

Do consumers who conduct online research also post online reviews? A model of the relationship between online research and review posting behavior

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Abstract The purpose of the research is to investigate whether consumers who conduct online product research also more likely to post online product reviews. An information theory-based classification algorithm is used to estimate the likelihood of a consumer posting an online review conditional on having conducted online product research. Data from a nationally representative probability sample of American internet users are used to estimate the model. The results indicate that the characteristics of consumers who have a greater propensity to conduct online product research but a lower tendency to post online product reviews differ substantially from those who are more likely to post online product reviews but less likely to conduct online product research. The research is important because the degree to which consumers who conduct online product research are similar to those who post online product reviews can be used to track the effectiveness of online word-of-mouth marketing campaigns.

Keywords Online reviews · Online product research · Word of mouth · E-commerce · Internet retailing

1 Introduction

An important feature of the online environment is the availability of consumer-generated information in the form of product reviews posted on retailer and social media websites. The importance of online reviews in influencing the buying decisions of consumers has been well established in the literature (Mudambi and Schuff 2010; Senecal and Nantel 2004; Zhu and Zhang 2010).

Potential buyers typically use online peer reviews as a means to manage online information overload (Smith et al. 2005), even when they know that these reviews

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have been written by strangers and may not be reliable (Kim and Srivastava 2007). Online product review forums also create the possibility where the opinions of a minority can shape online attitudes toward a product (Dellarocas and Narayan 2006; Koh et al. 2010). When evaluating online product reviews, potential buyers have to evaluate the expertise of the reviewer and the usefulness of the review. The expertise of the reviewer is often evaluated by identity-descriptive information provided by the reviewer (Forman et al. 2008). The usefulness of a review is often assessed by the “helpfulness ratings” it receives from other consumers. Reviews that are regarded as being helpful by consumers have considerable business value to companies (Chevalier and Mayzlin 2006).

Researchers have previously examined the characteristics of consumers who conduct online research (Johnson et al. 2004; Ratchford et al. 2007), but not enough is known about the characteristics of those who post online reviews (Bruyn and Lilien 2008). The interests of both potential buyers and internet retailers are best served when the opinions of a broad spectrum of consumers are represented in online product review forums. Hence, the purpose of the research is to investigate whether consumers who are more likely to conduct online product research also more likely to post online product reviews. Or is the tendency to post online reviews unrelated (or worse still, negatively related) to the propensity to conduct online research. Specifically, the characteristics of consumers who conduct online research and then choose to post an online review are examined in comparison to consumers who choose not to post online reviews. The research is important because the degree to which consumers who conduct online product research is similar to those who post online product reviews can be used to track the effectiveness of online word-of-mouth marketing campaigns initiated by companies.

2 Relevant research

An important theme in research on online product reviews has been on trying to understand the reasons why consumers post reviews (Dellarocas and Narayan 2006; Hennig-Thurau et al. 2004). The typical finding from these studies is that consumers post online reviews for a variety of reasons, ranging from the altruistic to the perverse. For instance, Hennig-Thurau et al. (2004) found that the primary motivations consumers have for posting online product reviews are (1) a genuine concern for other consumers, (2) the consumer’s desire for social interaction, (3) the need to vent strongly positive or negative feelings, (4) potential to enhance self-worth by appearing to be a connoisseur or an expert, and (5) economic incentives.

Recent research on the social transmission of information has found that product characteristics and consumer internal states/traits have an important influence on the reach, intensity, and persuasiveness of online word-of-mouth communications (Berger and Milkman 2012; Berger and Schwartz 2011; Cheema and Kaikati 2010; Gosling et al. 2011). For instance, Berger and Schwartz (2011) found that products that are interesting receive more immediate word-of-mouth, while products that are publicly visible receive more ongoing word-of-mouth. The internal states of consumers such as the arousal and emotions induced by online content have been found to influence the intensity of word-of-mouth communications (Berger and Milkman 2012).

Online product reviews may be regarded as a “public good” (Dellarocas and Narayan 2006). They require time and effort to produce, but once available, they are free for anyone to use. Public goods theory predicts that when people share the responsibility of producing a public good, there is a tendency towards undersupply. But when they share the consumption (i.e., use) of a public good, there is a tendency towards overuse. The imbalance in the production and use of online product reviews is an issue if there are significant differences in the characteristics of consumers who produce online reviews in comparison to those who use them. Online product reviews may not be representative of the views of the broader population for another reason, namely, the underreporting bias created when consumers with more moderate sentiments choose not to post a review (Hu et al. 2006; Koh et al. 2010).

3 Theory

Past research on online product research and review posting behavior has found that both economic and social influences determine the extent to which consumers engage in these activities. Hence, the present research examines the relationship between online product research and review posting using a modified cost–benefit model that considers both economic and social factors. For instance, the costs associated with conducting online research may be assessed in economic terms (e.g., time costs) and the benefits in terms of the monetary savings and/or product “fit” (i.e., the match between consumer needs and product attributes) achieved. Similarly, the costs of producing an online review may be viewed in economic terms (e.g., time costs) and the benefits in terms of the social value obtained. By adopting this combined approach, a deeper understanding of how consumer characteristics influence online review posting behavior may be obtained.

Income affects the valuation of time. Higher-income consumers value their time more because of its opportunity cost (Goldman and Johansson 1978; Stigler 1961). They are also known to use the internet more for consumption than for recreation (Comor 2000) and derive a greater benefit from online services because they use them to satisfy a wide-ranging set of consumption needs (Lambrecht and Seim 2006). Thus, they may be more likely to conduct online product research.

Yet, higher-income consumers have also been found to spend less time online than lower-income consumers (Goldfarb and Prince 2008; Goolsbee and Klenow 2006). Hence, they may be less likely to post online product reviews after their consumption needs have been satisfied. On the other hand, lower-income consumers are known to use the internet more for recreation than for consumption (Comor 2000; Goldfarb and Prince 2008). Hence, they may be more likely to post online reviews because of the social value obtained. Stated another way, consumers who are “time rich and income poor” may have the time to post online reviews, while those who are “income rich and time poor” may only have the time to conduct online product research.

In addition to the effect of income, education is also likely to have an independent effect on online product research and review posting behavior. Consumers with more education are more likely to have the cyber fluency needed to use electronic decision aids (e.g., shopbots, recommendation agents) that facilitate online product research. Moreover, these consumers are less likely to use online product review forums as a

source of trustworthy product information because of their ability to search for information from other more reliable online sources. On the other hand, participating in online product review forums does not require special skills or expertise. Hence, consumers with less education may opt-in to them as a means of acquiring product information.

The above arguments lead to the primary hypothesis tested in the research, namely, *higher-income, more-educated consumers are more likely to do online product research on the products they intend to buy, while lower-income, less-educated consumers are more likely to post reviews*. If the hypothesis is validated, the result would indicate that there is an important “demographic divide” between consumers who are more likely to conduct online product research compared to those who are more likely to post an online product review.

In addition to the effects of income and education, there are important generational differences in the use of the internet. Thus, it is possible that generational age potentially moderates the income and education-related differential between conducting online product research and posting online product reviews. Gen Y (18 to 30 years) and Gen X (31 to 42 years) consumers are almost always “connected” and lead wired lifestyles. Hence, they are more likely to conduct online product research and post online product reviews. Leading boomers (53 to 61 years) and matures (62 to 71 years) in comparison are less likely to engage in either activity. The generational difference can be attributed to the differential adoption rates of new information and communication technologies by older consumers (Gilly and Zeithaml 1985; Phillips and Sternthal 1977).

4 Data

Data from a national probability sample of 2,065 adults, 18 years and older, living in the continental USA were used to test the primary hypothesis of interest in this research. The data were gathered through a telephone survey conducted by Princeton Survey Research Associates during September 2010 on behalf of the Pew Internet & American Life Project. The nonprofit sponsoring organization is an authoritative source of information on how Americans use the internet, and the data provided by it are often used in setting government policy.

The telephone survey data were collected using a dual-frame sample design. Both landline and cellular random digit dial samples were used. The landline sample was a list-assisted random digit sample of telephone numbers selected from landline telephone exchanges in the continental USA. The cell phone sample was drawn from dedicated cellular exchanges based on the most recently available Terminating Point Master data file for the continental USA. The combined sample generalizes to the American population with an internet connection, with a margin of sampling error of ± 2.9 percentage points.

5 Dependent and independent variables

The primary dependent variables, *Conducted Online Research* and *Posted Online Review*, were operationalized using two dichotomous scales (1=yes; 0=no) based on affirmative answers to questions that asked whether respondents had “looked for

information online about a product or service” and “posted an online review.” For the independent variables, *income* was measured as the total household income from all sources before taxes in 2009 using a six-point ordinal scale. *Education* was measured using a five-point ordinal scale. *Age* was measured using a six-point ordinal scale that used breakpoints in chronological age that are normally used by demographers to distinguish between generations (e.g., Gen Y, Gen X, etc.)

Two additional variables that could potentially influence the primary relationships of interest were included as control variables. *Internet usage* which represented the frequency with which the respondent used the internet at work or at home was measured using a five-point ordinal scale. *Gender* was recorded by the phone interviewer on a two-point scale. Overall, the sample distributions on the study variables closely matched the demographic profile of the American population with an internet connection, which was to be expected, due to the use of a national sample frame and probability sampling. Frequency distributions and scale values for all study variables are reported in Table 1.

6 Model

The information theory-based classification model C5.0 (Quinlan 1992) was used to profile consumers who conduct online product research and then choose to either post or not post an online review. The main advantage of the C5.0 model is that makes no statistical assumptions about the distribution of the variables used in the partitioning. Instead, it uses an information gain (i.e., entropy reduction) measure to partition the data.

Recall from information theory that the information in an observation is inversely proportional to the probability of its occurrence and can be measured as minus the logarithm to base 2 of that probability. The entropy (or impurity) of a set of observations S can be stated as:

$$\text{Entropy}(S) = \sum_{i=1}^c -p_i \log_2(p_i),$$

Where p_i is the proportion of category i observations in S and c is the number of categories. The information gain from a variable is the reduction in entropy caused by partitioning the observations on that variable and can be stated as:

$$\text{Information gain}(S, A) = \text{entropy}(S) - \sum_v \frac{|S_v|}{|S|} \text{entropy}(S_v),$$

Where S_v is the subset of S for which variable A has value v . Details of the C5.0 classification model are available in Quinlan (1992) and Larose (2005). It has been primarily used in knowledge discovery (i.e., artificial intelligence) applications, and its use here is consistent with a recent call in this journal for using high-dimensional analytical methods (Naik et al. 2008). The primary advantage of the C5.0 classification model is that it assumes the effect of a variable in a subset of observations is unrelated to the effect of the same variable in other subsets of observations, thereby eliminating the need to explicitly specify interactions. Another

Table 1 Frequency distributions for study variables

	Frequency	Valid percent
Posted online review		
No	1,324	(65.7)
Yes	691	(34.3)
Conducted online research		
No	433	(21.5)
Yes	1584	(78.5)
Income		
Less than \$20,000	297	(17.3)
\$20,000 to \$40,000	395	(23.0)
\$40,000 to \$75,000	489	(28.5)
\$75,000 to \$100,000	228	(13.3)
\$100,000 to \$150,000	173	(10.1)
More than \$150,000	134	(7.8)
Age		
18–30 years (Gen Y)	518	(26.2)
31–42 years (Gen X)	393	(19.9)
43–52 years (Trailing boomers)	349	(17.7)
53–61 years (Leading boomers)	361	(18.3)
62–71 years (Matures)	242	(12.3)
72+ years (After work)	111	(5.6)
Gender		
Male	850	(42.1)
Female	1,169	(57.9)
Education:		
High school incomplete	115	(5.7)
High school graduate	493	(24.6)
Some college or vocational school	593	(29.6)
College graduate	458	(22.9)
Post graduate degree	345	(17.2)
Amount of internet usage		
Every few weeks	160	(8.1)
1–2 days a week	157	(7.9)
3–5 days a week	238	(12.0)
About once a day	334	(16.8)
Many times a day	1,095	(55.2)

advantage of the C5.0 algorithm is that it produces “rule sets” (i.e., if-then statements) that are easier to interpret by managers, in comparison to (say) logistic regression coefficients. Also, the decision maker has more leeway in selecting which rule sets to implement and which to ignore because the algorithm does *not* produce mutually exclusive rule sets.

7 Results

The dependent variables *Conducted Online Research* and *Posted Online Review* were cross-categorized to identify four groups, namely, respondents who had (1) conducted online research and posted an online review, (2) conducted online research, but not posted an online review, (3) posted an online review, but not conducted online research, and (4) neither conducted online research nor posted an online review.

A cross-classification between the grouped dependent variables and *income* showed that respondents who only conducted online research had higher incomes than those who conducted online research and also posted an online review (3.19 versus 3.08 on the 1=less than \$20,000 to 6=more the \$150,000 scale), while those who only conducted online research had higher incomes than those who only posted online reviews (3.19 versus 2.77). For *education*, respondents who only conducted online research had more education than those who conducted online research and also posted an online review (3.42 versus 3.28 on the 1=high school incomplete to 5=postgraduate degree scale). The corresponding values for those who only posted an online review or did neither were 3.09 and 2.73, respectively. Thus, as expected, respondents with higher income and more education had a greater propensity to conduct online research but not post online reviews in comparison to respondents with lower income and less education. The cross-classifications with *age* and *gender* showed that younger consumers are less likely to conduct online research, but more likely to post online reviews in comparison to older consumers, while females are more likely to post online reviews, but less likely to conduct online research in comparison to males.

The C5.0 model was estimated using the grouped dependent variables to estimate the likelihood of (a) posting an online review conditional on having conducted online research, and (b) posting an online review not having conducted online research. *Income*, *education*, *age*, *gender*, and *internet usage* were used as the predictor variables for generating rule sets that profiled the four groups of interest. The results show that consumers who conducted online research and posted an online review tend to be college educated females in the low- to middle-income brackets, with low levels of internet usage, while consumers who conducted online research but then chose not to post an online review tend to be older males in a higher income bracket who use the internet more frequently. Hence, there appears to be a demographic gap between consumers who conduct online research and then choose to either post or not post an online review. The specific rule sets that illustrate these differences are shown in Table 2.

The results also indicate that consumers who posted an online review but did not conduct online research tend to be younger males, with a high school education and in the lower-income bracket, while consumers who did not post an online review or conduct online research tend to be older females with some college education and in the lower-income bracket. As before, there appears to be a demographic gap between those who do not conduct online research, but still post an online review and those who do neither. The specific rule sets that illustrate these differences are shown in Table 3.

Table 2 Rule sets for posted online review conditional on conducted online research

Segment	Rule set	Rule confidence ^a
Posted online review and conducted online research	If gender=female & Age \geq 43 years & Education \leq college graduate & Income \geq \$75,000 & Internet usage \leq 1–2 days a week	$c=0.77$
	If gender=female & Age=18–30 years & Education=college graduate & Income=\$20,000 to \$40,000 & Internet usage \geq about once a day	$c=0.72$
	If gender=male & Age \leq 52 years & Education=postgraduate & Income \leq \$75,000	$c=0.65$
Did not post online review and conducted online research	Gender=male & Age \geq 43 years & Income \geq \$75,000 & Internet usage \leq 1–2 days a week	$c=0.67$
	If gender=female & Age=43–61 years & Education \geq some college & Internet usage=3–5 days a week	$c=0.65$
	If gender=male & Age=43–52 years & Income \geq \$75,000 & Internet usage=many times a day	$c=0.53$

^a Denotes proportion of respondents meeting rule set condition(s) that were correctly classified by the rule set

Taken together, the 12 rule sets depicted in Tables 2 and 3 provide strong support for the primary hypothesis tested in this research that consumers with more income and a higher educational level are more likely to conduct online research, while also being less likely to post online reviews, with the reverse being true for consumers with a less income and a lower educational level. In addition to the predicted income and education level differences, there appear to be some interesting gender- and age-related differences that emerge from the analysis. Females are more likely to post online reviews, while males are more likely to conduct online research. Similarly,

Table 3 Rule sets for posted online review conditional on did not conduct online research

Segment	Rule set	Rule confidence ^a
Posted online review and did not conduct online research	If gender=male & Education=high school incomplete & Income ≤\$20,000 & Internet usage=3–5 days a week	<i>c</i> =0.96
	Gender=male & Age=31–42 years & Education=high school incomplete & Income ≤\$75,000 & Internet usage=every few weeks	<i>c</i> =0.85
	If gender=female & Age ≤52 years & Education=some college & Income=\$20,000 to \$40,000 & Internet usage=1–2 days a week	<i>c</i> =0.70
Did not post online review and did not conduct online research	If gender=male & Age=18–30 years & Education=≤some college & Internet usage=1–2 days a week	<i>c</i> =0.78
	If gender=female & Age=31–71 years & Education≤high school graduate & Income ≤\$20,000 & Internet usage ≤3–5 days a week	<i>c</i> =0.76
	If gender=male or female & Age ≥43 years & Education≤some college & Income ≤\$75,000 & Internet usage=every few weeks	<i>c</i> =0.69

^a Denotes proportion of respondents meeting rule set condition(s) that were correctly classified by the rule set

leading boomers are more likely to post online reviews, while Gen Y and Gen X consumers are more likely to conduct online research. The findings have important implications for online retailers because they suggest that consumers who are more likely to conduct online product research are also the ones who are least likely to post online reviews.

8 Summary and conclusions

The findings indicate that the characteristics of consumers who have a greater propensity to conduct online product research but a lower tendency to post online product reviews differ substantially from those who have a higher propensity to post online product reviews but a lower tendency to conduct online product research. A comparison of those consumers who are most likely to post reviews and those who are not shows definitive contrasts in terms of gender (female versus male), age (older versus younger), education (more educated versus less educated), and income (high versus moderate). Interestingly, older female consumers with a college education are most likely to post online reviews, while younger male consumers with some college education (possibly because they are still in college) are least likely to post online reviews. There appears to be almost a generational divide between the two groups.

The findings show that higher-income consumers exhibit a strong tendency toward doing online research, but the relationship between income and online review posting behavior is less definite, possibly because of the opportunity cost of time. In applying the modified cost–benefit framework to understand their online review posting, it seems that the economic cost (i.e., time cost) of posting an online review exceeds the non-economic benefit (i.e., social value) they derive from so doing. For lower-income consumers, the situation is the reverse.

The literature on word-of-mouth and opinion leadership has found that the directional flow of product information in offline settings is typically from consumers who have conducted research to those who are in the process of gathering information (Duhan et al. 1997; Bone 1995). A reversal in the directional flow of product information where the opinions of consumers who post reviews, but do not conduct online research, can potentially influence the views of those who do conduct online research has important implications for online retailers.

Recent developments in adaptive web design (Baraglia and Silvestri 2007; Goy et al. 2007) have enabled retailers to significantly expand the personalization strategies that can be deployed online. An understanding of how the demographic characteristics of different consumer segments leads consumers to choose whether or not to post an online review can help online retailers implement strategies that create more value for consumers who rely on product information posted in online web forums.

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