Channel Interactions on Path-to-Purchase and Beyond

Abstract

Channel interaction at the level of individual customers is a relatively unexplored area despite its importance for personalized marketing strategies. We explore this topic using a customer level dataset collected from three brands of a North American specialty retailer. We find a variety of synergies between online and offline channels at the individual customer level across the three brands. Examining the effect of online product reviews, we find that the availability of online product reviews is negatively associated with returns of online purchases. We also find that the progression of customers from one step to another on path-to-purchase varies by brand and depends quite a bit on their demographic characteristics. The results have implications for the design of personalized marketing strategies.

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Introduction

More than 80% of the retailers and 94% of the top performing retailers sell products over multiple channels (Kilcourse and Rowen 2008). Sales channels include brick-and-mortar stores, online store, or mail/phone ordering system. The use of multiple sales channels is an established strategy[1] that has received renewed attention with the advent of online retailing. Due to the many advantages of the online storefronts retailers have included online selling as part of their multi-channel strategies. However, as often is the case when a new model of business is introduced, there has been some concern that online stores could cannibalize sales in existing channels. Understanding how online and offline channels interact has been a topic of interest to researchers for many years.

Most of the research in this area has looked at the problem through the lens of the retailers focusing on how overall investment in one channel affects the other channels. In an era where mass marketing has given way to personalized marketing, understanding how channels interact at the customer level can allow retailers to optimize their personalized marketing efforts. In this study we look at these phenomena at the granularity of individual customers. We consider the entire

[1] Sears started its multichannel strategy in 1925 by adding brick-and-mortar stores to the existing catalog channels.

spectrum of the customer interactions with the retailer: research during pre-purchase phase, purchases in brick-and-mortar store and at the online store, and post purchase activities including returns and reviews of products. Our objective is to understand the exact nature of interaction between activities of the customer across channels, how it varies by customer demographics, and how it is affected by marketing communication.

Literature Review

There has been a lot of research in Marketing and Information Systems area on how channels interact (Lieber and Syverson 2012). Despite the initial questions surrounding whether online and offline channels complement or compete (Steinfield 2004) it is generally agreed that there is synergy among these two channels (Saeed, Grover et al. 2003, Zhang, Farris et al. 2010, Dahlhoff 2012). For example, using data collected from a large upscale retailer, Dinner, de Serrano et al. (2011) have shown that significant cross channel effect of online advertising exists on offline customer activities. Naik and Peters (2009) has shown synergies between traditional advertising (TV, print, radio) and online advertising (banner and search ads) in the context of an automobile brand. Based on this synergy they have also derived a strategy for optimally spending a firm's advertising budget across media. Wiesel, Pauwels et al. (2011) have found evidences of cross channel effects at various customer touch points. Using a field experiment they have shown that by reallocating marketing budget towards customer initiated online activities, the firm can significantly improve net profit. Pauwels and Neslin (2008) have studied

cannibalization of direct marketing channels as a resulting of opening new offline stores. They find that, although opening a new store negatively affect catalog sales, it more than compensates in revenue by increasing availability to the customers. In the context of multiple media, Stephen and Galak (2012) have examined the effect of earned media—mentions about the firm in traditional press as well as social media that is not paid for by the firm. They show that mentions of the firm on social media and news media affect each other and both of them affect sales.

The subject of channel selection has received interest in Information Systems area as well. Devaraj, Fan et al. (2002) has examined the effect of factors such as ease-of-use, in customers preference towards electronic channels. Langer, Forman et al. (2012) have examined the effect of price, channel inertia, and inventory on the channel choice of customers in a B2B setting.

The extant literature suggests intense interest in the area of channel interactions. However, most of the studies have focused on the activities ranging from advertisement to product sales. In one of the few studies that look at post-purchase customer activities, product returns in particular, Petersen and Kumar (2009) have studied the effect of different factors at the purchase time on product returns as well as the impact of product returns on the profitability of the firm. Although it is recognized that post purchase activities such as product returns and reviews are also important customer activities that affect the firm, the effect of factors during pre-purchase stage, such as availability of product information, on post purchase activities has not been well studied. In addition, most of the studies on channel interactions have used aggregate firm level time series data to

understand how different channels interact at a macro level (Pauwels and Neslin 2008, Dinner, de Serrano et al. 2011). Many of these studies have come up with firm level policy recommendations based on their analysis.

In recent years, with the availability of detailed customer activity data marketers are turning to personalized marketing. Understanding how multiple channels interact for individual customers and their impact on purchase and post-purchase activities become important in this context. Macro level marketing strategies based on how the average customer responds to marketing activity across channels may not be the best possible strategy for each individual customer because they might behave very differently from the average customer.

Data Description

How do online and offline shopping channels interact at different points of a customer's engagement with a retailer? To answer this question we collected a longitudinal customer level dataset from a North American Specialty Retailer[2]. This is a specialty retailer, like GAP, whose products are sold only through the company owned online and offline stores. The retailer operates three different brands. The first sells women's apparel, accessories, and decorative home items (Brand A). The second focuses on trendy clothing items for women in their 20s (Brand B). The third is the flagship brand of the retailer that sells trendy apparels and accessories for men and women as well as some home furniture (Brand C).

[2] We are grateful to Wharton Customer Analytics Initiative for making this dataset available (http://www.wharton.upenn.edu/wcai/)

The dataset consists of information about product, customers, transactions and promotions run by the firm. The data was collected over July 2010 to June 2012. The product information includes category, description, online/offline availability, and ratings. The user information includes age, gender, zip code, and distances to the nearest store for each brand. In addition, we have record of the products they saw, online searches they performed, and rating activities on the website of the retailer. All the purchases and returns made by the customers in the dataset, either offline or online, are recorded as well. Such transaction data include the items purchased, price paid, promotions applied, if any, and the store at which the purchase or return was made. If the purchase was made online or return was not made at a store but mailed in, that is recorded as well. Each promotional email or catalog sent to one of these customers was recorded with timestamps as well.
The three brands target three different segments and are managed largely independently. This presents an opportunity for additional insights through comparative analysis of the brands. The descriptive statistics of the three brands are presented in Table 1.

Model Specification

The spectrum of interaction of a customer with a retailer can be thought of as a path through the phases of product awareness, research, purchase, return and reviewing. There is evidence in the literature (e.g., Srinivasan (2010)) that each of these steps can affect all others. Therefore, we model the interaction between a

customer's activities in each of these stages over time. This is modeled as an individual level multivariate autoregressive model.

$$\boldsymbol{y_t^i} \sim \boldsymbol{A_t^i} \times \boldsymbol{y_{t-1}^i} + \boldsymbol{B_t^i} \times \boldsymbol{x_t} \quad (1)$$

where, $\boldsymbol{y_t^i}$ is the vector of user-activity variables for user i in period t. $\boldsymbol{x_t}$ is a vector of variables with environmental factors that all users are exposed to, such as, holidays, promotions, discounts, and new product introductions. These variables are same for all users, but they change over time.

$\boldsymbol{A_t^i}$s and $\boldsymbol{B_t^i}$s are matrices that capture the effect of past user activities and environmental factors on the user activities in the current period. Note that these are user specific effects that vary over time. This is done to model the fact that user activities evolve differently for different users.

To reduce the number of parameters and gain insights into how these effects vary with user specific attributes, we let the $\boldsymbol{A}$'s and $\boldsymbol{B}$'s be linear functions of two types of variables

1. User specific unchanging attributes, e.g., age, gender, distance to store ($\boldsymbol{d^i}$)
2. User specific *changing* variables, e.g., marketing activity towards a particular user, number of reviews available on the products browsed by the user in the previous time period, average rating and popularity of the products browsed by the users ($\boldsymbol{u_t^i}$)

Table 2 describes how these variables are computed.

The effect of past user activities on present activities modeled as a linear function of the demographic and marketing variables.

$$\boldsymbol{A_t^i} = \sum_r d_r^i \alpha_{pqr} + \sum_r u_t^i \gamma_{pqr} \quad (2)$$

$\boldsymbol{A_t^i}$ is a square matrix of size $P \times P$, where P is the number of endogenous variables.

Similarly, we have a user-time period specific matrix $\boldsymbol{B_t^i}$ that captures the effects of exogenous variables. It is modeled as a linear function of the first type of variables.

$$\boldsymbol{B_t^i} = \sum_r d_r^i \beta_{pqr} \tag{3}$$

We include the intercepts to these two linear functions by prepending a column of 1's to the $\boldsymbol{d}$ variable.

Each user activity variables y_t^i is modeled using a separate negative binomial regression. For each y_t^i the set of explanatory variables is the same. But, there is a different set of coefficients for each regression. The coefficients of the model are α, γ, and β's. They tell us how demographics, marketing, and environmental variables explain the effect of lagged and exogenous variables on the dependent variable of interest.

By plugging in Equations (2) and (3) in Equation (1), it is easy to verify that our original equation becomes a linear model with a number of direct and interaction terms. This new linear model can be solved using the popular Iteratively Reweighted Least Square algorithm for Generalized Linear Models (Hardin and Hilbe 2012).

We use log-link function, i.e., the linear function on the right hand side of Equation (1) estimates the log of mean y. So, a coefficient of magnitude θ can be interpreted as "unit change in explanatory variable leads to e^{θ} times change in expected value of y. For small values of θ it can be approximated to θ fraction additive change of expected value of y.

Results

The estimated coefficients for the three brands are presented in Table 3, 4, and 5. From these tables we can see a number of interesting relations.

Online-offline Synergy

Offline marketing, specifically catalogs, have a significant positive effect on all observed online user activities: product browsing, searching, and online purchases. In addition past offline purchase also has a significant effect on the user's online activities. Similarly, email marketing has a significant positive effect on users' offline purchases. This suggests that there is a synergy among multiple channels not only at the firm level as other researchers have shown, but also when one looks at the individual's shopping behavior and the marketing communication an individual is subjected to. These effects are consistent across the three brands lending credibility to the finding.

One anomaly to this general trend is that past online shopping of an individual doesn't always foretell purchase in an offline store. For brand A and B we don't observe a direct effect of past online purchase on offline purchase. However, through our modeling of this effect as functions of demographic attributes, we do see that for certain customers, e.g., middle aged customers in this case, the effect of past online purchase on offline purchase is +ve and significant.

Impact of Ratings and Reviews

Online reviews have revolutionized online shopping (Dellarocas 2003). They provide potential customers with important product information in the pre-

purchase stage that helps them make a purchase decision. Consistent with expectations we see a clear positive effect of average rating on the products browsed by a customer in the previous time period on his online and offline purchase.

What is explored less often is the effect of such reviews after the purchase. If the reviews inform the customers and help them make better purchase decisions, it should lead to higher satisfaction with the purchase and less return. Indeed, we find that the more the reviews available on the products seen by a customer, the less was her return of *online* purchases. However, for Brand A and B, the two brands that can be considered to be primarily selling experience goods, the availability of online reviews did not have a significant effect on the return of *offline* purchases. This suggests that for products for which customer opinions are likely to differ or require customers to experience the products themselves, when there is direct information about the products available to the customers, online reviews may not help make a better purchase decision. For the Brand C, however we see that there is a negative relation between available reviews and return, i.e., availability of online reviews has a negative effect on in-store product returns. Since the Brand C carries many search goods the product reviews can provide evaluations on the product that users are likely to agree on. Therefore, availability of online reviews on products before purchase is likely to be helpful irrespective of the purchase channel used.

A somewhat surprising finding is the positive relation between average rating of the product and the product return. Upon closer examination we see that the positive effect of rating is larger for *online purchases* than for *offline purchases*.

At the same time the average rating values have a larger positive effect on return of online purchases compared to offline purchases. This seems to suggest that in the absence of information from direct physical examination of the product in store, customers rely too much on online reviews written by other people. Since people's tastes differ especially about clothing, accessories and furniture, relying on others' evaluation of products seems to result in unsatisfactory purchases that result in returns.

Channel interactions differ by demographics

Many of the effects of lagged user activities on the user activity in the current period vary with on the demographic attributes and marketing exposures. However, these directions of these effects are often brand specific, reflecting the different segments of the population they target and different ways in which the brands are managed. E.g., we find that there is a positive effect of past online search of the user on offline purchases for two of the brands, and negative effect for another perhaps indicating how successful the users' online research is for each of these brands. However, we find that for Female customers this effect is positive across the three brands. This and other such findings suggest that when designing marketing strategies for customers at different steps on their path-to-purchase, considering the attributes and activities of individual customer can help us better allocate our resources.

Conclusion

Channel interaction at the level of individual customers is a relatively unexplored area despite its importance for personalized marketing strategies. We explore this topic using a customer level dataset collected from three brands of a North American specialty retailer. We find synergy between online and offline channels at the individual customer level across the three brands. This finding complements the existing researches that have found synergy between online and offline channels. Examining the effect of online product reviews, we find that the availability of online product reviews is negatively associated with returns of online purchases. However, for experience goods there was no effect of reviews on products seen online by the customer on the return of his offline purchases. This suggests that the product reviews are especially important for online purchasers. We also observe that better product ratings on browsed products is associated with more sales online, a context where less product information could be available, than on sales offline, where more information is available to the customer through direct examination of the product. However, this is also associated with more returns of the products purchased online. These higher returns as a result of higher ratings may not necessarily be a bad outcome depending on the costs associated with product returns at a particular retailer.

We also found that the progression of customers from one step to another on path-to-purchase varies by brand and depends on their demographic characteristics. This suggests that it is important to take into consideration such characteristics while designing personalized marketing strategies.

One of the limitations of the current work is the lack of modeling user level heterogeneity beyond those captured by the demographic attributes and the activities of the customer in the last time period. There could be differences among the customers not captured by these two sets of user specific variables. Such differences could be modeled using mixed effects. However, scalable approaches need to be developed to estimate such models for large datasets.

Tables

Band	A	B	C
# of customers	18,556	14,000	14,000
# of products	105K	58K	182K
# of products with reviews	82K	49K	132K
Average ratings on the products	4.21	4.24	4.07
# of product views	3.4M	1.1M	3.5M
# of searches	39K	34K	133K
# of purchases	417K	70K	303K
# of returns	80K	12K	34K
# of catalogs mailed	292K	251K	254K
# of emails sent	3.4M	1.9M	5.4M

Table 1 Descriptive statistics of the data from three different brands.

User activity variables measured for each brand ($\boldsymbol{y_t^i}$)	
Views	# of products viewed online by a customer in each week
Searches	# of search queries run by a customer in each week
Offline	# of products purchased in-store by a customer in each week
Online	# of products purchased online by a customer in each week
Reviews	# of product reviews written by a customer in a week
On_Return	# of online purchases returned by a customer in a week
Off_Return	# of offline purchases returned by a customer in a week

Demographic attributes ($\boldsymbol{d^i}$)	
Age Dummy	Young (<35), Middle aged ([35,55)), and Old (> 55)
Gender	Male (0) or Female (1)
Distance	Distance to the nearest brand store
User specific marketing and product information variables observed each week ($\boldsymbol{u_t^i}$)	
Catalog Dummy	Whether any catalog was received
Email	Whether any promotional email was received
Reviews available	Average number of reviews on the products browsed by the user
Average rating	Average ratings on the products browsed by the user
Product popularity	Average number of times the products browsed by the user were sold in that week.
Environmental variables that all the users are exposed observed each week ($\boldsymbol{x_t}$)	
Holiday	Whether there is a holiday in the given week
Promo	# of promotions available in the week
Discount	Average price discount on the products sold in the week
New styles	# of new products introduced in the previous one month

Table 2 Variables and how they are computed

Brand A **(Table 3)**

Endog. Vars	Lags	Direct effects of Lags	Effect of demographics and marketing variables on the effect of lags (Interaction Effects)							
Views										
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-0.277**	-0.046**	-0.246**	-0.128**	0.108**	0.194**	1.198**	-0.005**	0.488**	1.151**
	Views	0.028**	-0.001**	0.004**	7.974e-04**	-0.002**	-0.002**	-0.013**	-5.094e-04**	0.072**	-0.009**
	OnlineRes	0.011**	0.028**	0.006**	0.022**	0.016**	-0.026**	-0.034**	-0.001**	-0.047**	-0.050**
	Offline	0.096**	0.002**	0.002	-0.025**	0.004**	-0.005**	-0.031**	5.297e-04**	-0.021**	-0.054**
	Online	0.039**	-0.024**	-0.054**	-0.008**	0.013**	0.036**	0.012**	-0.007**	-0.067**	-0.025**
	Reviews	-0.099**	-0.066**	0.622**	-0.030	0.046**	0.155**	0.076**	-0.002	-0.199**	0.006
	On_returns	0.186**	0.045**	0.015**	-0.103**	-0.008**	0.042**	-0.046**	-0.001**	-0.021**	-0.030**
	Off_returns	0.013	0.070**	0.188**	-0.042**	0.035**	0.008±	-0.037**	3.120e-04	-0.032**	-0.075**
OnlineRes											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-3.535**	0.520**	0.119*	0.108	0.018	0.532**	1.890**	-0.006**	0.899**	0.595**
	Views	0.027**	-0.001**	-4.104e-04	0.002**	-0.002**	-0.002**	-0.021**	-0.002**	0.064**	-9.438e-05
	OnlineRes	3.575e-06	0.013**	0.037**	0.056**	0.045**	-0.014**	-0.028**	0.002**	-0.058**	-0.023**
	Offline	0.340**	-0.061**	0.065**	-0.069**	-0.018**	-0.037**	-0.078**	-2.173e-04	-0.044**	-0.088**
	Online	0.137**	0.079**	0.012	-0.081**	-0.008*	0.063**	-0.009	0.011**	-0.042±	-0.019**
	Reviews	-1.790**	0.461**	1.917**	0.334±	0.411**	-9.853e-04	0.100	0.025	-0.427*	0.114
	On_returns	0.250**	0.035*	-0.095**	-0.267**	0.015**	-0.077**	0.081**	-0.017**	0.064**	-0.111**
	Off_returns	-0.670**	0.244**	0.321**	1.012**	-0.105**	-0.154**	-0.048	-0.001	-0.080*	0.251**
Offline											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-2.315**	0.085**	-0.004	-0.031	0.053**	0.353**	0.724**	-0.003**	0.210**	0.338**
	Views	0.015**	-8.394e-04**	9.360e-04**	-0.001**	-9.205e-04**	-0.004**	-0.006**	-0.002**	0.038**	-0.006**
	OnlineRes	0.024*	-0.009±	0.002	0.046**	-0.004	-0.027**	-0.011*	-0.003**	-0.023**	-0.003
	Offline	0.231**	-0.003*	0.044**	-0.040**	0.010**	7.415e-04	-0.061**	-0.002**	-0.006**	-0.067**
	Online	0.008	0.028**	-0.001	0.006	0.002	0.038**	0.037**	-0.002	-0.041**	-0.009**
	Reviews	-0.178	-0.064±	-0.371*	0.182	0.014	0.133*	-0.046	0.016*	-0.253**	0.205**
	On_returns	0.146**	0.062**	0.057**	-0.051**	-0.026**	0.004	-0.063**	-0.001	-0.004	0.007*
	Off_returns	0.271**	0.085**	0.105**	-0.045*	-0.018**	-0.021*	-0.179**	0.007**	0.029**	0.015*
Online											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-6.138**	-0.485**	-0.189**	-0.125±	0.133**	0.366**	2.002**	-0.015**	0.446**	0.960**
	Views	0.021**	-0.002**	0.005**	3.084e-05	-0.002**	-0.004**	-0.012**	-0.004**	0.068**	-0.005**
	OnlineRes	0.101**	-0.006	-0.124**	0.107**	0.018**	0.051**	-0.120**	-0.009**	0.007	-0.105**
	Offline	0.214**	-0.014**	-0.041**	-0.037**	-0.005*	0.083**	-0.054**	0.001	-0.057**	-0.091**
	Online	0.211**	-0.009±	-0.041**	-0.026**	0.018**	0.045**	-0.166**	0.013**	-0.031±	-0.020**
	Reviews	1.554**	-0.841**	0.079	-0.570*	-0.151**	0.330**	-0.270*	-0.052**	0.114	-0.298**
	On_returns	0.323**	0.064**	-0.024±	-0.130**	-0.003	-0.040**	-0.106**	0.011**	-0.112**	-0.037**
	Off_returns	-0.137	0.055*	0.133**	0.489**	-0.080**	-0.149**	-0.158**	-0.013*	0.118**	-0.046
Reviews											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-10.661**	1.002**	0.342	2.050**	0.389**	0.212**	2.407**	-0.042**	1.492**	4.171**
	Views	0.027**	0.002*	0.040**	0.014**	-0.003**	-0.006**	-0.014**	0.004**	0.063**	-0.037**
	OnlineRes	0.205	0.050	-0.052	-0.002	0.036	0.161*	-0.196**	-0.037**	0.180*	-0.217**
	Offline	0.437**	0.064**	0.050	-0.386**	0.044**	-0.014	-0.062±	0.009	-0.291**	-0.063*
	Online	1.034**	-0.283**	-0.018	0.497*	0.037	-0.021	-1.259**	0.046	-0.297	-0.147**
	Reviews	0.583±	-0.455**	-0.745	-0.057	-0.137**	0.166	0.351**	0.204**	-1.589**	-0.093
	On_returns	-0.135	0.269**	-0.228	0.234±	0.047±	-0.088	-0.101	0.049*	-0.535**	-0.020
	Off_returns	-0.075	0.433	-0.702	-0.412	0.204±	-0.230	0.410*	0.183**	-0.855±	-0.923**
On_returns											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-5.082**	0.073	0.427**	-0.171±	0.090**	0.302**	2.521**	-0.037**	0.809**	1.521**
	Views	0.026**	-0.002**	6.698e-04	-0.002**	-8.969e-04**	-0.002**	-0.014**	0.004**	0.032**	-0.012**
	OnlineRes	0.125**	-0.002	-0.094**	0.077**	0.008±	-0.005	-0.084**	0.003**	-0.048**	-0.117**
	Offline	0.305**	-0.018**	-0.013±	-0.010	0.021**	-0.074**	-0.127**	0.006**	-0.092**	-0.146**
	Online	0.263**	1.814e-04	-0.019*	-0.016	0.028**	0.019**	-0.134**	0.009**	-0.103**	-0.043**
	Reviews	0.675**	0.311**	0.162	-0.082	0.186**	-0.166	-1.589**	-0.065**	0.348*	0.583**
	On_returns	0.439**	-0.022*	-0.060**	-0.274**	-0.086**	-0.007	0.028±	0.008**	-0.041*	-0.002
	Off_returns	-0.090	0.234**	0.172**	0.277**	0.006	-0.099**	-0.114**	-0.008*	-0.062±	-0.018
Off_returns											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-5.274**	-0.504**	-0.458**	1.111**	0.003	0.422**	1.290**	-0.002	0.243**	0.985**
	Views	0.008**	-0.002±	-0.004**	0.001	0.005**	-0.016**	-0.013**	5.900e-04	0.059**	-0.006**
	OnlineRes	0.152**	-0.148**	-0.123**	0.007	-0.005	0.061*	-0.026	0.001	-0.025	-0.082**
	Offline	0.566**	-0.005	0.152**	-0.238**	-0.006**	0.099**	-0.092**	-0.011**	0.029**	-0.088**
	Online	0.052	-0.012	-0.065±	0.139**	0.047**	-0.160**	-0.223**	-0.005	-0.068	-0.034**
	Reviews	1.794**	0.152	-0.444	-0.349	-0.292**	0.632*	-0.721**	-0.038	0.549	-1.907**
	On_returns	0.202**	0.124**	0.191**	-0.167**	-0.028*	0.043	0.072**	-0.048**	0.140**	-0.062**
	Off_returns	0.179**	0.053**	0.457**	-0.159**	-0.043**	-0.175**	0.010	0.020**	0.036	0.025*

Brand B **(Table 4)**

Endog. Vars	Lags	Direct effects of Lags	Effect of demographics and marketing variables on the effect of lags (Interaction Effects)								
Views											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-0.771**	-0.038**	-0.224**	-0.036*	0.052**	0.254**	1.442**	-0.014**	0.588**	1.791**
	Views	0.077**	-0.004**	0.018**	-0.018**	-0.005**	-9.162e-04**	-0.024**	0.003**	0.032**	-0.033**
	OnlineRes	0.068**	-0.061**	-0.052**	0.017**	-0.001	-0.024**	-0.012**	-0.003**	3.476e-05	-0.165**
	Offline	0.365**	0.017**	-0.060**	-0.110**	0.004*	0.034**	-0.169**	1.717e-05	-0.055**	-0.125**
	Online	-0.128**	-0.019**	-0.051**	-0.034**	0.058**	-0.051**	0.099**	-0.008**	-0.047**	-0.018*
	Reviews	0.561	-0.456**	0.564**	2.232**	-0.642**	-0.068**	0.567**	-0.003	-0.439**	0.772**
	On_returns	0.349**	0.063**	0.182**	0.275**	-0.067**	0.030**	-0.290**	0.008**	-0.162**	-0.455**
	Off_returns	0.877**	0.205**	-0.548**	-0.650**	-0.028±	-0.172**	-0.111*	-0.025**	-0.164**	0.292**
OnlineRes											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-2.864**	0.091*	-0.183**	-0.497**	0.135**	0.201**	1.907**	0.002	0.724**	2.166**
	Views	0.048**	-0.015**	0.001	-0.011**	0.001**	0.003**	-0.020**	-0.002**	0.057**	-0.066**
	OnlineRes	0.129**	-0.035**	0.095**	0.072**	0.022**	-0.061**	-0.059**	0.002**	-0.053**	-0.106**
	Offline	0.537**	0.067**	-0.209**	-0.111**	0.015*	-0.070**	-0.338**	-0.003*	-0.056**	-0.252**
	Online	0.034	0.102**	0.142**	-0.077*	0.043**	-0.001	-0.043**	-0.009**	0.007	-0.131**
	Reviews	-0.280	-0.945**	-2.087*	2.759	-0.196*	0.066	-0.988**	0.135**	-0.964**	0.895*
	On_returns	0.887**	0.006	-0.106	-0.158±	0.019	0.063±	-0.624**	-0.015**	-0.014	-0.207**
	Off_returns	1.163**	0.157	-1.476**	-0.185	-0.047	0.061	-0.553**	-0.023**	-0.386**	0.890**
Offline											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-3.259**	-0.003	-0.071	0.374**	0.034*	0.324**	0.818**	0.012**	0.252**	1.047**
	Views	0.053**	-0.017**	2.889e-04	0.002	-0.002**	-0.006**	-0.028**	-0.003**	0.037**	-0.016*
	OnlineRes	-0.070**	0.084**	0.030	0.078**	-0.034**	0.061**	-0.008	-7.548e-04	0.007	0.108**
	Offline	0.508**	-0.002	0.015	-0.022	-0.003	-0.089**	-0.052**	-0.007**	-0.019**	-0.454**
	Online	0.073	0.101**	-0.158**	-0.123*	-0.005	0.035*	0.191**	-0.004	1.037e-04	-0.197**
	Reviews	-3.119	-1.297**	-2.260*	2.406	0.183	-0.073	1.481**	0.019	-0.481*	-0.173
	On_returns	-0.106	-0.181**	0.154	0.319*	0.081**	0.112	-0.466**	0.008**	-0.092*	0.485**
	Off_returns	-0.353	0.296*	0.243	0.580	0.048	0.613**	-0.524**	0.021*	-0.288**	-0.324
Online											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-6.692**	-0.133*	0.037	0.294**	0.104**	0.173**	1.759**	-2.500e-04	0.439**	1.060**
	Views	0.041**	0.003*	0.039**	-0.012**	-0.001**	-9.393e-04	-0.029**	-0.002**	0.061**	0.010*
	OnlineRes	0.040*	-0.046**	-0.146**	0.180**	-0.021**	-0.015	-0.079**	0.003**	-0.045**	-0.079*
	Offline	0.497**	0.076**	-0.031	0.013	-0.046**	-0.061**	-0.197**	-0.015**	-0.070**	-0.252**
	Online	0.003	0.040**	0.197**	-0.087**	0.118**	-0.142**	0.110**	-0.024**	-0.015	-0.164**
	Reviews	-1.977	-0.463±	1.465*	3.545	-0.632**	-0.064	1.414**	-0.019	-0.304±	0.618
	On_returns	0.442**	0.006	0.026	0.295**	-0.084**	0.135**	-0.383**	-0.011	-0.037	-0.357**
	Off_returns	0.672	-0.204	-0.792	-2.071**	0.342**	-1.324**	0.466±	0.069**	-0.296±	0.415
Reviews											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-11.173**	-0.026	-1.224**	2.259**	0.543**	0.756**	3.072**	-0.098**	1.093**	3.689**
	Views	-0.079	-0.028*	-5.387e-06	0.139*	-0.006	-0.004	-0.001	0.005**	0.056**	-0.043*
	OnlineRes	0.183	0.195±	0.675**	0.656±	-0.063	-0.149*	-0.670**	0.001	-0.059	-0.067
	Offline	-0.284	-0.545**	-0.213	0.005	-0.063	0.061	1.310**	0.109**	-0.758**	-0.262
	Online	0.490	-0.261	-0.983*	0.352	-0.004	0.216**	-0.608*	-0.046	-0.388	0.242
	Reviews	1.334	-1.636**	-3.336*	4.448	-0.373	-0.353**	-1.933**	-0.053	-0.584±	0.142
	On_returns	1.367	0.522	-0.717	0.953	-0.325	0.773	-0.837±	0.135*	-2.402**	-3.738*
	Off_returns	-0.656	1.068	0.409	-0.732	0.305	-1.691	-2.220	-0.096	0.446	3.227
On_returns											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-8.610**	0.392**	0.860**	0.952**	0.247**	0.356**	2.121**	-0.012*	0.644**	2.578**
	Views	0.069**	-0.004±	0.013*	0.017*	-0.010**	-0.008**	-0.028**	0.004**	0.014**	-0.060**
	OnlineRes	0.127±	0.108**	0.025	0.182**	-0.004	-0.020	-0.225**	0.002	-0.055**	-0.074
	Offline	0.764**	-0.169**	-0.029	-0.015	-0.058**	-0.083*	-0.220**	0.003	-0.156**	-0.473**
	Online	0.538**	0.133**	0.419**	-0.276**	0.102**	-0.041*	-0.255**	-0.018**	0.016	-0.650**
	Reviews	-0.773	-0.695	0.222	4.413	-0.928**	0.799**	0.445±	-0.094*	0.397*	-1.012
	On_returns	0.798**	-0.089*	0.449**	0.269*	-0.013	0.299**	-0.791**	-0.012	-0.046	-0.224
	Off_returns	-2.138	1.417**	0.294	0.359	0.350**	-0.443	0.187	0.022	-0.227	0.280
Off_returns											
		Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-3.140**	1.058**	1.138**	-1.977**	-0.960**	0.774**	1.979**	0.025	0.484**	0.394
	Views	0.074	-0.006	-0.009	-0.026	-0.002	-0.179**	-0.089**	-0.008*	0.104**	0.282**
	OnlineRes	1.352**	0.178	-0.017	-0.957**	-0.140*	0.768**	-0.142±	-0.013	-0.042	-0.262
	Offline	0.909**	0.272**	0.310**	0.187**	-0.199**	-0.071*	-0.056	-0.050**	0.134*	-0.483*
	Online	-0.565	-0.099	-1.253±	-0.272	0.421**	-0.419	0.106	-0.069*	0.255	-0.878*
	Reviews	-8.920	3.327	1.211	-0.656	1.092	2.862	1.527	-0.798±	4.272±	-4.138
	On_returns	-1.821	0.499	-0.837	1.809	0.402*	0.732	-0.840±	0.115±	-1.231**	0.848
	Off_returns	-1.413	-0.555	-1.412±	2.596	0.918**	-1.863**	-1.773**	0.017	-0.600**	1.083

Brand C **(Table 5)**

Endog. Vars	Lags	Direct effects of Lags	Effect of demographics and marketing variables on the effect of lags (Interaction Effects)							
			Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
Views												
	Intercept	-0.189**	-0.162**	-0.074**	-0.135**	0.053**	0.356**	1.051**	0.003**	0.431**	1.373**
	Views	0.018**	-0.004**	-9.531e-04**	0.006**	-0.001**	-0.004**	-0.008**	-0.002**	0.115**	-0.007**
	OnlineRes	0.217**	-0.007**	-0.014**	-0.016**	0.011**	-0.002	-0.116**	0.001**	-0.096**	-0.222**
	Offline	0.168**	0.022**	0.001	-0.018**	-0.005**	-0.020**	-0.074**	-0.002**	-0.027**	-0.073**
	Online	0.049**	0.016**	-0.046**	-0.028**	-0.001	0.030**	-0.019**	0.003**	-0.145**	-0.016**
	Reviews	-0.187**	0.076**	-0.118**	0.828**	-0.016	-0.351**	-0.181**	3.746e-04	-0.230**	-0.529**
	On_returns	0.092**	-0.030**	0.117**	0.110**	0.031**	-0.115**	-0.073**	-0.004**	-0.025**	-0.218**
	Off_returns	0.316**	0.153**	-0.076**	-0.148**	-0.039**	0.054*	-0.147**	0.018**	5.571e-04	-0.730**
OnlineRes												
			Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-3.304**	-0.178**	-0.018	-0.073±	0.155**	0.564**	1.462**	-3.487e-04	0.605**	1.437**
	Views	0.014**	-4.911e-05	-4.323e-04	0.006**	-1.489e-04	-0.005**	-0.012**	2.381e-05	0.069**	-0.014**
	OnlineRes	0.357**	-0.035**	0.035**	-0.007	-7.522e-05	-0.018**	-0.129**	-1.862e-04	-0.087**	-0.232**
	Offline	0.280**	-0.011*	-0.081**	0.006	-0.012**	-0.060**	-0.141**	-5.066e-04	-0.030**	-0.142**
	Online	0.136**	-0.010±	0.012	-0.041**	0.001	0.008	-0.087**	7.622e-05	-0.024*	-0.020**
	Reviews	-0.152	-0.362**	0.127	0.486**	0.094	-0.283*	-0.011	0.002	-0.173±	-0.232*
	On_returns	0.327**	0.177**	0.034	-0.059*	-0.019*	-0.069**	-0.151**	-0.013**	-0.011	-0.102**
	Off_returns	0.193	0.428**	-0.056	0.179±	-0.041±	-0.180*	-0.308**	0.002	-0.053	-0.956**
Offline												
			Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-2.461**	-0.150**	0.196**	-0.130**	-0.054**	0.417**	0.696**	-1.018e-04	0.138**	0.343**
	Views	0.009**	8.740e-04*	-0.002**	0.004**	-8.979e-04**	-0.003**	-0.003**	-4.156e-04**	0.054**	-0.020**
	OnlineRes	0.072**	0.020**	-0.017±	0.031**	0.013**	-0.037**	-0.060**	0.001**	-0.051**	-0.003
	Offline	0.418**	-0.013**	0.027**	-0.045**	-0.025**	-0.018**	-0.101**	4.912e-04	-0.036**	-0.132**
	Online	0.045**	0.006	0.086**	0.006	0.015**	0.032**	-0.056**	8.673e-04	-0.015	0.007
	Reviews	-1.383**	-0.803**	0.095	0.288	0.272**	-0.200	0.675**	-0.019*	0.165*	-0.325±
	On_returns	-0.111*	0.055**	-0.077*	0.127**	0.004	-0.217**	0.016	-0.019**	0.028	-0.011
	Off_returns	0.306**	0.197**	0.002	-0.163*	0.082**	-0.044	-0.266**	-0.034**	0.014	0.674**
Online												
			Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-6.421**	0.049	0.398**	-0.326**	-0.078**	0.539**	1.676**	-0.005**	0.274**	1.883**
	Views	0.018**	-0.002**	-0.002**	0.007**	9.563e-04**	-0.007**	-0.015**	-9.836e-04**	0.084**	-0.022**
	OnlineRes	0.361**	0.005	-0.007	0.037**	-0.011**	-0.023**	-0.237**	0.002**	-0.077**	-0.240**
	Offline	0.151**	0.042**	0.012	0.104**	0.013**	-0.048**	-0.163**	-9.337e-04	-0.023**	-0.241**
	Online	0.206**	-0.044**	-0.032**	-0.044**	-0.015**	0.025**	-0.056**	0.003*	-0.088**	-0.032**
	Reviews	-0.667	-0.317	0.026	0.798	-0.380**	-0.608*	1.198**	-0.009	-0.209	-1.766**
	On_returns	0.040	0.188**	0.217**	-0.196**	-0.015±	-0.145**	0.246**	-0.013**	0.135**	-0.362**
	Off_returns	-0.366±	0.481**	-0.052	-0.411**	0.097*	0.098	0.188	-0.008	-0.693**	1.299**
Reviews												
			Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-4.814**	0.637±	1.143*	-2.814**	-0.215	0.456**	3.478**	-0.003	0.912**	5.847**
	Views	0.060**	0.011**	0.013*	0.016**	-0.005**	0.004	-0.050**	7.784e-04	0.151**	-0.063**
	OnlineRes	0.855**	0.256**	0.075	-0.042	-0.053	-0.204*	-0.271**	0.019**	-0.579**	-1.921**
	Offline	0.785**	-0.611**	-0.700**	-0.104	0.025	-0.554**	-0.188±	-0.018±	0.035	-1.109**
	Online	0.969**	-0.245**	-0.372*	-0.592**	0.058	0.027	-0.227**	-0.003	0.472**	-0.086
	Reviews	0.596	0.363	-14.198**	-1.012	-0.461*	-0.345	1.562	0.106**	-1.328**	0.324
	On_returns	1.561*	0.760*	-0.339	1.173*	-0.861**	0.805±	-0.828±	0.021	0.185	-2.210*
	Off_returns	-1.287	0.541	0.401	0.426	-0.125	-0.127	-1.056	0.099	-0.781	-1.653
On_returns												
			Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-6.226**	-0.159*	0.313**	0.301**	-0.244**	0.621**	2.362**	-0.009**	0.643**	3.012**
	Views	0.034**	-0.002**	0.002*	-0.005**	-8.471e-04**	-0.003**	-0.015**	4.033e-04	0.099**	-0.044**
	OnlineRes	0.441**	0.079**	-0.008	0.017	0.029**	-0.154**	-0.367**	-0.005**	-0.047**	-0.327**
	Offline	0.528**	0.048**	-0.057*	-0.151**	-0.002	0.036±	-0.204**	0.004**	-0.089**	-0.348**
	Online	0.294**	-0.009	0.037**	-0.002	-3.164e-04	-0.051**	-0.064**	-9.137e-04	-0.159**	-0.125**
	Reviews	4.328**	-2.127**	-1.057*	-2.361**	-0.292	-2.629**	1.330±	-0.012	-0.070	-3.464**
	On_returns	0.106±	0.077**	-0.015	0.294**	-0.006	-0.310**	-0.067±	-0.002	-0.044±	-0.642**
	Off_returns	0.176	-0.019	0.535**	-0.046	0.071	-0.212	0.080	-0.052*	0.019	-0.389
Off_returns												
			Intercept	Mid_age	Old_age	Female	Distance	Catalog	Email	Reviews_Seen	Rating_Val	Popularity
	Intercept	-6.177**	-0.052	0.118	-1.016**	0.338**	0.876**	1.416**	-0.016**	0.324**	0.602**
	Views	-0.004	0.013**	0.014**	0.013**	0.006**	-0.019**	-0.033**	-0.003*	0.114**	-0.018
	OnlineRes	0.262**	0.026	-0.013	0.056	-0.019	-0.056	-0.192**	7.380e-04	0.045±	-0.246**
	Offline	1.061**	0.078**	-0.027*	-0.189**	-0.113**	-0.009	-0.123**	0.005±	-0.062**	-0.026
	Online	-0.212±	0.099±	0.250**	0.114	0.034±	0.168**	0.150±	0.005	-0.344**	-0.219**
	Reviews	2.456	-0.849	-0.974	-2.253	-0.993	0.736	0.031	0.009	-0.596	-0.290
	On_returns	0.225	-0.053	0.034	0.364**	0.128**	0.240	-0.322*	0.014	-0.184	-1.595**
	Off_returns	1.138**	-0.045	0.167	0.205	-0.002	0.401**	-0.962**	-0.228**	0.057	-0.744

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