Journal of International Technology and Information Management

Volume 27 | Issue 1 Article 4

1-1-2018

Not All Consumers Follow Suit: Information Choices and Effect of Reviews

Seung Lee
University of Minnesota, Duluth, slee@d.umn.edu

Recommended Citation
Lee, Seung (2018) "Not All Consumers Follow Suit: Information Choices and Effect of Reviews," *Journal of International Technology and Information Management*: Vol. 27: Iss. 1, Article 4.
DOI: https://doi.org/10.58729/1941-6679.1349
Available at: https://scholarworks.lib.csusb.edu/jitim/vol27/iss1/4

Not All Consumers Follow Suit: Information Choices and Effect of Reviews

Seung Lee
University of Minnesota, Duluth

ABSTRACT

Understanding the process of consumers' buying decisions is not intuitively obvious from the way it appears. Before we come up with any acceptable account of the process, we should learn more about consumers' traits as well as the characteristics of the goods or services they intend to purchase. The goal of this study is to establish the alignment of consumers' buying decisions with information choice and determine why consumers may or may not make buying decisions compatible with reviewer comments. To explain the reality of multiple consumer equilibria, the paper draws on the four information choice theories: inattentiveness, rational inattention, information markets, and costly precision. Based on the theories, this paper considers why consumers may arrive at different buying decisions through their choice and processing of signals from consumer product reviews though the reviews are identical and considering that, in general, higher product ratings are associated with higher sales. Overall, this paper contributes to a better understanding of why consumers arrive at different buying decisions from the same pool of online consumer product reviews.

KEYWORDS: information choice, signal, noise, consumer buying decisions, product reviews

INTRODUCTION

As consumers get into a process of purchasing a product or service, they go through several stages, one of which is identification and observation of the product information sources (Engel et al. 1968). Consumers browse the internal and external environment to identify information sources and choose an information set to observe (Bunn 1993). Therefore, the final purchase decision can be influenced heavily by the observed, positive or negative information, especially from other customers, and by the level of motivation to refuse or accept the information (Kotler et al. 2009; Nielsen 2016; Wang and Cole 2016). For example, Wang and Cole (2016) found that the consumer's age, level of expertise, and information type contained in product descriptions have different effects on consumers' evaluation of products. In other words, the final purchase decision can be influenced greatly by consumers' choice of information and the way they see the signals from the chosen information.

In buying decision processes in today's culture, consumers almost totally rely on online reviews. A recent study found that online consumer reviews aside from personal recommendations play a major role in purchase decisions (Paul and Hogan, 2015). As consumers search for product information for their purchase decisions, they often have access to a whole slew of online product reviews from other consumers. Those online consumer reviews are readily available along with other consumer-empowering product information, including third-party reviews, email newsletters, and personal recommendations generated by recommender systems. The effect of third-party reviews (Akdeniz et al. 2014; Chen and Xie 2005) and the role of email newsletters (Hartemo et al. 2016) have been studied extensively). Many studies have also been conducted on the role of online recommender systems (Baum and Spann 2014; Zhijie 2014) and the positive influence reputational and institutional mechanisms can have on consumer trust (Ba and Pavlou 2002; Fang et al. 2014; Gefen and Pavlou 2008). In addition, many studies have examined the effects of online customer reviews on purchase decisions from numerous different perspectives, such as the characteristics of reviewers (Forman et al. 2008; Salehan and Kim 2016; Smith et al. 2005) and the temporal effect of reviews (Li and Hitt 2008). Previous studies have also found that online consumer reviews, in both the macro and micro levels, can have a positive impact on sales (Chen et al. 2008; Chen and Xi 2008; Chevalier and Mayzlin 2006; Clemons et al. 2006; Mudambi and Schuff 2010). Particularly, Chen et al. (2008) found that, at a disaggregate level, consumers' evaluations of individual reviews are affected by both the reviewer quality in an online community and the helpfulness of the review to the community measured by the content quality. As past research found, online customer reviews influence consumer purchase decisions and higher product ratings are associated with higher sales. One area in need of further study, though, is why not all consumers follow suit. In other words, why do consumers get different signals from the same reviews and end up with different purchase decisions? For example, many online consumer reviews read like "This book is a masterpiece. I feel fortunate that I discovered it before most other people. *I discovered it by reading an extremely negative review for this book* [emphasis added] …" (Gary 2015), "'Suicide Squad' Opens at Number One Film as Fans *Ignore* Critics [emphasis added]" (Sakoui 2016), and many others (see Streitfeld 2016). Furthermore, consumers are more likely to buy a product based on the quantity of reviews, rather than the quality of what the reviews say (Powell et al. 2017). These seemingly erratic behaviors of consumers call for a study on the relationships between online consumer reviews and consumers' final purchase decisions from a different vantage point.

Between the reviews posted on retail websites (e.g., www.amazon.com), social media (e.g., www.reddit.com), expert reviews (e.g., www.cnet.com), and crowd-sourced review sites (e.g., www.angieslist.com), people are awash in product or service information, most of it accessible at negligible cost. However, humans have only a finite capacity to process all of it. While the average consumer has access to a large amount of online reviews when he/she is in a buying decision process (Chevalier and Mayzlin 2006), not all the reviews can receive equal attention. How carefully does a consumer read online reviews from other consumers before making a final purchase decision? How many reviews does a consumer read from the strangers? In other words, depending on the types of information choices and the amount of information consumers choose to observe, different consumers can arrive at different purchase decisions even if those decisions are not the best ones in light of the reviews. The incongruent purchase decisions may be affected by either idiosyncratic signal noises or common signal noises or both. Idiosyncratic signal noises or independent signal realization (Myatt and Wallace 2012) fall into consumers' cognitive domain or characteristics. They include consumers' perception on the review authenticity (Kugler 2014), consumers' previous knowledge or experiences with the products or services contradictory to the reviews (Park and Kim 2008), increased awareness even with negative reviews (Berger et al. 2016), positive views as good products or services regardless of their reputations (Monks 2015; Thaler 1980), perceived information diagnosticity of a review (Jiang and Benbasat 2004 2007; Kempf and Smith 1998; Pavlou and Fygenson 2006; Pavlou et al. 2007), and social learning (Powell et al. 2017). On the other hand, common signal noises or common signal realization (Myatt and Wallace 2012) are related to product characteristics, such as the product type (experience vs search), product popularity, product category (hedonic vs utilitarian), hype around the product, and inaccurate information about the product (Black 1986; Mudambi and Schuff 2010; Zhu and Zhang 2010).

This implies that consumers do not always choose to buy products with the most favorable online consumer reviews. Products that do not receive stellar reviews may still be purchased by consumers depending on the consumers' types of information choices, the signals they choose to observe, and signal noises. From a different point of view, products with relatively higher positive online consumer reviews may not entirely crowd out the competing products that have relatively lower reviews. As digital technologies accelerate, consumers have access to overwhelming amounts of information as never before—from other proprietary and public sources, not just from online consumer reviews. This is profoundly changing the strategic landscape:

altering the structure where business competes, redefining the way in which business operates, and, ultimately, transforming performance across industries (Hirt and Willmott 2014). Indeed, providing and responding to online consumer reviews, either online or blended, have become an important strategic component of many businesses (Chevalier et al. 2016). Given the strategic importance of consumer reviews and those being an important resource for consumers making purchase decisions, we draw on information choice theory and on past research to explain why different types of information choices can bring multiple different purchase decisions on different consumers. Overall, this paper contributes to a better understanding of why consumers arrive at different buying decisions after reading the same pool of online consumer product reviews.

The remainder of this paper is organized as follows: The next section reviews literature related to information choice and processing. We then present a theoretical framework as common ground for applying the four information choice theories to consumer buying decision process. In the next section, each information choice theory elaborates why consumers can arrive at different buying decisions based on the same product reviews. In the last section, we conclude the article with implications of the four different information choice theories on the effect of reviews on consumer buying decisions.

THEORETICAL FOUNDATION

In neoclassical economics, consumer behavior is explained by utility maximization. The objective of the consumer is to choose a product that maximizes his/her utility under the given constraints, including tastes, budget, and prices. Meanwhile, the economics of information proposes that consumers often must make purchase decisions with partial information when they do not have complete information on product quality, seller credibility, and the available substitutes. This lack of information introduces uncertainty in a buying decision process, therefore, consumers seek additional information to reduce their uncertainty. However, seeking information incurs both internal and external search costs (Smith et al. 1999). The major external costs are the monetary costs of obtaining the information and the opportunity cost of the time spent on searching. Internal costs include sorting and choosing the incoming signals and integrating them with the consumer's prior knowledge. Search costs are not the same for all consumers; they are often determined by the consumer's socioeconomic background and level of performance in the search (Smith et al. 1999; Stigler 1961).

The key objective of the consumer's buying decision process is to make a decision close to the true state (optimal decision that carries a maximum utility) and close to the average action of other consumers or, at least partially, to increase decision accuracy by reducing uncertainty (Myatt and Wallace 2012; Hellwig et al 2012). For reduced uncertainty, consumers can search for more information while acknowledging that an additional search may not even out added benefits with extra costs (Stigler 1961). Consumers can use decision and comparison aids (Wang and Benbasat 2009) and numerical content ratings, such as the star rating (Poston and Speier 2005), to reduce search costs and improve the buying decision process. Consumers can also utilize various types of information choices to determine the information sets and signals to observe, and they can process the signals with or without the influence of signal noises to take an action (Myatt and Wallace 2012; Reis 2006; Sims 2003; Veldkamp 2006). That is, their types of information choices and the context of information processing under uncertainty can increase decision accuracy or bring multiple decision results—either all consumers, no consumers, or some consumers follow other consumers' decisions as manifested in their online reviews.

Information, Signal, and Signal Noise

In information economics, information is a key player in economic decisions (Allen 1990; Arrow 1996; de Langhe et al. 2016; Hellwig and Veldkamp 2009). Information is often hard to trust; it may be functional or dysfunctional due to different cognitive processes or signal noises; it can be endogenous or exogenous; or it can be considered a commodity because its acquisition can be costly. It is possible for consumers in a purchase decision process to have a certain degree of information or knowledge about the product under consideration. Nevertheless, they desire information because it helps them reduce the uncertainty of taking action by complementing or substituting their prior knowledge (or, more generally, by reducing information asymmetry). Uncertainty is a state that arises when a consumer is engaged in a decision making process based on less than perfect information or knowledge (Downey and Slocum 1975). In the communications perspectives, information is a signal; an observed random variable that is not independent of unobserved variables that affect economic decisions (Arrow 1996). Put differently, signals are observable characteristics attached to a piece of information or information set that can be manipulated by its source (Spence 1973). The signals consumers observe depends both on the availability of an observable pool of information known as an information set and on the consumers’ choice of what to learn. Consumers who want to replicate other consumers’ behavior want the knowledge that their predecessor has. The opposite is also true. Consumers who choose to act when other consumers choose not to act want more information regarding not acting.(Hellwig and Veldkamp 2009). This involves searching for information from various sources. Each information source provides informative signals with some source-specific noise, and a consumer observes the signals with some additional noise of his or her own (Myatt and Wallace 2012).

Black (1986) defined noise as something that is the opposite of information. Consumers as economic agents sometimes make decisions on information in the usual way. They seem to maximize expected returns or obtain maximum utilities, at least close to the true state. On the other hand, agents sometimes commit transactions on noise as if it were information. These transactions end up incorrect or suboptimal decisions. In a different perspective, Black defined noise as what makes agents' observations imperfect. It keeps consumers from knowing the expected return on their purchases. In general, noise keeps consumers from knowing what, if anything, they can do to achieve better decision outcomes. He also viewed noise as the arbitrary element in expectations and unknown information. As another point of view, the noise from an information source (sender noise), which is error contained in the source, determines the underlying accuracy of the signals, and the noise from a signal observer (receiver noise), which is error either in observing signals or in acquiring or absorbing signals, determines the signal clarity. The sender noise is a common or external noise, and the receiver noise is an idiosyncratic or internal noise (Myatt and Wallace 2012; Wu and Newell 2003). This suggests that making a buying decision depends heavily on conceptualizations—consumers' internal, mental models of themselves and of the things with which they are interacting—they bring to the task (Friestad and Wright 1994; Noman 1983).

Knowledge and Mental Model

As past studies on online consumers have found, purchase decisions are greatly influenced by the review system and the consumer's mental model of the review system. The review system consists of the available online consumer reviews on the product under consideration, the characteristics of the information contained in the reviews, and an appropriate representation of the system in the sense of linking the buyer and seller that is accurate, consistent, and complete. Mental models naturally evolve through interaction with a review system (Norman 1983). These models are not technically accurate as they are continually modified to get to a workable result and constrained by such things as consumers' decision-making styles, prior product knowledge, and the limitations of individual's information processing capacity (Friestad and Wright 1994; Norman 1983; Miller 1956). Specifically, Norman (1983) found that the mental models people bring to perform a task are not precise and sophisticated. They are fractional and contain areas of uncertainties, inconsistencies, imprecision, and idiosyncratic oddities.

Besides, people often feel uncertain of their own knowledge—even when it is, in fact, complete and correct—and their mental models include accounts of the degree of certainty they feel for different aspects of their knowledge. Thus, a person's mental model includes knowledge or beliefs that are considered to be of doubtful validity. Some of this leads to seemingly correct decisions, even if they make no sense. People's doubts and various degrees of certainty about their knowledge control their behavior and make them exercise extra caution when making decisions under the available information set, with the chosen signals out of the available information set, and with the limited capacity for information processing within a background of noise (Norman and Bobrow 1975). This is especially likely to be the case when a person is knowledgeable about the category of the product under consideration and has extended experience with review systems (Wang and Cole 2016; Zhu and Zhang 2010). Therefore, from past research on online consumers and mental models, we can state that an online buying decision process is heavily influenced by the consumer's information choice. It is in turn dependent on information costs (e.g., search and acquisition costs), review system (e.g., signal and signal noise embedded in online consumer reviews), product characteristics (e.g., product type, such as search, experience, hedonic and utilitarian goods), and consumer characteristics (e.g., mental model formed upon previous experience and prior knowledge).

Information Choice Theories

Economic activities, such as purchasing, involve making decisions. To make better decisions, economic agents, including consumers, need information. Thus, the problem of choice, acquisition, and observation of information has become a key issue in information economics. Past research in information economics has identified four major types of information choices: inattentiveness (Reis 2006), rational inattention (Sims 2003), information markets (Veldkamp 2006), and costly precision (Myatt and Wallace 2012).

As past economics literature has extensively examined (see Smith et al. 1999), it is costly for a rational consumer to acquire and process information to make an optimal purchase decision that maximizes his/her utility subject to such standard constraints as budget, prices, and preferences. Obtaining information, processing and interpreting it, and deciding optimal action are all costly in money and time. Moreover, the entire process may be annoying or frustrating for some consumers. Consequently, a consumer does not pay attention to all the information. This type of information choice is called the inattentiveness (Reis 2006). The consumer simply acts as if he/she was living under perfect certainty. There are a couple of properties of inattentiveness (Reis 2006). The smaller the costs of acquisition, processing, and interpretation of information plus the costs of planning an optimal action, the more a consumer will be inattentive to information. In addition, the lower is the risk faced by the consumer and the lower her aversion to this risk, the more he/she will be inattentive to information. This implies that if the overall costs of information and planning are not too small, inattentiveness is optimal behavior (Reis 2006). Meanwhile, another stream of research on information choice puts more weight on the finite capacity of consumers in processing information, not just costs.

Given a physical constraint on the rate at which people can process information, which is known as the Shannon’s channel capacity (Cover and Thomas 2006), consumers decide what signals to observe from the chosen information sources. They also decide how much attention to devote to different signals so that they can make purchase decisions close to the true state in the Bayesian sense and close to the average action of other consumers (Myatt and Wallace 2012). Rational inattention theory incorporates such limits in individual's information processing capacity (Sims 2003). It does not assume a symmetry of reactions to positive or negative information. The theory focuses on how consumers allocate attention, one of the scarce resources, when they make economic decisions. That is, consumers as decision makers have a limited amount of attention so that they have to decide how to allocate it. For example, there is a large amount of information on the product available to consumers, but due to limited attention, it is simply impossible for the consumers to attend to all that information. Therefore, consumers must choose which information to attend to more carefully, which information to attend to less carefully, and which information to ignore (Sims 2003). With the view of the rate of information flow as the rate of uncertainty reduction, Sims (2003) modelled attention as an information flow and limited attention as a bound on information flow. The more attention a consumer allocates to information, the less uncertainty he/she gets. Thus, limited attention simply imposes a limit on the signal-to-noise ratio in the signal on the subject of a purchase decision. Yet, another branch of study on information theory, dubbed information markets by Veldkamp (2006), focuses on the non-rival nature of information and access to multiple information markets.

In economics, rivalry is used to describe a characteristic of a good, including a physical good or a nonphysical good such as information. A good can be characterized on a continuum between rival to non-rival. A good is considered non-rival if, for any level of production, the marginal cost of production is zero or nearly zero. Non-rivalry does not mean that the total production costs are low. It is just concerned about the marginal cost of production (Cornes and Sandler 1986). The non-rival nature of information, coupled with free entry in the information market, can reduce the uncertainty over a decision—making process, and the riskier the perceived consequence of a decision, the more valuable the public information becomes because it can be used both to predict the true state and to predict others' actions (Veldkamp 2006). Thus, the marginal value of public information exceeds the marginal value of private knowledge. When a decision entails a low risk, the degree of the complementarity or substitutability of the information diminishes, or the information can be completely ignored (Veldkamp 2006). Depending on the amount of consumers' knowledge (idiosyncratic noise) or, put differently, depending on the degree of complementarity of information about the product under purchase consideration, observation of the information may or may not increase the dispersion of the consumers' decisions. Highly dispersed decisions imply that consumers do not follow suit. For example, when consumers have a lower degree of knowledge about products, risk-averse consumers may purchase only the products with the highest ratings and numbers because the consumers prefer products that they are informed about. This is more likely in a multiple information markets setting where access to the markets is free and marginal cost of producing information is very low or even zero (Grossman and Stiglitz 1980; Romer 1990; Veldkamp 2006).

The fourth information choice theory, called the costly precision is proposed by Myatt and Wallace (2012) and centers around the underlying accuracy of an informative signal (how precisely it identifies the true state) and clarity of the informative signal (how easy it is to understand). According to Myatt and Wallace (2012), when there is a collection of information sources accessible to economic agents such as consumers, the informative signal from each source comes with some source-specific noise named sender noise. It determines the signal's underlying accuracy. A consumer then observes this signal with some additional consumer-specific noise named receiver noise, which determines the signal's clarity. Receiver noise is reduced if a consumer listens to the signal with great care, which of course incurs a greater cost. Sender noise is originated from an information source, while receiver noise comes from error either in observation or in understanding of a signal. Then, to which information sources do consumers listen, and how carefully do consumers choose to listen to each informative signal? The answers are determined by the degree of precision of accuracy and clarity, as well as the cost of information against its benefit (Wyatt and Wallace 2012). The costly precision theory concludes that the clearest signals receive attention, even if they have poor underlying accuracy and that the number of signals consumers observe decreases as the complementarity of other consumers' actions rises. This is because decision-makers look for actions that are not only matched to some unknown true state of the world but also matched to the actions taken by others.

THEORETICAL FRAMEWORK

The above reviews on the concepts and the information choice theories imply that consumers who must make buying decisions under uncertainty and wish to maximize their utilities would consider the actions of other consumers. Then the purchasing consumers make purchase decisions close to the true state based on some inference from their mental models of other consumers' actions and knowledge of the product under consideration. Intuitively, as in the Keynesian beauty contest (Keynes 1936), the consumers choose what information to observe about the true state before they make purchase decisions. Different types of information choices by the consumers result in different cost functions for the information choice set and different constraints on the signal choice set. Specifically, under the unknown true state s, which is drawn from a prior distribution of the random variable s and a series of signals about s, consumers indexed by a continuum of measure one observe their chosen signals and simultaneously take an optimal action or make a decision. In other words, consumers choose an action a_i to minimize the expected squared distance between the weighted average $\bar{a}$ of the individual consumer's action and the unknown true state s, minus any cost c of acquiring information, where c is expressed in units of expected utility:

(1) $u(a_i, \bar{a}, s) = -(a_i - r\bar{a} - (1 - r)s)^2 - c.$

The coefficient r (which is always less than 1) measures the complementarity and/or substitutability of consumers' decisions. A positive, higher r means more complementarity. If the coefficient r is greater than 0, decisions are complementary—that is, best decisions are increasing in the actions of other consumers. If $r < 0$, decisions are strategic substitutes. If s is a common, well-known state (i.e., if there is no or virtually no alternative choice), the best action of i^{th} consumer is $a_i = (1 - r)s + r\bar{a}$, and $a_i = \bar{a} = s$ constitutes the unique decision.
Let K_i represent the information set including the chosen signals **s**. The first-order condition of (1) with regard to a_i turns out $a_i = E[r\bar{a} + (1 - r)s \mid K_i]$. The utility function (1) is then simply a conditional variance $u(a_i, \bar{a}, s) = Var(r\bar{a} + (1 - r)s \mid K_i) - c$. The conditional variance can be decomposed into the variances of individual terms of the expression $r\bar{a} + (1 - r)s$ and a covariance term, which constitutes the expected utility of i^{th} consumer:

(2) $E[u(a_i, \bar{a}, s)] = -(r^2 Var[\bar{a} \mid K_i] + 2r(1-r)Cov[\bar{a}, s \mid K_i] + (1-r)^2 Var[s \mid K_i]) - c.$

Because (2) is the expected utility of a consumer who acts optimally after observing his chosen signals *S*, it is the payoff function for his/her information choice. This means that to figure out the value of any information choices, it is sufficient to know what the information implies for the three moments: (1) the conditional variance of the state (i.e., the variance of the true state given the information set); (2) the conditional variance of the average action (i.e., the variance of the average action given the information set); and (3) the covariance between the average action and the true state.

Taking Noises into Account

As Black (1986) defined, noise is something opposite of information. Consumers can be exposed to either common noise or idiosyncratic noise or both. Suppose there is a k-dimensional vector of common signal noises $\mathbf{p}$, distributed with mean = 0 and a variance, independent of the true state s. Besides, for each consumer, there is a l-dimensional vector of idiosyncratic signal noises $\mathbf{q}^i$, distributed with mean = 0 and a variance, independent of the true state s and $\mathbf{p}$. This introduction of noises at the individual consumer level gives an n-dimensional vector of potentially observable signals to each consumer, denoted by $\mathbf{z}^i$, including the two types of noise.

(3) $\mathbf{z}^i = \mathbf{1}_n.s + D\mathbf{p} + B\mathbf{q}^i,$

where $\mathbf{1}_n$ is an n x 1 vector of ones and D and B are n by k and n by l matrices of coefficients with rank n, respectively. Therefore, the consumer i's jth signal can be represented as $z_j^i = s + d_j\, p_j + b_j\, q_j^i$. This composition of individual consumer's signals allows for arbitrary correlation in signals across consumers. Specifically, by setting either the row vector **d** or the row vector **b** equal to zero, we can define a spectrum of signals between two extremes: pure private signals and pure public or common signals. As $d_j + b_j$ approaches infinity, signal j gets unobserved or uninformative because noise becomes a dominant component of the consumer i's jth signal. Consequently, the consumer's cost of information is determined by a function $c(\mathbf{d}, \mathbf{b})$, where the cost decreases as **d** and/or **b** gets larger.

Updating Priors Beliefs to Posterior Beliefs

Individual consumer i's signals are an unbiased predictor of the true state s with variance $b_j^2 + d_j^2$. Following the Bayes' Law, consumers' posterior beliefs $E[s \mid K_i]$, $Var[\text{s} \mid K_i]$, and $E[\bar{a} \mid K_i]$ are reversely related to the variance $b_j^2 + d_j^2$ and the parameters of the true state s distribution $N(\mu, \tau_s^{-1})$, where τ_s^{-1} (the reciprocal of the variance) represents the precision of the true state s (i.e., the width of the distribution of s), and K_i denotes the information set including the chosen signals **s**. In particular, the update of the average action $\bar{a}$ by consumers depends on the characteristics of the signal they observe. In case of symmetric information choices, where all consumers choose to observe signals with the same precision and, therefore, choose the same action rules, signal outcomes and realized actions may differ. This can be shown as $a_i = \Upsilon_0 \mu + \sum_j \Upsilon_j z_j^i$, where Υ_0 denotes the weight on priors in actions, Υ denotes the weight on the signal if only one signal is observed, and Υ_j denotes the weight on signal $j \geq 1$ when multiple signals are observed. Since q^i (idiosyncratic noise of the i's consumer) is independent across consumers, $\bar{a} = \Upsilon_0 \mu + \sum_j \Upsilon_j (s + d_j p_j)$. Thus, the posterior beliefs about average actions are summarized by

$$(4) \qquad E[\bar{a} \mid K_i] = \Upsilon_0 \mu + \sum_j \Upsilon_j (E[s \mid K_i] + d_j E[p_j \mid K_i])$$

INFORMATION CHOICES AND BUYING DECISIONS

A consumer's learning about the true state s and the consequent actions can be explained by many different information choice theories, each of which is a case of (3) with varying restriction on **d** and **b**. In this section, we discuss the implications of the restriction for the three statistics (i.e., $Var[s \mid s]$, $Var[\bar{a} \mid s]$, and $Cov[\bar{a}, s \mid s]$) and the information choice equilibria. In Bayesian statistical inference, a prior is a probability distribution of an uncertain quantity that would express one's beliefs about the quantity before some evidence is considered.

Inattentiveness and Buying Decisions

Let us assume two extreme cases where a consumer can choose one of two options: observe no signal ($\mathbf{d} + \mathbf{b} = \infty$) or observe s exactly ($\mathbf{d} = \mathbf{b} = 0$) at a cost c. The first option means that all signals are either purely private or common. The second option indicates that the signals are not observed or unattended. In both case, the precision tends to infinity. Reis (2006) called this information choice the *inattentiveness*, where consumers choose their own information update paths at some intervals and hence adjust their actions infrequently.

Since, in this case, informed consumers know the true state s and other consumers' information sets, they can deduce average actions. Thus, $Var[s \mid s] = Var[\bar{a} \mid s] = Cov[\bar{a}, s \mid s] = 0$. Let β be the subset of consumers who choose to update information. According to the first order condition, uninformed consumers should choose $a_i = \mu$, and informed consumers should choose $a_i = (1 - \Upsilon)\,\mu + \Upsilon s$, where $\Upsilon = (1 - r)/(1 - r\beta)$ and r measures either substitutability ($r < 0$) or complementarity ($r > 0$). The statistics for uninformed consumers are $Var[s] = \tau_s^{-1}$, $Var[\bar{a}] = \Upsilon^2\,\tau_s^{-1}$ and $Cov[\bar{a}, s] = \Upsilon\,\tau_s^{-1}$. Thus, the inattentiveness theory can bring about three types of possible equilibria: either all consumers, no consumers, or some consumers acquire full information by update. The prevailing equilibrium depends on the information cost c, the degree of complementarity r, and prior precision τ_s.

Proposition 1: With fixed costs of information update and complementarity in consumer actions ($r > 0$), either all consumers, no consumers, or some consumers act in line with the given product reviews if $c \in ((1 - r)^2\tau_s^{-1}, \tau_s^{-1})$. When $r > 0$, a consumer's buying decision is based on the reviews. When $r < 0$, a buying decision becomes a strategic one unconcerned about the reviews.

Rational Inattention and Buying Decisions

Some reviews such as bought reviews or puff pieces tend to be biased and correlated. However, in many cases, individual reviews (signals) about the true state s are uncorrelated across consumers ($D = 0$). Suppose the consumer observes a single signal. Then, $z^i = s + b^i q^i$ where $q^i \sim N(0, 1)$ are independent across i. Each consumer chooses b^i to maximize expected utility (2), subject to a cost function $c(b^i)$ that is decreasing in b^i (the coefficient of the idiosyncratic signal noise). Sims (2003) described this kind of information choice using rational inattention theory, where a consumer can access all information. Nevertheless, consumers' limited information-processing ability causes them to introduce noise to whatever they observe. Each consumer creates his/her own noise, independent of any other consumer. Having $\mathbf{d} = 0$ means that, as consumer i observes more information, $Var[s \mid K_i]$, $Var[\bar{a} \mid K_i]$, and $Cov[\bar{a}, s \mid K_i]$ fall together by the same proportion, where and K_i denotes the information set including the chosen signals $\mathbf{s}$ by a consumer.

If consumers acquire more information, they put more weight on the *more* precise private signals (idiosyncratic noises) when forming their actions. Thus, $(1 - \Upsilon_0)$ increases because as consumers acquire more information, the weight on their priors in actions decreases. When actions are complements ($r > 0$), consumer i acquires more information to decrease $Var[s \mid K_i]$. This is a complementarity in information acquisition. However, this complementarity does not seem to explain various buying decisions made by consumers either in line with the reviews or not (Hellwig and Veldkamp 2009). The decision based on one private signal's precision would be unique. With two or more private signals and a cost function of the sum of the signal precisions, there will always be multiplicity because a consumer would be indifferent between any signal precisions that have the same sum. Therefore, multiple decisions exist. When the true state *s* and the signals are normally distributed, rational inattention prescribes that the amount of information processed is $M = \frac{1}{2}\ln(|\ Var(s)\ |\ /\ |\ Var(s\ |\ K_i\ )\ |)$, which leads to any arbitrary cost function $c(M)$.

Rational inattention has the property of diminishing marginal cost of precision: (1) Assuming *s* is a scalar, if signal precision increases by a one-unit, posterior precision $1/Var(s\,|\,K_i\,)$ increases by one unit. This means that: (1) the marginal cost of precision decreases proportionally as $Var(s)$ decreases and explains that why learning about something unfamiliar (high $Var(s)$) is costly; (2) $Var(s)$ falls as a consumer learns more about *s* over time, which means that signal precision could get better over time for a given *M*; and (3) when there are multiple risks resulting from a decision, *M* depends on the determinant of the precision matrix $|Var(s\,|\,K_i)^{-1}|$. If risks and signals are independent, *M* is a product of posterior precisions: $\Pi_j\ (\tau_{sj} + b_j^{-2})$. Thus, increasing the precision of signals by acquiring more signals (by processing more information) that are already precise (high b_j^{-2}) gets cheaper. This explains a process of refined, less costly search. The amount of information *M* is approximately the same as the number of binary signals that are necessary to transmit information of the given precision (Sims 2003). Once the consumer knows by the first binary signal where his/her decision outcomes are, he/she would know which *quartile* the outcomes are in by the second signal, and so forth, because the information *M* is measured in terms of the number of binary signals. If the outcomes have a uniform distribution, each additional signal reduces the standard deviation by half (increases the precision four-fold). This implies that the interpretation of the second review depends on the first review and illustrates how existing reviews help consumers interpret new reviews more effectively. The diminishing marginal cost of precision can lead to multiple decisions. When the multiplicity of private signals is removed from the cost concavity, multiple decisions may arise.

Information Markets and Buying Decisions

Consumers make choices based on the information they have. Most of the time this information is incomplete and gathering more information involves frictions such as time, effort, and money. Veldkamp (2006) suggested a modeling of information frictions with the assumption that consumers can purchase signals from an information market (e.g., Angieslist.com). In a typical information market, the signal is supplied and sold after being discovered or generated by a producer. It is not free because the discovery process is costly. Once discovered, the signal can be replicated and sold to others. Because the producer is selling exact copies of the same signal, it is a purely public signal ($\mathbf{b} = 0$). Consumers choose a set J^i of signals to purchase and observe.

If they try to make decisions using the same strategy (in a symmetric equilibrium), $Var[\bar{a} \mid K_i] = 0$ and $Cov[\bar{a}, s \mid K_i] = 0$. Only $Var[s \mid K_i]$ (the true state s) is uncertain. However, if a consumer who learns less public information than others has a higher $Var[\bar{a} \mid K_i]$, he/she would reduce by learning more. If a consumer who learns more public information than others, he/she would not change $Var[\bar{a} \mid K_i]$ when $r > 0$ (Hellwig and Veldkamp 2009). In other words, when decisions are complementary, public information is more valuable because the consumer can lower $Var[\bar{a} \mid K_i]$ by using the information in estimating both the true state and others' actions. This implies that the marginal value of public information is bigger than the marginal value of private information. However, observing one additional piece of public information, beyond what other consumers have observed, is like observing private information. It is in fact public because other consumers can also observe that piece of information, but it is effectively private because other consumers have chosen not to observe it. If other consumers observe that additional public information, then observing the information has a higher marginal value because it reduces $Var[\bar{a} \mid K_i]$. Observing that public signal becomes a best strategy. If others choose not to observe that additional signal, it is effectively a private signal and has lower value. Therefore, the additional signal may not be valuable to observe.

Costly Precision and Buying Decisions

In this section, we consider signals with both public and private noise. First, as in Myatt and Wallace (2012), suppose the amount of public (common) noise is constant while consumers are allowed to choose private noise. Second, assume the amount of private noise is constant while customers are allowed to vary the weight their signal places on public noise. According to Myatt and Wallace (2012), a lower coefficient b_j is interpreted as "paying more attention" and a lower coefficient d_j is interpreted as "clarifying" signal j.

Such information choices have the following effects. First, more attention to signal j (lower b_j) reduces the conditional variance of the true state s, $Var[s \mid K_i]$. Lowering b_j has a larger effect on the conditional variance when d_j is small (when both public noise and private noise are weighted smaller) and lowering d_j also has a greater effect when b_j is small. This means that paying more attention to signal j is valuable when the signal is clear and that clearer signals are more valuable if a consumer can pay close attention to them. Second, the covariance of this average action with the true state s, $Cov[\bar{a}, s \mid K_i]$, is proportional to $Var[s \mid K_i]$. Third, the conditional variance of the average action, $Var[\bar{a} \mid K_i]$, depends on how consumers estimate others' signals and on the weight Υ_j they place on the j^{th} signal in actions. As a consumer pays less and less attention to signal j (when b_j gets larger), then signal j

gets closer and closer to a private signal. This increases $Var[\bar{a} \mid K_i]$ (the degree of uncertainty about $\bar{a}$) because the consumer understands less and less of what signals other consumers observe. As a consumer pays more and more attention to signal j (when b_j gets smaller), then signal j gets continually closer to a public signal. This reduces $Var[\bar{a} \mid K_i]$ (the degree of uncertainty about $\bar{a}$) because the consumer understand more and more of what signals other consumers observe.

Proposition 2: Assume that a consumer's information costs are a function of the sum of private precisions (costs increase as private precision increases). Then a consumer who has precise private information about the product will make a buying decision unconcerned about the reviews.

Now consider the case where, instead of holding **d** constant and choosing **b**, **b** is held constant while allowing consumers to choose **d**. One way to describe this case of information choice is that consumers choose from a variety of sites that provide the equally good or bad reviews with some common noise, where some sites carry a higher signal-to-noise ratio than others. In addition, consumers may introduce independent signal-processing noise to whatever they observe, but they cannot control this noise. In the previous section, the cost of information of the consumer has been defined as $c(\mathbf{d}, \mathbf{b})$, which is decreasing in both arguments. This means that as the weight on either the common signal noises or idiosyncratic noises increases, the consumer's information cost decreases because they would be willing to spend more time and effort on information acquisition.

Proposition 3: If $c(\mathbf{d})$ is a convex function and $r \in [0, 1]$ (that is, if a consumer's information cost decreases as he/she leans more toward other consumers' reviews and the reviews are complementary to her buying decision), then there is a unique symmetric equilibrium in the choice of signal clarity **d** (that is, in extreme cases the consumer may or may not follow the other consumers' reviews).

One might think that choosing **d** and choosing the number of reviews to observe would cause similar problems. In addition, it is not the presence of private signal noise that explains why buying decisions can be different among consumers even after they observe the same reviews. Even if $B = 0$, Proposition 3 still holds because consumers could choose different levels of clarity on the same reviews.

As for clarity versus quantity of a review, a consumer can break the signal from the review into information that others care about and information they do not (for example, brand versus price of a device). The information other consumers observe has a different marginal utility for the consumer from the additional information they have not observed. That difference creates the idiosyncrasies in utility and, hence, buying decisions. In the signal clarity problem, there is no such breakdown. For example, if $B = 0$, then a consumer who observed two signals with different degrees of clarity could infer the public noise p and the true state s accurately. In addition, as the level of precision of private signal about the true state s increases, it hides more about u and, thus, informs the consumer less about what other consumers know and what they will do. In other words, it can raise $Var[\bar{a} \mid K^i]$. A consumer who acquires more information from the review would never forgo his/ her private signal and, therefore, would maintain a minimum level of $\bar{a}$. Consequently, more information would always increase expected utility.

CONCLUSION

Understanding the process of consumers' buying decisions is not intuitively obvious from the way it appears. Before we come up with any acceptable account of the process, we should understand more about consumers' traits as well as the characteristics of the goods or services those consumers intend to purchase. Consumers' buying decisions would be affected by many factors such as the types of product and income elasticity of a product. Buying decisions would also be influenced by personal traits, including susceptibility to assertions in product and service marketing, budget constraints, sensitivity to the prices of goods or services, prior knowledge of the purchase items, and information processing capacity. Moreover, buying decisions could be affected by the properties of a consumer review, such as depth, length, and the reviewer, per se. Recently, Netflix has replaced its five star-based review system with a simple thumbs-up and thumbs-down because they believe a product gets more ratings when the reviewer has fewer decision points (Fowler, 2017). According to Powell et al. (2017), consumers tend to purchase a product based on the quantity of reviews, rather than the quality of them.

Consumers' buying decision problems can also be formulated with information choice. In other words, depending on the way that consumers choose and process signals from the reviews, they may or may not make busying decisions in line with the reviewers. That is, in economics term multiple equilibria can exist, although in general, higher product ratings are associated with higher sales. Nevertheless, the presence of multiple equilibria explains why not all consumers follow suit. This implies that consumers get different signals from the same reviews that result in different purchase decisions. The consumers observe different signals from the same reviews and process them in different ways. Of the information choice theories, inattentiveness is applicable to describing factual signals, such as expert reviews, that can be known objectively and communicated easily. Browsing such reviews might require some time and effort, but they are not likely to be observed with noise. Every consumer who observes that particular review knows that other consumers have seen the same signal. Rational inattention is a useful way to describe more subjective reviews—such as consumer reviews that might include seemingly biased viewpoints or narrowly focused opinions—which are often influenced by the number of decision points of the reviewer. Reasonable consumers might come up with different conclusions on the same reviews. It might require consumers to make more cognitive effort to improve their buying decisions. Yet another information choice theory, information markets seems to be appropriate to explain a situation where the signal may be incorrect (e.g., reviews on subscription-based review sites and sponsor content on media), but once a consumer see the signals, he/she might know what was observed and he/she might also know that other consumers observed the same thing. Finally, the costly precision theory describes both the idea that the underlying signal may have error and that consumers may disagree about how to interpret that signal. The level of disagreement in interpreting the signal depends on the weight of the accuracy and clarity of the signal a consumer takes into account at the time of signal processing. Considering the information choice theories altogether, when consumers want to follow decisions that other consumers have already made, they want to know what those other consumers know.

However, consumers' buying decisions can be strategic substitutes depending on the choice of signals to observe and the precision with which to observe those signals. Thus, there are cases of "my way or the highway" buying decisions depending on the consumer's information choice. When decisions are complementarity, information choice theories can explain why the same reviews can result in multiple different buying decisions. A recent study (von Helversen et al. 2018) found that information choices could be different across age groups. The study found that if making a purchase decision is difficult due to the trade-offs between product attributes, younger adults tend to choose the higher-rated product. A purchase decision based on higher rate, however, can be changed by a single highly influential negative or positive review. On the other hands, older adults's purchase decisions are more influenced by a single highly influential negative than a powerful positive review. They do not take into account average consumer ratings or single powerful positive reviews. The study suggests that consumers in different age groups receive different signals from consumer reviews.

REFERENCES

Akdeniz M., Calantone R., and Voorhees C. 2014. "Signaling Quality: An Examination of the Effects of Marketing- and Nonmarketing-Controlled Signals on Perceptions of Automotive Brand Quality," *Journal Of Product Innovation* Management (31:4), pp. 728-743.

Allen, B. 1990. "Information as an Economic Commodity," *American Economic Review* (80:2), pp. 268–273.

Arrow, K. J. 1996. "The Economics of Information: An Exposition," *Empirica* (23:2), pp. 119-128.

Ba S., and Pavlou P. 2002. "Evidence of The Effect of Trust Building Technology in Electronic Markets: Price Premiums and Buyer Behavior," *MIS Quarterly* (26:3), pp. 243-268.

Baum D., and Spann M. 2014. "The Interplay Between Online Consumer Reviews and Recommender Systems: An Experimental Analysis," *International Journal of Electronic Commerce* (19:1), pp. 129-162.

Berger J., Sorensen A., and Rasmussen S. 2016. "Positive Effects of Negative Publicity: When Negative Reviews Increase Sales," *Marketing Science* (29:5), pp. 815-827.

Black, F. 1986. "Noise," *Journal of Finance* (41:3), pp. 529-543.

Bunn, M. D. 1993. "Taxonomy of Buying Decision Approaches," *Journal of Marketing* (57:1), pp. 38-56.

Chen, Y., and Xie, J. 2005. "Third-Party Product Review and Firm Marketing Strategy," *Marketing Science* (24:2), pp. 218-240.

Chen, Y., and Xie, J. 2008. "Online Consumer Review: Word-of-Mouth as a New Element of Marketing Communication Mix," *Management Science* (54:3), pp. 477-491.

Chen, P., Dhanasobhon, S., and Smith, M. 2008. "All Reviews Are Not Created

Equal: The Disaggregate Impact of Reviews on Sales on Amazon.com," working paper, Carnegie Mellon University (available at SSRN: http://ssrn.com/abstract=918083).

Chevalier, J. A., Dover, Y., and Mayzlin, D. 2016. "Channels of Impact: User Reviews When Quality Is Dynamic and Managers Respond," working paper (available at SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2766873).

Chevalier, J., and Mayzlin, D. 2006. "The Effect of Word of Mouth on Sales: Online Book Reviews," *Journal of Marketing Research* (43:3), pp. 345-354.

Clemons, E., Gao, G., and Hitt, L. 2006. "When Online Reviews Meet Hyperdifferentiation: A Study of the Craft Beer Industry," *Journal of Management Information Systems* (23:2), pp. 149-171.

Cornes, R., and Sandler, T. 1986. *The Theory of Externalities, Public goods, and Club Goods*, Cambridge: Cambridge University Press.

Cover, T. M., and Thomas, J. A. 2006. *Elements of Information Theory*, New York: John Wiley & Sons.

de Langhe, B., Fernbach, P. M., and Lichtenstein, D. R. 2016. "Navigating by the Stars: Investigating the Actual and Perceived Validity of Online User Ratings," *Journal of Consumer Research* (42:6), pp. 817-833.

Downey, K. H., and Slocum, J. W. 1975. "Uncertainty: Measures, Research, and Sources of Variation," *The Academy of Management Journal* (18:3), pp. 562-578.

Engel, J. F., Kollat, D. T., and Blackwell, R. D. 1968. *Consumer Behavior*, New York: Holt, Rinehart and Winston.

Fang, Y., Qureshi, I., Sun, H., McCole P., Ramsey E., Lim, K. H. 2014. "Trust, Satisfaction, and Online Repurchase Intention: The Moderating Role of Perceived Effectiveness of E-Commerce Institutional Mechanisms," *MIS Quarterly* (38:2), pp. 407-A9.

Forman, C., Ghose, A., Wiesenfeld, B. 2008. "Examining the Relationship Between Reviews and Sales: The Role of Reviewer Identity Disclosure in Electronic Markets," *Information Systems Research* (19:3), pp. 291-313.

  ISSN: 1941-6679-On-line Copy

Fowler, G. A. (2017, April 5). "Grade-Inflation on the Internet: Why Star Ratings are Broken," The Wall Street Journal, pp. B1.

Friestad, M., and Wright, P. 1994. "The persuasion knowledge model: How people cope with persuasion attempts," *Journal of Consumer Research* (21:1), pp. 1-31.

Gary. 2015. Masterpiece! Our myths make us who we are [Review of the book *Sapiens: A Brief History of Humankind*, by Y. N. Harari], *Amazon* (available at https://www.amazon.com/Sapiens-Humankind-Yuval-Noah-Harari/dp/0062316095/ref=lp_4919321011_1_5?s=books&ie=UTF8&qid=1469631907&sr=1-5).

Gefen, D., and Pavlou, P. 2006. "The Moderating Role of Perceived Regulatory Effectiveness of Online Marketplaces on the Role of Trust and Risk on Transaction Intentions," in Proceedings of the 27th International Conference on Information Systems, Milwaukee, WI, pp. 1313-1330.

Grossman, S. J., and Stiglitz, J. E. 1980. "On the Impossibility of Informationally Efficient Markets," *American Economic Review* (70:3), pp. 393-408.

Hartemo M., Suomi R., and Hakala U. 2016. "Towards Improved Performance: A Model for Testing Email Newsletter Design," *Journal of Electronic Commerce in Organizations* (14:3), pp. 1-16.

Hellwig, C., and Veldkamp, L. 2009. " Knowing What Others Know: Coordination Motives in Information Acquisition," Review of Economic Studies, 76, pp. 223-251.

Hellwig, C., Kohls, S., and Veldkamp, L. 2012. "Information Choice Technologies," *American Economic Review* (102:3), pp. 35-40.

Hirt, M., and Willmott, P. 2014. " Strategic Principles for Competing in the Digital Age," McKinsey & Company (available at http://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/strategic-principles-for-competing-in-the-digital-age).

Jiang, Z., and Benbasat, I. 2004. "Virtual Product Experience: Effects of Visual and Functional Control of Products on Perceived Diagnosticity and Flow in Electronic Shopping," *Journal of Management Information Systems* (21:3), pp. 111-147.

Jiang, Z., and Benbasat, I. 2007. "Investigating the Influence of the Functional Mechanisms of Online Product Presentations," *Information Systems Research* (18:4), pp. 221-244.

Kempf, D. S., and Smith, R. E. 1998. "Consumer Processing of Product Trial and the Influence of Prior Advertising: A Structural Modeling Approach," *Journal of Marketing Research* (35), pp. 325-337.

Keynes, J. M. 1936. *The General Theory of Employment Interest and Money*. London, England: Macmillan London.

Kotler, P., Keller, K.L., Koshy, A., and Jha, M. 2009. *Marketing Management: A South Asian Perspective* (13th ed.), India: Prentice Hall.

Kugler, L. 2014. "Keeping Online Reviews Honest," *Communications of The ACM* (57:11), pp. 20-23.

Li, X., and Hitt, L. 2008. "Self-Selection and Information Role of Online Product Reviews," *Information Systems Research* (19:4), pp. 456-474.

Miller, G. A. 1956. The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information (63:2), *Psychological Review*, pp. 81-97.

Monks, K. 2015. "Can a Company Succeed with a Toxic Reputation?" CNN (available at http://www.cnn.com/2014/12/01/business/success-toxic-rep/).

Mudambi, S. M., and Schuff, D. 2010. "What Makes a Helpful Online Review? A Study of Customer Reviews on Amazon.com," *MIS Quarterly* (34:1), pp. 185-200.

Myatt, D. P., and Wallace, C. 2012. "Endogenous Information Acquisition in Coordination Games," *Review of Economic Studies* (79:1), pp. 340–74.

Nielsen. 2016. "What are Connected Shoppers Doing and Not Doing Online," The Nielsen Company (available at http://www.nielsen.com/us/en/insights/news/2016/what-are-connected-shoppers-doing-and-not-doing-online.html).

Norman, D. A. "Some Observations on Mental Models," in *Mental Models*, D.

Gentner and A. L. Stevens (eds.), New York: Psychology Press, pp. 7-14.

Norman, D. A., and Bobrow, D. G. 1975. "On Data-Limited and Resource-Limited Processes," *Cognitive Psychology* (7), pp. 44-64.

Park, D., and Kim, S. 2008. "The Effects of Consumer Knowledge on Message Processing of Electronic Word-of-Mouth Via Online Consumer Reviews," *Electronic Commerce Research and Applications* (7:4), pp. 399-410.

Paul, A. K., and Hogan, S. K. 2015. "On the Couch: Understanding Consumer Shopping Behavior," Deloitte University Press (available at http://dupress.com/articles/understanding-consumer-behavior-shopping-trends/).

Pavlou, P., and Fygenson, M. 2006. "Understanding and Predicting Electronic Commerce Adoption: An Extension of the Theory of Planned Behavior," *MIS Quarterly* (30:1), pp. 115-143.

Pavlou, P., Liang, H., and Xue, Y. 2007. "Uncertainty and Mitigating Uncertainty in Online Exchange Relationships: A Principal-Agent Perspective," *MIS Quarterly* (31:1), pp. 105-131.

Poston, R., and Speier, C. 2005. "Effective Use of Knowledge Management Systems: A Process Model of Content Ratings and Credibility Indicators," *MIS Quarterly* (29:2), pp. 221-244.

Powell, D., Yu, J., DeWolf, M., and Holyoak, K. J. 2017. "The Love of Large Numbers: A Popularity Bias in Consumer Choice," Psychological Science. doi: https://doi.org/10.1177/0956797617711291

Reis, R. 2006. "Inattentive Consumers," *Journal of Monetary Economics* (53), pp. 1761–1800.

Romer, P. M. 1990. "Endogenous Technological Change," *Journal of Political Economy* (98:5), pp. S71-102.

Sakoui, A. 2016. "'Suicide Squad' Opens at No. 1 Film as Fans Ignore Critics," *Bloomberg* (available at http://www.bloomberg.com/news/articles/2016-08-07/-suicide-squad-gives-warner-bros-win-as-fans-ignore-critics).

Salehan, M., and Kim, D. J. 2016. "Predicting the Performance of Online Consumer

Reviews: A Sentiment Mining Approach to Big Data Analytics," *Decision Support Systems* (81), pp. 30-40.

Sims, C. A. 2003. "Implications of Rational Inattention," *Journal of Monetary Economics* (50:3), pp. 665–90.

Smith, D., Menon, S., and Sivakumar, K. 2005. "Online Peer and Editorial Recommendations, Trust, and Choice in Virtual Markets," *Journal of Interactive Marketing* (19:3), pp. 15-37.

Smith, G. E., Venkatraman, M. P., and Dholakia, R. R. 1999. "Diagnosing the Search Cost Effect: Waiting Time and the Moderating Impact of Prior Category Knowledge," *Journal of Economic Psychology* (20:3), pp. 285–314.

Spence, M. 1973. "Job Market Signaling," *Quarterly Journal of Economics* (87:3), pp. 355-374.

Stigler, G. J. 1961. "The Economics of Information," *Journal of Political Economy* (69:3), pp. 213-225.

Streitfeld, D. 2016. "Online Reviews? Researchers Give Them a Low Rating," New York Times (available at http://www.nytimes.com/2016/06/09/technology/online-reviews-researchers-give-them-a-low-rating.html?_r=0).

Thaler, R. 1980. "Toward a Positive Theory of Consumer Choice," *Journal of Economic Behavior & Organization* (1:1), pp. 39-60.

Veldkamp, L. L. 2006. "Media Frenzies in Markets for Financial Information," *American Economic Review* (96:3), pp. 577–601.

von Helversen, B., Abramczuk, K., Kopeć, W., and Nielek, R. 2018. "Influence of consumer reviews on online purchasing decisions in older and younger adults," Decision Support Systems. In press. Available at https://doi.org/10.1016/j.dss.2018.05.006.

Wang, W., and Benbasat, I. 2009. "Interactive Decision Aids for Consumer Decision Making in E-Commerce: The Influence of Perceived Strategy Restrictiveness," *MIS Quarterly* (33:2), pp. 293-320.

Wang, J., and Cole, C. A. 2016. "The Effects of Age and Expertise on Product Evaluations: Does the Type of Information Matter?" Management Science (62:7), pp. 2039–2053.

Wu, B. T., and Newell, S. J. 2003. "The Impact of Noise on Recall of Advertisements," Journal of Marketing Theory and Practice (11:2), pp. 56–65.

Zhijie, L. 2014. "An Empirical Investigation of User and System Recommendations in E-Commerce," *Decision Support Systems* (68), pp. 111-124.

Zhu, F., and Zhang X. M. 2010. "Impact of Online Consumer Reviews on Sales: The Moderating Role of Product and Consumer Characteristics," *Journal of Marketing* (74:2), pp. 133-148.