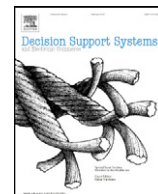




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## Decision Support Systems

journal homepage: [www.elsevier.com/locate/dss](http://www.elsevier.com/locate/dss)

## The influence of online word-of-mouth on long tail formation

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## ARTICLE INFO

Available online xxx

## Keywords:

Long tail  
 Word-of-mouth (WOM)  
 Customer review  
 Information cascade

## ABSTRACT

The long tail phenomenon has been attributed to both supply side and demand side economies. While the cause on the supply side is well-known, research on the demand side has largely focused on the awareness effect of online information that helps consumers discover new and often niche products. This study expands the demand side factors by showing that online information also influences the long tail phenomenon through the informative effect, which affects consumers' evaluation of product quality. We examine the informative effect in the context of online WOM. Two sets of theories suggest opposite directions for the implication of the informative effect. Information search and information cascade literatures indicate that WOM provides additional information to consumers, reduces the occurrence of information cascade, and encourages the formation of long tail. Studies on behavior heuristics, however, suggest that consumers tend to ignore online information inconsistent with their prior beliefs, which leads to a rich-gets-richer effect for popular products and curtail the formation of the long tail. We empirically examine the conflict by analyzing different impacts of online WOM across product popularity and WOM ratings. Using a panel data collected from Amazon.com, we show that positive reviews improve the sales of popular products more than the sales of niche products, while negative reviews hurt niche products more than popular products. The results are consistent with the prediction of the behavior heuristic and suggest that online WOM restrains the formation of long tail.

Published by Elsevier B.V.

## 1. Introduction

Online retailers have long noticed that the sales of non-hit or niche products account for a significant portion of overall product sales. This phenomenon is known as the long tail [1] and has attracted attention of both industry practitioners and academic researchers. Several factors are conducive to the emergence of the long tail phenomena in online markets. The supply side drivers include lower storage costs, faster distribution and the aggregation of geographically dispersed niche markets [5]. These enable online retailers to carry a far wider range of products than their physical counterparts. On the demand side, studies note that the use of information sharing mechanisms such as recommender systems, co-purchase networks, search tools, and blog sites, enables customers to discover new and niche products more easily and encourages the long tail formation [1,4,5,15,34,42].

Although prior demand side studies focus on how online information increases awareness of less known products, the influence of online information often goes beyond helping consumers discover new products. Consumers are known to use a two-stage process in making purchase decisions [28]. In the first stage, consumers identify a set of

potential products for further consideration. In this stage, consumers use IT-enabled tools both actively and passively to identify products of potential interest. Search tools and recommendation systems help narrow down possible choices according to consumer preferences. In the second stage, consumers obtain detailed information on each product in the consideration set to form a purchase decision. Product awareness created by searching tools and recommendation systems is important in the first stage. However, it is the detailed product quality information that ultimately shapes consumers' purchase decisions in the second stage. Such information increasingly comes from online sources such as online WOM. However, little is known on how these information sources influence the long tail phenomenon. The goal of this study is to take the first step to understand this influence.

Two sets of theories suggest opposite directions for the impact of online WOM on the long tail phenomenon. A key challenge for electronic commerce is that customers are often uncertain about product quality before purchase. The lack of information leads to herding where consumers follow the choices of others, as suggested by information search and informational cascade literatures [3]. In an informational cascade, it is optimal for a user to follow predecessors' behavior and ignore his private information. As such, a few "hit" products take up the most sales. Such behavior could lead to "bad" herding where popular products are not necessarily of high quality. One of the key conditions for informational cascade is that users do not have access to the private information of others. However, online review allows consumers to reveal private information, helps future consumers to learn about the true

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quality before purchase, and reduces the occurrence of “bad” herding [36]. In particular, the arrival of negative WOM could stop the positive informational cascade of a popular but low quality product, while the arrival of positive WOM could stop the negative cascade of an unpopular but high quality product [3]. From this respect, WOM information encourages the formation of the long tail.

However, the opposite is implied by behavior heuristics studies. Behavior heuristics theories believe that individuals are biased in making adjustments to accommodate new information. Information consistent with prior belief often leads to overreaction, while contradictory information leads to under-reaction [26,36]. Since product popularity commonly serves as a starting point for prior belief, consumers tend to overreact to positive WOM on popular products and negative WOM on unpopular products, and underreact to negative WOM on popular products and positive WOM on unpopular products, leading to a rich-get-richer effect. In this respect, WOM constrains the formation of the long tail.

To examine the conflicting hypotheses, we note that the hypotheses suggest that the influence of a customer review depends on the interaction between review valence and product popularity. As such, testing the hypotheses requires an analysis at the customer review level instead of the product level. This is in contrast with most prior WOM research that often uses aggregate WOM measures such as average review rating to study the effect of WOM at the product level. Compared to the product level analysis, analysis at the review level allows us to capture consumers' reaction to each specific review and how their reaction varies for different combinations of review valence and product popularity. To facilitate the analysis, we use a first difference approach. This approach allows us to analyze the influence of each customer review on changes in product sales and provides significant flexibility in modeling factors that moderate the influence of individual customer reviews. We apply the model to a panel data collected from Amazon.com on 3000 books over 200 days. The results indicate that positive WOM benefits popular products more than niche products, while negative WOM hurts niche products more. Our finding supports the prediction of behavior heuristics theory and suggests that consumers are not fully rational in reacting to incoming customer reviews. Instead, they are biased toward their initial expectation. As a result, online WOM constrains the formation of the long tail.

The rest of the paper is organized as follows. Section 2 is literature review. Section 3 introduces the theoretical background and develops key hypotheses. Section 4 develops a first difference model that allows WOM's influence to differ across product popularity and WOM valence. Section 5 describes the data collection process. Section 6 presents the empirical results. Section 7 discusses the implication of our findings and concludes the study.

## 2. Literature review

### 2.1. Online WOM

Online WOM plays an important role in electronic commerce. A survey of Bizrate.com found that 44% of users consulted opinion sites prior to making a purchase [7]. This survey also found that 59% of respondents considered consumer-generated reviews to be more valuable than expert reviews. A number of studies have been conducted to examine the impact of WOM on consumer purchase decisions [2,9,13,16,17,20,23,30,40,42]. These studies reveal that online WOM has both awareness effect and informative effect. The awareness effect is reflected in the influence of WOM volume on product sales. WOM volume captures the underlying dispersion of WOM within and across online communities and studies show that WOM volume predicts future product sales [13,17,23,27].

The informative effect for product quality, on the other hand, is mainly reflected in review ratings and their impact on product sales. Zhu and Zhang [41] find that online customer reviews are important resource for consumers to seek product quality information. Moon et al. [28] use new movie ratings as a measure of movie performance

and argue that positive ratings can enhance the effectiveness of advertising spending to raise movie revenues. Chevalier and Mayzlin [9] compare book sales across two online retailers and find that improvement in a book's average review rating at one site leads to an increase in relative sales at that site. Similarly, Zhang et al. [40] study the relationship between movie ratings and box office sales and find that online consumer ratings have significant impact on movie revenue. Moe and Trusov [31] decompose the rating effect on sales into a baseline component and a social dynamic component and show both the direct impact of baseline component and the indirect impact through social dynamics influence product sales. Clemons et al. [12] suggest that the informative effect of WOM plays a key role in redefining a firm's product strategy. We extend this stream of literature by noting that the influence of WOM could vary with the interaction between WOM and product popularity due to economic or behavioral motivations. We also show that such variations could have significant implications for the long tail phenomenon.

Our analysis complements the literature on the informative effect of WOM. For example, Sun [36] models high average rating as an indicator for high product quality and high rating variance as an indicator for niche products, which some consumers love and others hate. She finds that a higher standard deviation of ratings on Amazon improves a book's relative sales rank when the average rating is lower than 4.1 stars. In contrast, Chintagunta [10] find that review variance does not matter after controlling for movie specific and market specific effects.

Our analysis also complements recent studies that identify factors moderating the influence of WOM. Zhu and Zhang [41] claim that online reviews are more influential on less popular video games and games whose players have greater Internet experience. Chevalier and Mayzlin [9] reveal that negative WOM is more influential than is positive WOM. Chen et al. [8] and Duan et al. [18] find that WOM is more influential on less popular products. Hu et al. [29] and Chen et al. [8] show the importance of reviewer reputation in determining the influence of the review. Moon et al. [28] suggest that positive ratings can enhance the effectiveness of advertising spending to raise movie revenues. We complement these literatures by identifying new moderating factors based on information search and informational cascade theory and behavior heuristic theory. Our hypotheses suggest that consumers infer product quality information from both WOM and product popularity and that whether the two sets of information are consistent with or contradictory to each other could have significant influence on consumer purchase decisions.

### 2.2. The long tail

This study also contributes to the emerging literature on the long tail phenomenon. Brynjolfsson et al. [6] find that the sales distribution of a retailer's online channel is less concentrated than that of its traditional channels, indicating that a reduction in search costs contributes to the long tail phenomenon. Rahman and Hahn [35] find that the long tail phenomenon is more prevalent in search goods than in experience goods, and Wimble et al. [39] find the product dispersion of purchases made by households with broadband access is more flattened than that by households without broadband access. Both studies suggest the importance of search costs in the long tail formation. A number of long tail studies take a step further to identify the underlying information sources that facilitate the long tail phenomenon. Oestreicher-Singer and Sundararajan [33] show that the long tail phenomenon is influenced by the presence of co-purchase networks which allows online consumers to observe products commonly bought together. Dewan and Ramaprasad [15] find that blogging activities lead to more purchases of niche products and contribute to the long tail phenomenon. Goh and Bockstedt [24] show that product sampling plays an important role in the long tail phenomenon.

Prior studies of the long tail phenomenon also reveal the presence of both long tail and superstar phenomenon. Most studies consider

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