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The impact of Online Reviews with Brand Equity on Electronics Item Purchasing Behaviour

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Abstract

Online purchasing is a booming business in itself and it is a known area of research in management and information system. Online product reviews influences consumer's purchasing behaviour and their attitudes. We seek an answer to two important questions in this research. First do online reviews, ratings and sentiment score influence the buyer's purchasing behaviour for an item? Second keywords and it's importance in online reviews. Study also reveals comparative analysis of different machine learning algorithm and their ability in text classification. Study also explores term-frequency and inverse document frequency count on keywords in a document and it's comparison with the count of occurrences of words in a text using bag-of-words models. Thus, sequential pooled logit model is proposed using panel data to evaluate the impact of sentiment-score, user's-rating, reviews helpfulness and user's recommendations on the purchase behaviour of the electronics products. We used the data collected from http://jmcauley.ucsd.edu/data/amazon on Electronics item of eight months. Sentiment score, ratings, reviews helpfulness number and user's recommendation shows a positive significant impact on the purchase of an electronics item.

Introduction

Online purchasing is the booming business and is studied extensively in marketing and information systems research. Our research objective is to find the factors that influence online purchase irrespective of companies and marketing firms which mainly deals with marketing strategies showcasing physical products. The literature on online reviews reveals mixed impact of online reviews on purchasing. We want to examine the impact of online reviews in purchase of an Electronic item and also interested in exploring different brand equity element present in the online reviews in the form of key words along with the impact of user's rating, review's helpfulness score, user's recommendation on purchase of an item. Electronic product is a flourishing, global business and Amazon in itself is a well known brand when it comes to consumer electronics. Some of well known products of Amazon is Kindle, Fire-stick, E-reader and others.

We seek an answer to two questions in this research .First key words in online reviews and impact of keywords on the overall document Second the impact of online reviews, User's ratings, user's review helpfulness score and User's recommendation on the purchasing behaviour of consumer for an item. We will use existing model that test these constructs on purchase of online Electronic items from Amazon.com. We then analyze the effect of these reviews on electronic item purchase using panel data week by week over 32 week span. Given the objective of our research, we will first review the existing literature regarding e-wom along with sentiment analysis on online reviews. Next we will discuss the research model and hypotheses. Following our model we will detail our results and provide a discussion of next steps and limitations. Lastly we will conclude our findings and describe implications of our research both managerially and theoretically.

Review of Literature
Background and Related Work

A number of studies have been conducted for analyzing the insights of online consumers buying behaviour. However, only a few of them have addressed the customers buying behaviour for durable goods. Critical evaluation of the background and related work in this paper classifies the literature into the following four subsections, (1) Factors influential for online shopping, (2) Social Network and Brand, (3) Impact of Online Consumers Review, and (4) Prediction of consumer purchase intention and recommendations. A number of key factors exist in the literature which influences the consumer online buying behaviour. Consumers get influenced for buying from three different sources, eWOM (electronic word-of-mouth), manufacturer/retailer, and neutral /third party[2][4].The gender differences and products type also influences the purchase[13]

Some online resources like video and blogs [11] changed the consumer's mindset on the physical and social attractiveness. Social media largely influences the brands quality and loyalty in the consumer's mind. 80% of the Twitter users are habituated to mention brands in their tweets

In the recent era, online reviews are making biases on the social influence and product selection. In order to reduce the biases [1] have investigated the retailer promoted reviews and self –motivated reviews for the same product. Further, [16] have explored the effects of online consumer reviews, good type and the perceptions in the decision –making process on consumers buying intention. The derivation suggests that negative reviews has more severe impact on purchase decision than positive reviews. According to[7] previous sales data and consumer reviews are helpful for forecasting the product sales, which was verified by integrating the model of sentiment analysis and Bass/Norton model[10] have been observed the same findings by summarizing the reviews based on the different feature.

Literature also suggests that consumer perceived risk, usefulness, structural assurances, effectiveness and so on from the product reviews and get influenced to buy goods individually or in the group[6][16][12].

Hypothesis Development

The literature regarding online reviews on product sales is mixed. Some literature states that online reviews have a positive effect on product sales [4][9][12]while others show no real effect[5].In our model, product purchase consists of user's reviews, user's rating, user's recommendation and helpfulness of user's online reviews. These dimensions are used to define product purchase.

Fig.1 Four Dimensions of online purchase behaviour of Electronics Item
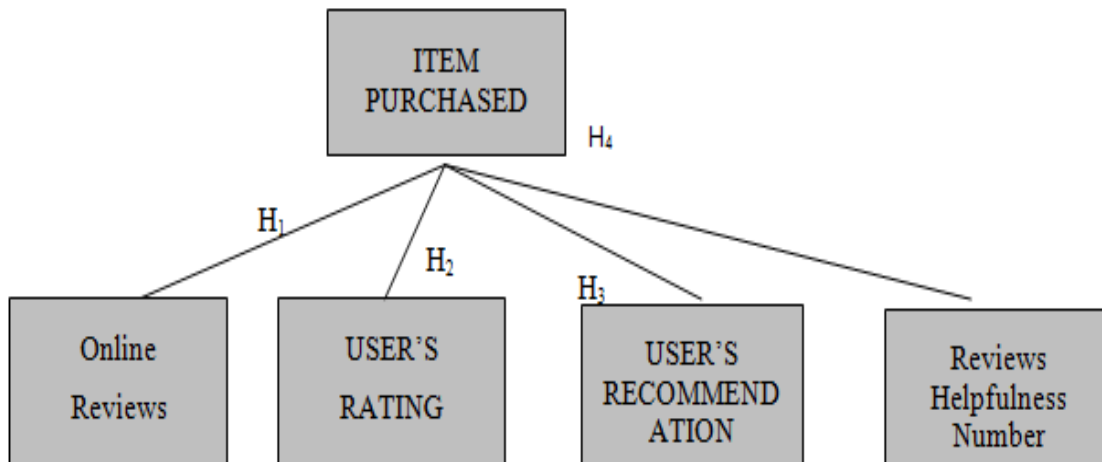
Online reviews can be seen as a form of WOM Consumers look to online product reviews more and more when gathering pre-purchase product information [17]. Therefore, we hypothesize that higher level of positive sentiments in online reviews lead to higher product purchase.

Hypothesis 1	Positive online reviews has higher impact on Electronics item purchase
Hypothesis 2	Higher online rating has positive impact on Electronics item purchase
Hypothesis 3	Positive recommendation has positive impact on consumer purchase of electronics item
Hypothesis 4	Higher usefulness score of online reviews has significant impact on online purchase of electronics item

Research Methodology
Data

Data for the research were collected from http://jmcauley.ucsd.edu/data/amazon/ .This dataset comprise product reviews and metadata from Amazon including 142.8 million reviews. Dataset for study is collected from pre-category files. It consists of individual products categories which already had duplicate item reviews removed.

The details of the product was collected for 8 months starting from October 19,2016 to 3- june 2017.Each review record consisted of product name, product category, manufacturer, brand, user's recommendation, user's purchase, reviews summary,

Asian Resonance

user's id. Our sample consisted of 35000 product reviews for sentiment analysis task.

Sentiment Analysis

The sentiment analysis in this study is conducted using the Naive-Bayes process the pre-treatment process, after raw material cleanup and sentence tokenization,35,000 pieces of reviews were covered .Sentiment Analysis task was performed on these reviews to classify as positive or negative . A comparative analysis between different Machine learning algorithms was conducted and ROC curve was generated. Key-words during the process was extracted and impact of keywords by Tf-Idf(term frequency and inverse document frequency) count and their relative occurrences by bag of words model was observed. Keywords are mainly noun and each key word refers to one dimension in representation.

AUC score of Multinomial, Bernoulli and Logistic Regression was found to be 0.81, 0.82 and 0.86 respectively. Sentiment- score of each review was calculated by using Text Blob library module of Python. It was found that the overall sentiment of the reviews was positive. Experiment results for sentiment analysis task.

Fig2. Word Cloud

Figure 3.Positive Words

Figure 4. Negative Words

Figure 5.Tf -IDf Count

	feature	coef
54	automation	-0.797434
7	actually	-0.326009
28	alexia	-0.318161
16	ads	-0.309174
86	blue	-0.297069
11	addition	-0.274995
97	bright	-0.272754
64	bang	-0.245188
4	account	-0.237335
83	birthday	-0.226763
81	big	-0.213941

Figure 6. Term Occurrences

	occurrences	term
370	1322.852930	great
865	1076.098301	tablet
522	927.361388	love
931	916.010848	use
252	864.061944	easy
360	732.377825	good
91	695.755597	bought
459	653.853449	kindle
676	641.239761	price
35	628.557172	amazon
687	620.555949	product
986	533.163655	works
524	508.789887	loves
488	501.885244	like
457	482.948919	kids
918	453.841739	tv

Asian Resonance

Fig.7 Classifier Comparison

Fig 8.Sentiment Score

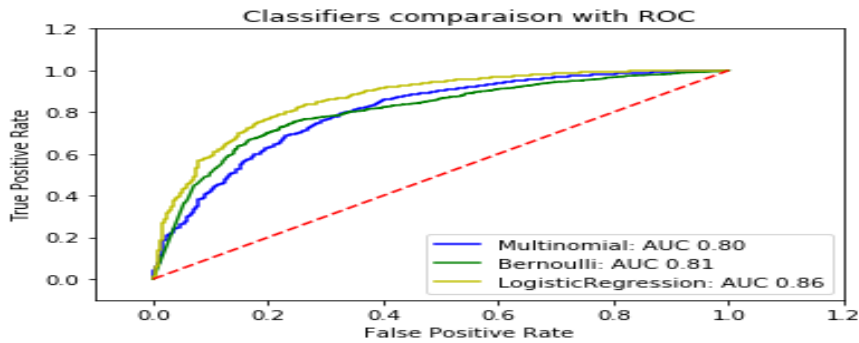|		
AVqkIhwDv8e3D1O-Iebb	i love ordering books and reading them with th...	0.500000
AVqkIhwDv8e3D1O-Iebb	not easy for elderly users cease of ads that p...	–0.216667
AVqkIhwDv8e3D1O-Iebb	excellent product easy to use large screen mak...	0.549206
AVqkIhwDv8e3D1O-Iebb	wanted my father to have his first tablet and ...	0.278667
AVqkIhwDv8e3D1O-Iebb	simply does everything i need thank youand sil...	0.000000
AVqkIhwDv8e3D1O-Iebb	got it as a present and love the size of the s...	0.250000
AVqkIhwDv8e3D1O-Iebb	the kindle is easiest to use graphics and scre...	0.416667
AVqkIhwDv8e3D1O-Iebb	nice reader almost perfect for what i want nee...	0.766667
AVqkIhwDv8e3D1O-Iebb	i really like this tablet i would have given s...	–0.196875
AVqkIhwDv8e3D1O-Iebb	great video quality lots of fun apps fun for t...	0.400000
AVqkIhwDv8e3D1O-Iebb	love love love my kindle fire this is what my ...	0.361111
AVqkIhwDv8e3D1O-Iebb	excellent tablet with nice screen i wish amazo...	0.866667
AVqkIhwDv8e3D1O-Iebb	preloaded with the reading app from kindle but...	0.208333
AVqkIhwDv8e3D1O-Iebb	very happy with this product and easy to use p...	0.583333
AVqkIhwDv8e3D1O-Iebb	my grandchildren are home schooled and utilize...	0.575000
AVqkIhwDv8e3D1O-Iebb	great size easy to carry for traveling need to...	0.526667
AVqkIhwDv8e3D1O-Iebb	i purchased this when my last tablet died it m...	0.266667
AVqkIhwDv8e3D1O-Iebb	perfect for downloading and reading books perf...	0.825000

As we are interested in examining the effect of sentiment score, reviewer's rating, reviewer's recommendation and reviews helpfulness on consumer's purchase decision. We construct an equation with weekly average purchases as dependant variable and sentiment score along with other set of independent variables. Log likelihood hypothesis is proposed and estimated coefficients directly reflects the elasticity of dependent and independent variables.

Table1.Variable description

Variable	Description and Measure
Week Purchase$_{it}$	Overall purchase of product i at week t
Week Rating$_{it}$	Overall rating of product i at week t
Week Reviews helpfulness number$_{it}$	Overall helpfulness score of product i at week t
Week Recommendation $_{it}$	Overall recommendation of product i at week t
Week SentimentScore$_{it}$	Overall sentiment score of product i at week t

The log transformation converts the relationship of those discrete count variables into a linear form for empirical estimation. To control for any electronic item specific idiosyncratic factors that could influence user reviews, such as electronics item type, vendor size and others we include electronics item specific fixed effect in the model by adding item specific dummy –variables. The advantage of fixed effects estimation is that it controls for intrinsic review characteristics, which inherently affect user reviews. In addition fixed effects estimation also allows the error term to be arbitrarily correlated with other explanatory variables, thus making the estimation results more robust.

The equation is specified as follows:

$$\log(\text{Week Purchase}_{it}) = \alpha_{0it} + \alpha_{1it}\log(\text{Week Rating}) + \alpha_{2it}\log(\text{Week Recommendation}) + \alpha_{3it}\log(\text{reviews Helpfulness}) + \alpha_{4it}\log(\text{Sentiment score}) + \text{€it} \quad (1)$$

Equation(1) reflects the weekly average item purchase .Let i = 1------N index the electronics item .The constant α_{0it} captures the idiosyncratic behaviour of the consumer . α_{1it} log(Week Rating) is an estimate for user's rating for that item,α_{2it}log(Week Recommendation) is the estimate of recommendation for the electronics item on the purchase,α_{3it}log(reviews Helpfulness),α_{4it}log(Sentiment-score). The most updated information about the recommendation, rating, sentiment score is used to assess the product purchase behaviour.

Results and Descussions

The maximum likelihood estimation (MLE) procedure was used to estimate equation (1) to consider both the endogeneity of the dependent variables and the correlation of equation (1).The MLE results for Eqs(1) are reported in Table 2.

Table 2. Fixed Effect Maximum likelihood Estimation Results

Variable	Coefficient	Std. Err
Ln(Reviews Helpfulness)	2.66	0.05***
Ln(Week Rating)	2.13	0.09***
Ln(Week Recommend)	6.31	1.28***
Ln(Week Sentiment)	12.30	1.21***

Hypothesis 1:- Higher positive sentiment in online reviews about an electronic item tend to higher electronic item's purchase from table 2 using eqn(1) the overall positive sentiment has a significant impact on consumer's buying behaviour.

Hypothesis 2: Higher user's online rating of an electronic item is positively associated with higher electronic item's purchase from from table 2 using eqn(1) the overall positive online rating has a significant impact on consumer's buying behaviour

Hypothesis 3; Higher levels of user's recommendation about an electronic item are positively associated with higher electronic item's purchase. from table 2 using eqn(1) the overall positive user's recommendation has a significant impact on consumer's buying behaviour

Hypothesis 4: Higher levels of positive online reviews helpfulness number are positively associated with higher electronics item's purchase. from table 2 using eqn(1) the overall positive helpfulness score of online reviews has a significant impact on consumer's buying behaviour.

Summary Screenshots of Panel Data Analysis

```
Optimization terminated successfully.
         Current function value: 0.181717
         Iterations 9
                      Results: Logit
================================================================
Model:                Logit          Pseudo R-squared: -4.867
Dependent Variable:   1.0000         AIC:              260.0409
Date:                 2019-03-12 19:35 BIC:            273.6899
No. Observations:     699            Log-Likelihood:   -127.02
Df Model:             2              LL-Null:          -21.650
Df Residuals:         696            LLR p-value:      1.0000
Converged:            1.0000         Scale:            1.0000
No. Iterations:       9.0000
----------------------------------------------------------------
                   Coef.   Std.Err.    z     P>|z|   [0.025 0.975]
----------------------------------------------------------------
reviews.rating     0.7593  0.0954   7.9611  0.0000  0.5723 0.9462
reviews.numHelpful -0.0186 0.0584  -0.3188  0.7498 -0.1331 0.0959
Sentiment          2.5194  1.2184   2.0678  0.0387  0.1314 4.9074
================================================================
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Conclusions

Online consumer reviews play an important role in purchasing. There are many factors influencing the purchase decision. In this research we examined the impact of sentiment score, review's rating, recommendation and helpfulness score of the reviews, result shows that they have a significant impact on purchase of an electronics item. Research has contribution to both academic and industrial arena as well. First, electronics companies can use this research to increase their sales objectives .Knowing the consumer's outlook towards a product or services companies can improve their service quality as well as product quality. Second Amazon provides it's platform for other sellers to sell their products thus research can also help them to increase the traffic to their sites reaping revenues from advertisers and other companies.

From theoretical perspective this research add to the growing body of both brand equity and e-wom literature. By using sentiment analysis approach analysis of 35000 reviews down to sentence level was performed, reviews contained elements of brand equity in the form of key words, earlier literature suggests research only by survey and interview method but the proposed methodology uses new measurement conducted on large sample size.

Limitation and Future Study

One limitation of the study is that it is restricted to electronics products, however generalization is an issue. In future course of study more comprehensive view of measuring and evaluating service quality by mining social media content and performing multiple tests and across various industries. Another methodological limitation associated with current study is that we used sentence level analysis and assigned each sentence to one dimension however, one sentence can be assigned to multiple dimension based on the content of the sentence. More sophisticated and advanced sentiment analysis techniques are expected to be developed and applied in our future research endeavours in examining user generated contents. Other future studies,as we allude to in the

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aforementioned discussions, includes taking a detailed look at the effect of various information aggregation and display strategy on consumer behaviour,examining the effect of different strategies of managing and using user-generated content,and establishing the direct link of different dimensions of user-generated content with product and sales as well as overall firms performance.

References

Askaliddis, G. K. (2017). Understanding the overcoming biases in online review systems . Decision Support System 97,, 23-30.

Baker, A.,. (2016). Investigating how word of mouth conversations about brands influence purchase and retransmission intentions . Journal of Markeitng Research,53(2), 225-239.

Bronnenberg, B. K. (2016). Zooming in on choice ;How do consumer search for cameras online? Marketing Science 35(5), 693-712.

Chen P.Y Wu S. and Yoon, J (2016) " The impact of Online Recommendations and Consumer Feedback on Sales"

Duan W. Gu B. And Whinstone A.B.(2016) "Do Online Reviews Matter?- an Empirical Investigation of Panel Data" Decision Support Systems(45:4), pp.1007-1016

Elwalda, A.(2016). Perceived derived attributes of online customer reviews. Computer in human behavior,56, 306-319.

Fan Z-P ., C. Y.-J.-Y. (2017). Product sales forecasting using online reviews and historical sales data:A method combining the Bass model and sentiment analysis. Journal of business research68(6), 1261-1270.

Filleri, R. (2015). What makes online reviews helpful A diagnostic -adotion frame-work to explain informational and normative influences in ewom. Journal of business research 68(6), 1261-1270.

Godes, D and Mayzlin D (2016).Using Online Conversations to Study Word-of-Mouth Communication" Marketing Science) pp 545-560.

Kangale Kumar, S. N. (2016). Mining of consumer reviews to generate ratings of different product attributes while producing feature-based review-summary . International Journal of system science47(13), 3271-3286.

Lee, J. &. (2016). Youtube vloggers influence on consumer luxury brand perceptions and intentions. Journal of Business Research 69(10), 5753-5760.

Liu. X, Singh, P.V & Srinivasan K. (2016). A structured analysis of unstructured big data by leveraging cloud computing..Marketing Science,35 (3),363-388.

Otterbring T ., R. S. (2017). The Abercrombie & Fitch effect : The impact of physical dominance on male customers' staus -signaling consumption. Journal of Marketing Research.

Role of Product and Consumer Characteristics. "Journal of Marketing (74:2) pp 133-148.

Shi, X. I. (2017). online consumer review and group buying participation:The mediating effect of consumer beliefs. Telematics and Informatics 34(5), 604-617.

Zhao, K. Z. (2017). Sources and impacts of social influence from online annonymous user reviews. Information and management .

Zhu F and Zhang X (2010)"Impact of Online Consumer Reviews on Sales"