social interactions and online shopping demand is significantly negative ($\widehat{\beta}_{1,2} = -3.412$, $p < 0.001$). As one would expect, regions with higher online shopping preferences may already be more familiar with the advantages of online shopping and are therefore less likely to be affected by information from external sources, such as social interactions.

6.2. The results of Model 2

In differentiating between the two types of offline social interactions, we find that they do indeed impact online shopping demand in opposite directions. This result supports our premise: these offline social interactions may be established under different mechanisms and affect online shopping demand in a different way. It is also in line with previous research in political and social sciences suggesting that offline social interactions can be categorized into active and passive interactions (Adler & Goggin, 2005; Centola & Macy, 2007; Gouldner, 1957; Merton, 1968; Reagans & Zuckerman, 2008; Susarla et al., 2012; Wojcieszak, 2009). Several interesting observations can be made.

First, active offline social interactions have a significantly positive effect on online shopping demand ($\widehat{\beta}_{2,1} = 9.649$, $p < 0.001$), supporting H1. In a region with higher active offline social interactions, consumers are more likely to be connected with their long ties, and interactions with these ties provide new and rich information that is useful in reducing uncertainties associated with online shopping (Granovetter, 1973; McLeod et al., 1999; Wojcieszak, 2009). The positive effect from overall offline social interactions in Model 1 is likely to be attributed to informational influence from active offline social interactions rather than passive ones. This inference makes sense, furthermore, because previous studies in marketing measure offline social interactions with variables that are likely to capture long ties (e.g., the frequency of interaction between neighbors for Lee & Bell, 2013) rather than local ties.

Second, the main effect of passive offline social interactions is significantly negative ($\widehat{\beta}_{2,2} = -5.485$, $p < 0.001$). Unlike active offline social interactions, passive offline social interactions are from consumers' local ties with whom they usually have close relationships. In a region with higher passive offline social interactions consumers thus try to maintain their local relationships and follow local-tie norms that are less likely to support online shopping (Deutsch & Gerard, 1955; Turner, 1991). Thus, H2, the normative influence from passive offline social interactions to online shopping demand, is supported.

We now explore the moderating role of online shopping preferences in the informational and normative influences from offline social interactions. As can be seen from Table 2, online shopping preferences weaken both influences ($\widehat{\beta}_{2,3} = -5.752$, $p < 0.001$; $\widehat{\beta}_{2,4} = 2.956$, $p < 0.001$), supporting H3 and H4. Consumers in a region with higher online shopping preferences will likely have more information on the benefits of online shopping. Information from long-tie social interactions then become less useful which in turn lowers the positive informational influence. Consumers in a region with higher online shopping preferences also have a more positive attitude towards online shopping (Forsythe & Shi, 2003; Herhausen et al., 2015; Montoya-Weiss et al., 2003). As consumers tend to share online shopping with their local ties more positively and frequently, the negative normative influence is weakened.

The main effect of online shopping preferences is significantly positive. Unsurprisingly, higher online shopping preferences are likely to be established over positive experiences either personally or through useful information from other sources. That is, regions with higher online shopping preferences tend to have more experiences and receive more information that can be helpful in online shopping, thus leading to higher online shopping demand.

Most of the control variables have significant and expected effects on online shopping. Effects of overall online social interactions and customer base size are consistent with the previous literature (Choi et al., 2012; Lee & Bell, 2013); a high proportion of online referrals and a large number of buyers promote online shopping demand. The effect of offline shopping demand for baby products is positive given that offline shopping demand serves as a proxy for the market size of the baby product category in addition to the target population density. Local sales tax rate has a significantly positive impact on online shopping since consumers in regions with higher rates can save money by purchasing online (the channel for which sales taxes are likely to be exempt). Additionally, online shopping demand is higher in regions with a higher population density of children less than five years of age, as the population of this age range represents the target consumers of the baby product category. Local affluence, income, and diversity also affect local demand for online shopping significantly. Finally, more educated consumers display a higher online shopping demand since they are likely to use the Internet more in their daily lives and thus have a greater chance for exposure to online shopping.

7. Discussion and conclusion

Online retailers would benefit from understanding offline social interactions and their influence on online shopping. However, in spite of the fact that the key constructs have been individually well studied, there has been little work that considers them in a single framework. Our research merges and develops ideas from various research fields and offers new findings. First, active offline social interactions, which show preference for new information obtained over a broader range of connections, exert a positive informational influence on online shopping demand. Second, passive offline social interactions (that is, offline social interactions with strong local ties that are likely to follow local norms) have a negative normative influence on online shopping demand. Third, both informational and normative influences from offline social interactions are weakened by online shopping preferences. Our results offer theoretical as well as managerial implications.

7.1. Theoretical implications

First, our research contributes to the literature studying offline factors affecting online shopping (e.g., Choi & Bell, 2011; Forman et al., 2009) by providing new findings from offline social interactions. The few studies in this area (e.g., Lee & Bell, 2013) do not focus on how offline social interactions impact online shopping beyond the adoption stage. Our findings are fairly new in that we show that demand for online shopping, dollar sales of high involvement products in our context, is influenced by offline social interactions. Moreover, we introduce the categorization of offline social interactions, which has been studied in political and social sciences (e.g., Adler & Goggin, 2005; Susarla et al., 2012), into the marketing arena. The specification of offline social interactions helps clarify mechanisms of informational and normative influences that previous studies fail to distinguish between when explaining offline social interactions.

This brings us to our second contribution: the ability to clearly identify and distinguish between the positive informational and negative normative influences from overall offline social interactions. Our study focuses on products of high involvement and uncertainties. As consumers of this category are more reluctant to purchase online, our research can study consumers' decision processes regarding their purchase decision (e.g., what consumers are worried about, which factor can reduce their concerns). The overall impact can be more finely nuanced into the two significant influences - the positive effect of new information and the negative influence from local norms – acting in opposite directions.

Finally, our work contributes to the prior research that has explained the moderating roles of online shopping preferences using the concepts of informational redundancy and perceptional influence. Our results confirm previous studies in that online shopping preferences indicate useful information and a positive perception of online shopping. We further the understanding of online shopping preferences by studying cross-channel moderating roles (i.e., how online shopping preferences moderate the two effects of offline social interactions differently).

7.2. Managerial implications

Online shopping has grown over the years and is considered one of the common shopping platforms. However, consumers of high involvement products with uncertainties still have lower preferences for shopping online and rely on offline social interactions before making purchase decisions. Our findings thus suggest improved marketing strategies, given the degree of offline social interactions and online shopping preferences, for online retailers selling such products.

First, online retailers can increase their online demand by targeting regions where active offline social interactions are high - for example, regions where large public meetings and/or social campaigns are frequently held. One strategy could be to support active social interactions (e.g., large social meetings) in such regions. As consumers would like to share new information at the meetings, sponsoring such meetings can increase chances that consumers talk about new information regarding online shopping. Retailers can also increase their targeting effectiveness by considering online shopping preferences. As for regions with high active offline social interactions, the online shopping demand at regions with low online shopping preferences is nearly twice the online shopping demand at regions with high online shopping preferences.[2]

Second, online retailers can induce passive offline social interactions to exert less influence on online demand in regions having frequent small-group local interactions, and in turn lead consumers to purchase online. Of note is that consumers who interact with close local friends take into account these friends' opinions and inputs to a greater extent, compared to those having active social interactions. One strategy would thus be to provide more opportunities to share the benefits and experiences of online shopping, especially in regions having higher online shopping preference. For instance, regions with high online shopping preferences have approximately double the online shopping demand volume compared to regions with low online shopping preferences due to the weakened negative effect of passive offline social interactions.

A natural follow-up question, of course, is how online retailers can obtain such information (i.e., active and passive offline social interactions, online shopping preferences) and identify the regions to target. Since online retailers typically do geo-targeting, they may not have to collect individual-level social networking information which can be both expensive and time consuming. Directly investigating consumer survey data can help produce a solid forecast of online shopping demand opportunities, but the degree of offline social interaction that precedes purchasing requires more data. One way to obtain this is to outsource data that can complement internal data and help create a more comprehensive mechanism of overall online shopping habits.

[2] Specifically, we calculate the expected online demand using the parameter estimates. In doing so, we assume regions that have high and low values of our key variables (i.e., offline social interactions and online shopping preferences) by assigning their first and third quartile values whereas means are added to the remaining variables.

Another alternative evolving from our study is to measure offline social interactions and/or online shopping preferences by purchasing zip code-level data from public or private data suppliers and to merge this information with their internal data.

7.3. Limitations and future research

This study confirms the distinct influences from active and passive offline social interactions and the moderating role of online shopping preferences on these influences. While our research offers new contributions to both marketing research and online retailers, there are nevertheless some limitations that could not be addressed given the constraints on our data. For example, it would be of interest to collect more extensive data and compare other mechanisms driving social interactions (e.g., Subrahmanyam et al., 2008). Thus, considering the degree of online social interactions (i.e., active vs. passive) might help better understand online shopping demand and enable the advancement of related theories. Second, it may be interesting to examine other potential moderators, such as product types. For instance, we focus on high involvement products which can be more influenced by social interactions. For low involvement products such as packaged groceries and low-priced products, however, consumers may be less likely to rely on others' product experiences and be influenced by social interactions (Gu et al., 2012). It would thus be interesting to compare the effects of social interactions on shopping demand for high involvement versus low involvement products. Moreover, the effect size of offline social interactions might be larger with experience goods than with search goods, because experience goods have higher product uncertainties that could be reduced by active offline social interactions (e.g., Lee & Bell, 2013). Third, a longer data window can offer a chance to investigate dynamic relationships between offline social interactions and online shopping. The intensity of offline social interactions can vary over time, which could provide rich, additional insights. We leave these issues for future research to explore.

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