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產品受歡迎資訊與網路購物：以消費者解讀為干擾變數

Popularity Information and Online Purchases: Consumer Interpretation as the Moderator

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摘 要

產品受歡迎資訊往往是網路消費者做購物決策時的重要指標。這種資訊在網路上可以即時更新，所以特別受到網路消費者的重視。這個研究主要在探討消費者如何解讀兩種產品受歡迎資訊－產品市場（反映產品在市場上的需求量）與產品銷售量。這兩種資訊在網路上常常是共同存在的，而且通常會引發兩種不同的解讀（品質評估與社會比較），當小眾產品的銷售量與大眾產品的銷售量相同時，大多消費者會把這種訊息解讀為產品品質的指標，認為小眾產品的品質較好。然而，同樣的資訊也可以被解讀為潮流的指標，會吸引消費者去跟其他消費者做比較，而且覺得自己應該要得到那些消費者所擁有的東西。這種比較的過程，就是所謂的社會比較。這篇研究假設，當產品的市場大小與銷售量是不一致時（例如：小眾產品的銷售量大過於大眾產品時），購買小眾產品的機率會比當產品的市場大小與銷售量是一致的狀況下來得高，而其增加的量是以用產品品質為聯想的狀況高過於以社會比較為聯想的狀況。這個實驗是以實驗法，讓 200 位受試者在網路上進行實驗。最後的實證結果強烈支持我們的假設，並且對電子商務提供了許多實質的意涵。

【關鍵字】產品受歡迎資訊、社會比較、產品品質、指標、網路購物行為

Abstract

Popularity information of products, frequently observed by consumers for making purchase decisions, has become an even more common point of reference in E-commerce where such information is readily updated. This study investigates how consumers interpret breadth of appeal and sales volume, which are two common kinds of popularity information that often co-exist on the Internet, with different inferences (quality evaluation or social comparison) under conditions when the two kinds of popularity information are congruent or incongruent. It is hypothesized that when a product's breadth of appeal and sales volume are incongruent, the probability of purchasing a narrow-appeal product significantly increases compared to the condition of congruence; moreover, the magnitude of increase between the two conditions of congruency is higher for consumers with the inference of quality evaluation compared to that of social comparison. The method of laboratory experiment was adopted, with 200 participants. The empirical results strongly supported the proposed hypotheses and provided practical implications for e-commerce.

【Keywords】 popularity information, social comparison, product quality, signal, online purchase behavior

1. Introduction: Popularity Information in E-Commerce

The emergence of the Internet has enabled e-businesses to carry much wider selections of products, including products that suit mainstream tastes (Broad-appeal Products) and those that serve a small niche of the market (Narrow-appeal Products). That is, online purchase has become a new choice for consumers (Shih, Chang, and Peng, 2002). Furthermore, e-businesses can display the most up-to-date sales volume next to every product (including both broad- and narrow-appeal products) at a relatively low cost. Thus, it has become common to see the information of sales volume (actual sales accumulated from prior consumers) and breadth of appeal (potential sales conducive to consumers' preferences) co-existing in e-commerce, while this is difficult to achieve in the traditional sales channels due to limited space and high cost (Brynjolfsson, Hu, and Smith, 2010). However, most prior research merely focuses on the effect of single source of popularity information (e.g., sales volume) on consumer purchases (Cai, Chen, and Fang, 2008; Chen, 2008), concentrating on the underlying signal, mainly quality inference. To our knowledge, only a few recent studies have started to examine the joint effect of different types of popularity information and reveal countervailing results from the previous research (Tucker and Zhang, 2011). Thus, this research intends to explore further in this direction and examine how the congruency of different types of popularity information impact consumers' online purchase behavior with consumers' interpretation as the moderator.

Classic research in popularity information found that consumers tend to infer the sales volume as an indicator of quality and believe higher popularity indicates better product quality (Anderson and Holt, 1997; Celen and Kariv, 2004; Chen, 2010; Duflo and Saez, 2003). Based on the same quality inference, Tucker and Zhang (2011) argued that higher sales volume may not necessarily signal better quality and lead to stronger purchase intention. They suggested that consumers may infer the signal differently corresponding to two types of popularity information: sales volume and breadth of appeal, which are jointly considered and the signals conveyed by these two types of information are incongruent. Typically, it is congruent to see a broad-appeal product have a higher sales volume than a narrow-appeal product, whereas it is incongruent to see a narrow-appeal product have an equally high or higher sales volume than a broad-appeal product. Their research results showed that, with an equally high sales volume, consumers infer greater quality for a narrow-appeal product than for a broad-appeal product based on the assumption that the potential customer base of a narrow-appeal product should be much

smaller than that of a broad-appeal product. This suggests the same kind of quality inference may lead to different purchase behavior when taking the congruency of different types of popularity information into consideration. Nevertheless, while the quality evaluation seems to be the dominant inference in this field, Salganik, Dodds, and Watts's (2006) research results showed that a product's quality may not necessarily lead to a product's success in sales, suggesting that product quality is not the only dominant inference when viewing popularity information. Instead, an alternative social-related inference may drive consumers to alter purchase decisions (Sridhar and Srinivasan, 2012). However, to the best of our knowledge, little research has empirically investigated popularity information based on the social-related inference.

Therefore, this research intends to fill in the gap by extending the prior work in several ways. First, it further explores the effect of popularity information based on a social-related inference - social comparison, which is a prominent kind of social influence on every human being. Second, the research makes direct comparisons between different inferences (i.e., quality evaluation vs. social comparison) and examines how these inferences moderate the relationship between popularity information and online purchases. Third, the researchers investigate how the congruency of two types of commonly coexisting popularity information— sales volume and breadth of appeal, jointly impact consumers' online purchases. We believe two dominant inferences (i.e., quality evaluation vs. social comparison) may impact the conditions of congruence and incongruence differently and thus lead to different purchase decisions in e-commerce. The contributions of this research should allow the power of popularity information to be more broadly applied to different conditions and provide meaningful recommendations for e-commerce on how to strategically highlight popularity information for products with different breadth of appeal.

2. Literature Review

Popularity information is an indicator that reflects the preferences of earlier consumers (Duan, Gu, and Whinston, 2009), and can be displayed in different formations. Firstly, a product's sales volume reflects consumer's actual purchase decision, and is usually displayed in a numeric format (Gu, Tang, and Whinston, 2013). Second, a product's natural breadth of appeal refers to the range of consumers' tastes, suggesting a product's potential sales conducive to consumers' preferences (Tucker and Zhang, 2011). A broad-appeal product caters to a broad range of tastes and therefore enjoys a higher

potential of being chosen, whereas a narrow-appeal product serves a small niche of the market and consequently has a lower potential of being chosen (Tucker and Zhang, 2011). Third, a product's reviews are displayed in text, and the content of reviews could be anything, depending on reviewers' experience (Lee, Park, and Han, 2008; Park and Kim, 2008; Park and Lee, 2009). Fourth, a product's ratings reflect prior consumers' overall satisfaction level and could be displayed in a numeric or text format (Sridhar and Srinivasan, 2012).

In this study, only popularity information related to purchase, i.e., breadth of appeal and sales volume, are assessed in the context of e-commerce due to the following reasons. First, breadth of appeal and sales volume reflect real purchase decisions of prior consumers, whereas reviews and ratings are prior consumers' opinions about a product but may not necessarily reveal their real purchase decisions. In this research, we are more interested in assessing consumers' direct response, i.e., prior purchase decisions, rather than opinions or ratings that involve complicated emotions and reasons. Second, the topic of online consumer reviews or ratings has been widely studied (Bickart and Schindler, 2001; Chevalier and Mayzlin, 2006; Zhu and Zhang, 2010), while research focusing on the joint effect of market size and sales volume is relatively rare (Tucker and Zhang, 2011). Third, different from the traditional purchasing channels, advanced technology on the Internet has enabled e-businesses to carry products with a wide range of appeal (including both broad- and narrow-appeal) and display sales volume next to every product. This means that breadth of appeal and sales volume information often co-exist with a product on the Internet. In conclusion, this research intends to focus attention on the joint effect of breadth of appeal and sales volume in the context of e-commerce.

2.1 Observational Learning and Signaling Effect

Much research has shown that individuals' behavior is impacted through observing the behavior of others and the information contained therein (Cai et al., 2008; Chen, 2008). Observational learning can take place as long as the underlying problems faced by individuals are similar (Zhang, 2010). In particular, it includes the mechanism of learning from others through direct communications or observing the behaviors of others (Bikhchandani, Hirshleifer, and Welch, 1992, 1998). In terms of efficacy, learning through direct communications requires individuals to be close in time, space and/or social distance, while learning through behavior does not always have such constraints. The focus of this research is the latter where consumers are unable to physically inspect a

product or communicate with another individual face to face. The uncertainty of the online environment can increase consumers' reliance on existing information regarding a product and on signals from the information therein (Pavlou, Liang, and Xue, 2007; Lim, Sia, Lee, and Benbasat, 2006; Yoo and Kim, 2012). Therefore, the role of popularity information becomes apparent because it allows customers to observe prior consumers' purchase decisions and interpret the signals in between (Simpson, Siguaw, and Cadogan, 2008).

2.2 Popularity Information Signaling Product Quality

Signaling theory took root in the idea of asymmetric information, in which one party has more or better information than the other (Spence, 2002). In the context of consumer purchases, a certain party must have more information regarding a product than the other party, either because they are experienced or have purchased the product. In this condition, the less-informed party would try to interpret the signal from the better-informed party with the hope to reveal some pieces of relevant information (Kirmani and Rao, 2000). Based on the interpretation of the signal, the less-informed party may adjust their purchase behavior accordingly. Such a phenomenon should be even more obvious in the context of e-commerce as individuals can not physically inspect the product or consult someone face-to-face (Brynjolfsson and Smith, 2000; Lynch, Kent, and Srinivasan, 2001). When they perceive the lack of product information, popularity information could serve as a signal for potential consumers to observe/interpret what other consumers think and how they act regarding the product (Chen, 2010; Tucker and Zhang, 2011; Boulding and Kirmani, 1993).

Research about signaling theory in regard to popularity information is dominant with the view of product quality (Boulding and Kirmani, 1993). Evidence of quality evaluation has been documented both in the lab (Anderson and Holt, 1997; Celen and Kariv, 2004; Chen, 2010; Duflo and Saez, 2003) and in the field (Duan et al., 2009; Duflo, 2006). Most of these researchers conducted their experiments based on a single source of popularity information and drew similar results that a high level of popularity (e.g., high sales volume) conveys a signal of high product quality and positively impacts consumers' purchase decisions.

Based on the same inference of quality evaluation, Tucker and Zhang's (2011) research argued that higher sales volume may not necessarily lead to better sales. Such a phenomenon becomes especially apparent when jointly considering two types of product

information— a product's breadth of appeal and sales volume, and the signals conveyed by these two types are incongruent. Since the customer base of a mainstream broad-appeal product is expected to be bigger and wider than a narrow-appeal product, it would be congruent to see a broad-appeal product has a higher sales volume than a narrow-appeal product; however, it will be incongruent to see a narrow-appeal product have a lower sales volume than a broad-appeal product. Surprisingly, Tucker and Zhang's (2011) research results showed that in the condition of incongruence (equal sales volume for the broad- and narrow-appeal products), more consumers prefer to purchase the narrow-appeal than the broad-appeal product due to interpreting the incongruent condition as a greater quality signal for the narrow-appeal product. This countervailing finding from the classic research has demonstrated the importance of considering different types of popularity information (sales volume and breadth of appeal) and the congruency in between them.

2.3 Popularity Information and Social Comparison

While quality inference is the predominant inference in this field, some research suggests that a product's quality may not necessarily lead to the success in sales (Salganik et al., 2006; Sridhar and Srinivasan, 2012). When consumers are uncertain about their purchase decision, they often infer information from the actions of others and follow the majority's decision regardless of the true reason behind it (Bikhchandani et al., 1992; Bonabeau, 2004). The majority here serves as a reference group with which consumers may make comparisons. The reference group could be someone known or not known, similar or dissimilar, better-off (Upward Comparison) or worse-off (Downward Comparison) (Brown, Ferris, Heller, and Keeping, 2007; Khan and Khan, 2005; Schiffman and Kanuk, 2000; Mussweiler and Strack, 2000). Through the comparison process, consumers could use the comparison result to determine their social status and self-evaluate their decision making (Self-evaluation), protect or bolster their self-esteem (Self-enhancement), or improve their ability (Self-improvement) (Shepherd, Briggs, Reinig, Yen, and Nunamaker, 1995; Buunk, 1995; Taylor and Lobel, 1989; Wood, 1989). Such a comparison process could be accounted for by social comparison theory, which is one of the most prominent social influences and is a central feature of human social life (Buunk and Gibbons, 2007; Suls, Martin, and Wheeler, 2002).

When the inference of social comparison is dominant in the context of consumer purchases, consumers experience a strong desire to own what their reference group owns

(Hoch and Loewenstein, 1991). This strong desire is driven by the fear of failing to own what they feel entitled to have, which is referred to as *deprivation* in literature (Loewenstein, 1988; Luo, 2005). When the purchase is made as expected, consumers would not feel deprived because they are indulged in the joy of owing what they perceive they are entitled to own (Iyengar, Van den Bulte, and Valente, 2011; Wu and Lee, 2008a, 2008b). However, when the purchase is not made, the feeling of deprivation becomes apparent, which makes consumers experience strong disappointment because they realize that they have less of what they believe to be entitled to, compared to their reference group (Wu and Lee, 2008a, 2008b). In this condition, only a quick purchase (impulsive purchase) could quell the feeling of deprivation and bring a feeling of happiness (Luo, 2005; Rook, 1987). This explains why much research has reported a strong purchase intension when the effect of social comparison interferes.

2.4 Inferences of Quality Evaluation and Social Comparison

When different levels of sales volume (high or low) are displayed next to products with different breadth of appeal (broad-or narrow-appeal), the consistency between the signals conveyed by these two types of information determines whether consumers would perceive the condition as congruence or incongruence. It is congruent to see a broad-appeal product have a higher sales volume than a narrow-appeal product, whereas it is incongruent to see a narrow-appeal product have an equally high or higher sales volume than a broad-appeal product. In the following paragraphs, we will examine consumers' interpretations and purchase behaviors when facing the conditions of congruence and incongruence with different dominant inferences.

When the inference of quality evaluation is dominant, consumers' main focus is to purchase a high quality product. Prior research suggested that consumers infer a higher sales volume as a signal of higher quality (Bonabeau, 2004). Since a broad-appeal product with a higher sales volume suggests that it enjoys a higher chance of being chosen (higher potential sales) and possesses a higher actual sales (higher sales volume) than a narrow-appeal product, this means that both types of popularity information convey congruent signals of higher quality. Therefore, it is logical to infer that consumers with the dominant inference of quality evaluation will have a higher purchase intention for a broad-appeal rather than a narrow-appeal product in the condition of congruence. On the other hand, consumers with the dominant inference of social comparison will focus more on following the reference group's purchase behavior that signals a social trend but care less about the

product quality. Since a broad-appeal product with a higher sales volume suggests that it has a wider potential customer base and a higher actual sales volume than a narrow-appeal product, this means that the two types of popularity information consistently show that this product is the majority's choice by two potential reference groups in the condition of congruence. Given that the mechanism of social comparison is to compare their purchase decision with the reference group and own what their reference group owns (Iyengar et al., 2011; Wu and Lee, 2008a, 2008b), it is logical to infer that consumers with the dominent inference of social comparison have a higher probability of purchasing a broad-appeal over a narrow-appeal product in the condition of congruence. Therefore, we hypothesize as shown below:

H1: When a product's breadth of appeal and sales volume are congruent in e-commerce, consumers have a higher probability of purchasing a broad-appeal product over a narrow-appeal product.

Based on the foundation of hypothesis 1, we continue to examine consumers' online purchase decisions for narrow-appeal products in the condition of incongruence. When a narrow-appeal product obtains a higher sales volume than a broad-appeal product, it is considered as an incongruent condition since it is rare to see a narrow-appeal product with a smaller customer base to outweigh a broad-appeal product in sales. Consumers may thus infer this as a signal of higher quality and have a higher probability of purchasing a narrow-appeal than a broad-appeal product. This also suggests that the probability of purchasing a narrow-appeal product should be significantly increased in the condition of incongruence than that of congruence where most purchase decisions focus on a broad-appeal product.

On the other hand, when the inference of social comparison is dominant, consumers may view the condition of incongruence as an inconsistent response from two reference groups. Since the mechanism of social comparison is to follow the majority's decision, consumers may choose to treat the higher sales of the narrow-appeal product or the broad-appeal product that suits mainstream customers, yet with less sales volume, as their main reference group. Since the two reference groups suggest purchasing different product choices, consumers' purchase decision may thus be scattered between the two choices, which is very different from the condition of congruence where only few decisions allocate on the narrow-appeal product. Therefore, as for consumers with the social inference, the probability of purchasing a narrow-appeal product should be significantly

increased in the condition of incongruence than that of congruence.

However, the magnitude of increase may be different for consumers with different dominant inferences. In the condition of congruence, the quality and social signals conveyed from the information of sales volume and breadth of appeal are apparent and both indicate that the broad-appeal product is a better purchase choice. On the other hand, in the condition of incongruence, the quality signal for consumers with quality inference is still apparent and indicates that the narrow-appeal product is a better purchase choice. However, as for consumers with social inference, the higher sales of the narrow-appeal product and the broad-appeal product with lower sales both represent a majority's choice (implying two potential reference groups), which causes consumers' purchase decision on the narrow-appeal product to be less concentrated than for those with the quality inference. Therefore, we conclude that the probability of purchasing a narrow-appeal product significantly increases in the condition of incongruence compared to that of congruence; yet the magnitude of increase is higher for consumers with the quality inference than for those with the social inference.

H2: When a product's breadth of appeal and sales volume are incongruent in e-commerce, the probability of purchasing a narrow-appeal product significantly increases in comparison to the condition of congruence; yet the magnitude of increase is higher for consumers with the quality inference than for those with the social inference.

3. Research Methodology

3.1 Experimental Design

The entire experiment was conducted in the context of e-commerce. The key task assigned to the participants was to purchase three kinds of food products in a given commercial website: cookies, drinks and chips. Participants were given two choices for each kind of product, a broad-appeal and narrow-appeal product (e.g., chocolate cookie, which is widely available vs. cinnamon cookie, which is an unusual flavor only to be found in certain stores) and were required to choose one among the two alternatives. Therefore, the dependent variable was consumers' purchase decision, which reflected the probability of purchasing a broad-appeal or narrow-appeal product. The independent variable was the congruency of popularity information (congruence vs. incongruence). A product's sales volume and breadth of appeal are congruent when a broad-appeal product has a higher sales volume than a narrow-appeal product; whereas, it is the condition of

incongruence when the narrow-appeal product has a higher sales volume than the broad-appeal product. The moderator was inferences, which could be a product-related inference based on quality evaluation or social-related inference based on social comparison. The relationship among each variable is illustrated in Figure 1. The independent variable and moderator were between-subjects; thus, there were four conditions in total (a 2*2 factorial design).

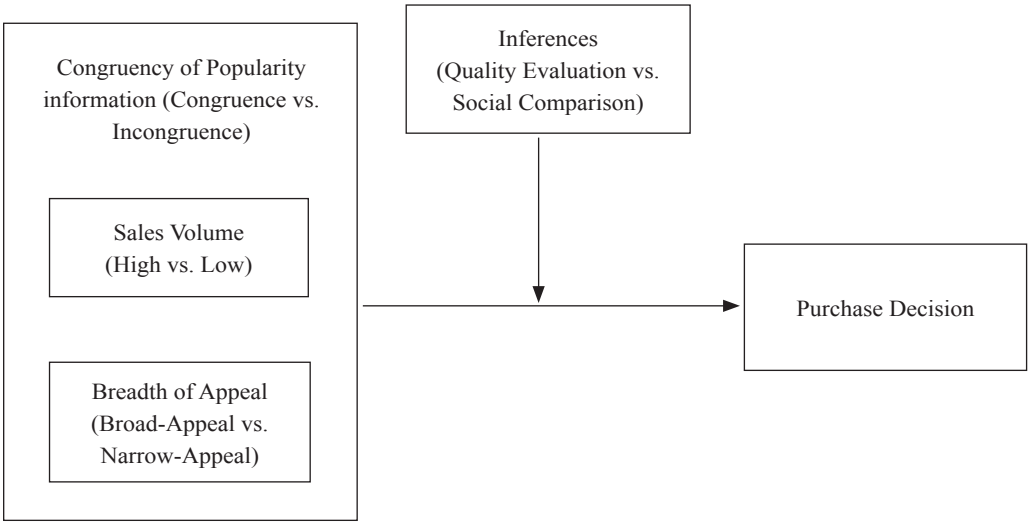

Figure 1 Research Model

3.2 Stimulus Materials

The products used for this experiment were selected based on the following criterion: low-cost, frequently purchased, and prevalently sold online, such that most of the potential participants have at least some experiences with them (Grunert and Ramus, 2005). Following this reasoning, we chose the product category of food, including cookies, drinks and chips as the products to be purchased by the participants in the experiment. The broad-appeal and narrow-appeal alternatives for each product were first selected, and then a norming test was conducted to ensure that the breadth of appeal for each product was appropriately identified. In total, 50 volunteers participated in the norming test and were asked to purchase a product out of two alternatives. The results showed that 92% of the participants chose chocolate cookie vs. 8%, cinnamon cookie; 66%, green tea vs. 34%, Chinese herbal tea; 78%, BBQ-flavored chips vs. 22%, vegetable-flavored chips. Given

that the differences between the percentage of choosing broad-appeal and narrow-appeal products were obvious and matched with the characteristics of broad-appeal and narrow-appeal products, the products chosen by the norming test were thus used in the real experiment. Interestingly, the average percentage of choosing the three products was 79% for the broad-appeal products vs. 21% for the narrow-appeal products, which were close to the 80/20 distribution reported in the literature (Brynjolfsson, Hu, and Simester, 2011; Pareto, 1964).

In the real experiment, the sales volume of each product alternative was revealed to the participants. As we have mentioned, the sales volume of the broad-appeal product was higher than that of the narrow-appeal product in the condition of congruence, whereas the sales volume of the narrow-appeal product was higher than that of the broad-appeal product in the condition of incongruence. Prior research shows that consumers feel the difference when the sales volume of two products is 2-fold apart (Tucker and Zhang, 2011). In order to make the difference of the sales volume sufficiently distinct, the difference in each pair of products was approximately 6-fold, with 64 for the high sales volume and 10 for the low sales volume. Therefore, in the congruent condition of cookies, the sales volume of the broad-appeal alternative was 64, and 10 for the narrow-appeal, while the sales volume was reversed in the incongruent condition.

In the experiment, two different scenarios were used to prime the inferences derived from popularity information. Both scenarios explained that the sales volume was obtained via a survey that was designed to explore how popular various products were among different groups of people. In the scenario for quality evaluation, it was stated that the sales volumes were contributed by food connoisseurs who were highly sensitive to food quality. On the other hand, in the scenario for social inference, the sales volumes were contributed by celebrities, who were favorably popular. The reason why these two groups of people were used in the scenarios was due to their distinctive characteristics. Food connoisseurs are known to have high standards regarding the quality of food and are considered experts who are perceived to possess knowledge about the product (Ohanian, 1990). We therefore use food connoisseurs to induce the quality inference. On the other hand, celebrities are typically recognized as a popular comparison target who can create a significant effect of social comparison on consumers and drive consumers to feel entitled to own what they have (Amos, Holmes, and Strutton, 2008; Silvera and Austad, 2004; Wu and Lee, 2008a, 2008b). Prior research shows that young people especially tend to consider celebrity idols as their idealized self-images and want to revise their physical

appearance, abilities, values, and attitudes in order to imitate that of their idols (Chan and Prendergast, 2008). Young consumers reported that they were more likely to use products endorsed by famous celebrity (Lafferty and Goldsmith, 1999). Thus, we use celebrity to induce participants' social inference. The scenarios are demonstrated in Appendix A and the sample page of the experiment on the Website is illustrated in Appendix D.

In order to examine whether the expected inference (quality evaluation vs. social comparison) was induced by the scenarios, three questions of manipulation check were constructed. Participants were asked to answer these questions based on their decision making process in the experiment. Two questions were used to examine whether the social inference was successfully induced. The first question was: What level of impact did other consumers' purchase decision have on your purchase decisions? The second question asked participants to rate their disappointment level if the product they intended to purchase was out of stock. Past research has shown that if consumers fail to purchase the same product as their reference group, they experience even stronger disappointment than those who do not undergo the process of social comparison (Loewenstein, 1988; Luo, 2005). As for the quality inference, participants were asked to rate what level of impact product quality had on their purchase decisions. The manipulation check questions are listed in Appendix B.

3.3 Pilot Test

A pilot test was conducted in a computer lab located at a university in Taoyuan, Taiwan. The purpose of conducting this preliminary study is to test logistics and gather information prior to the formal study, in order to improve the study's overall quality and clarity. Specifically, the clarity of the experiment is referred to whether instructions are comprehensible and easy to follow, wordings used in the experiment are appropriate, etc. The samples consisted of 20 volunteer staff and students from the university, who were randomly assigned to one of the four conditions, with 5 participants in each condition. After completing the experiment, participants were asked to perform a face-to-face interview to answer a series of open-ended questions, including 1) assess whether the wordings used in the scenarios are clear and appropriate, 2) the length of the experiment is reasonable, 3) the steps in the experiment are easy to follow, and 4) the difference of the sales volume in each pair of products is sufficiently distinct. The pilot results consistently matched the expectations of the researchers and confirmed the appropriateness of the experimental design and material.

3.4 Experimental Procedure

All participants were randomly assigned to one of the four conditions and were linked to the privately-constructed commercial website of the assigned condition. Participants were asked to purchase three food products. Participants in the quality condition received the scenario of food connoisseurs, whereas participants in the social condition received the scenario of celebrities. Two alternatives were provided, one broad-appeal and one narrow-appeal product, for each kind of food product. In addition, a sales volume was presented along with each product alternative. After reading the assigned scenario and browsing the information of product alternatives, participants needed to make a purchase decision between the choices of broad-appeal and narrow-appeal. In total, they were asked to make three purchase decisions. At last, participants answered questions regarding the manipulation check of inference, demographic information and online shopping experiences. After completing the experiment, every participant received a gift worth of US$5 as appreciation for their participation.

3.5 Participants

A mass email describing the purpose of the experiment was sent to potential candidates in universities and companies in Taiwan. A total of 200 participants in this experiment comprised of 44% male and 56% female. The majority of participants (88.5%) were aged 15 to 34. Demographic information of the sample population is illustrated in Appendix C.

Participants who responded and were willing to participate in the experiment were asked to conduct the experiment online by following the self-explanatory guide. Every participant was randomly assigned to one of the four conditions. At last, a total of 200 volunteer participants, with 50 in each condition, were recruited. On average, it took around 10 minutes to finish the assigned task. Since participants could be from universities or companies (48% students vs. 52% nonstudents), the KS test was performed to verify whether there was a significant difference between the responses of these two groups. The result showed no significant difference between the purchase decisions of students and non-students (D = .091; p = .808, *n.s.*); therefore, the data of these two groups of participants were combined for later analysis.

4. Empirical Results

The data obtained for manipulation check was analyzed using MANOVA because the values of responses were continuous and could be possibly correlated with each other. In contrast, both the dependent variable and the independent variables are categorical, and the dependent variable is binominal. Therefore, Generalized Linear Mixed Model (GLMM) was used for analysis. Both independent variables were treated as fixed variables, and products and participants were treated as random variables in the analysis.

The overall trend of participants' responses matches expectations. Participants who received the social condition reported of perceiving a stronger impact from other consumers' purchase decisions than their counterparts who received the product quality condition (4.55 vs. 4.01, $F(1,198) = 8.45$, $MSe = 341.74$, $p = .004$). The social condition also reported a stronger level of disappointment when the product was not purchased than did participants in the quality condition (3.26 vs. 2.96, $F(1,198) = 3$, $MSe = 297.08$, $p = .084$), although the difference is only marginally significant. On the other hand, participants assigned to the quality condition perceived a stronger level of impact from product quality than did participants assigned to the social condition, but the difference is not significant (3.17 vs. 2.93; $F(1,198) = 1.65$, $MSe = 346.62$, $p = .20$). One possible reason to explain the insignificant difference of quality impact is that product quality is perceived as an essential factor for both conditions. Nonetheless, the two conditions still responded to the three questions differently in the way expected. As for the two social related questions, participants consistently reported a significantly higher mean in the social condition than in the quality condition. However, the phenomenon was reserved in the quality related question. Participants reported a higher mean in the quality condition than in the social condition. The different response patterns between the two conditions shows that the manipulation of social comparison and product quality is successful.

Table 1 presents the average percentages of the broad-appeal or the narrow-appeal products being purchased by participants in the four conditions. In the condition of congruence, consumers in both inference groups have a significantly higher percentage of choosing a broad-appeal product over a narrow-appeal product (Quality Evaluation: Broad-appeal (77%) > Narrow-appeal (23%); $t(1192) = 6.16$, $SD = .193$, $p < .0001$; Social Comparison: Broad-appeal (78%) > Narrow-appeal (22%), $t(1192) = 6.42$, $SD = .1971$, $p < .0001$). That is, Hypothesis 1 is strongly supported by the empirical data in this study.

Table 1 Percentages of Purchasing Broad-appeal vs. Narrow-appeal Products in the 2 (Congruency between Popularity Information) * 2 (Inferences) Conditions

Congruency between Popularity Information	Inferences	Purchase Decision	
		Broad-appeal	Narrow-appeal
Congruence: (Broad-appeal > Narrow-appeal)	Product Quality	77%	23%
	Social Comparison	78%	22%
Incongruence: (Narrow-appeal > Broad-appeal)	Product Quality	49%	51%
	Social Comparison	62%	38%

Given that the sales volume is congruent with breadth of appeal, it is hard to differentiate the effects of sales volume and breadth of appeal in the congruent condition. However, if we compare the average percentages of the broad-appeal vs. the narrow-appeal products in the congruent condition with those in the norming test, where no sales volume was provided, we can see similar percentages of these two products (Experiment: Broad-appeal, 77% vs. Narrow-appeal, 23%; Norming: Broad-appeal, 79% vs. Narrow-appeal, 21%). That is, the information of sales volume does not seem to evoke any add-on effect to purchase, given that it is consistent with the general pattern of breadth of appeal. Furthermore, there is no difference between the distribution of broad-appeal vs. narrow-appeal purchase in the two inference groups (Product Evaluation: Broad-appeal, 77% vs. Narrow-appeal, 23%; Social Comparison: Broad-appeal, 78% vs. Narrow-appeal, 22%; $t(98) = .12$, $SD = .084$, $p = .548$, n.s.), where the sales volume consistently favors the broad-appeal products, namely either signaling product quality or confirming the existent social trend. Therefore, it is particularly interesting to see the results of the incongruent condition, where the narrow-appeal product has a higher sales volume.

When a product's breadth of appeal and sales volume are incongruent, the average percentages of choosing a narrow-appeal product are significantly higher compared to the condition of congruence (44.5% vs. 22.5%; $t(98) = 2.39$, $SD = .092$, $p = .009$). The results suggest that a higher sales volume does boost subsequent sales for the narrow-appeal products. However, this boost effect of sales volume only occurs for the narrow-appeal products, as suggested by the results of the incongruent condition, not for the broad-appeal products, as shown in the results of the congruent condition. This result is consistent with that of Tucker and Zhang (2011), who found a stronger boost effect on sales volume for narrow-appeal products than for broad-appeal products.

Furthermore, such boost effect of sales volume is observed in both inference conditions. For the quality evaluation condition, the average percentage of the narrow-appeal alternative significantly increases from 23% in the congruent condition to 51% in the incongruent condition ($t(98) = 3.03$, $SD = .092$, $p = .002$). Similarly, for the social condition, the purchase of the narrow-appeal products also increases significantly from 22% in the congruent condition to 38% in the incongruent condition ($t(98) = 1.7730$, $SD = .090$, $p = .004$).

Most importantly, comparing the magnitude of increase from the condition of congruence to incongruence, the percentage of purchasing narrow-appeal products is increased differently between the two inferences. The quality inference has a significantly higher magnitude of increase in purchasing the narrow-appeal alternative (51% – 23% = 28%) than the social inference (38% – 22% = 16%; $t(98) = 1.46$, $SD = .082$, $p = .007$). That is, a higher level of sale volume does boost the purchase of narrow-appeal products, but the boost effect is significantly stronger for participants in the quality condition than their counterparts of the social condition. That is, Hypothesis 2 is also supported by the empirical results.

5. Discussion, Conclusions, Implications, Limitations and Future Research

5.1 Discussion

Two things should be specially noted for the results of incongruence. First, with the social inference, the percentage of choosing a broad-appeal product is significantly higher than that for a narrow-appeal product (Broad-appeal (.62) > Narrow-appeal (.38); $t(1192) = 2.91$, $SD = .1682$, $p = .0037$), which is a different purchase pattern from the condition when the quality inference is dominant. Although the sales volume by celebrities of the narrow-appeal product is higher than that of the broad-appeal product, participants may still choose to believe that their tastes regarding the low-cost, ordinary food provided in the scenario are more likely to be similar to the general public in the market than the celebrities who seem to be superior. Thus, they would rather follow the tastes of general consumers in the market and purchase the broad-appeal product, disregarding the fact that the narrow-appeal product has a high sales volume among celebrities. This result illustrates that the effect of social comparison has been successfully induced, which leads to a different purchase decision from the quality inference. Second, participants' average

percentages of purchase decisions in the condition of congruence are very similar to that in the baseline (Quality: Broad-appeal (.77) vs. Narrow-appeal (.23); Social: Broad-appeal (.78) vs. Narrow-appeal (.22); Baseline: Broad-appeal (.78) vs. Narrow-appeal (.21). This suggests that the effect of popularity information and inference do not impact consumers' purchase decisions so much. However, participants' average percentages of purchase decisions in the condition of incongruence are very different from that in baseline and the patterns between the two inferences are dramatically different. This suggests that the effect of popularity information and inferences jointly influence participants' purchase decisions, which matches the central belief of this research.

5.2 Conclusions

The emergence of the Internet has fundamentally changed how sellers and consumers supply and respond to popularity information. Specifically, Internet technology has enabled e-businesses to carry a wide assortment of products, including both broad-appeal and narrow-appeal products and allows them to implement up-to-the-minute sales volume next to every product with relatively low cost and effort (Brynjolfsson et al., 2010). Moreover, due to a wide variety of product selections on the Internet, products in similar categories can be easily placed together for ease of access. This suggests that consumers may often see broad-appeal and narrow-appeal products in the same category placed together, each with their own higher or lower sales volume, which matches the conditions of congruence and incongruence described in this research. All of the above have demonstrated how the information of sales volume and breadth of appeal are linked and may jointly influence consumers' purchase decision in e-commerce. Therefore, we have intentionally developed the fundamental setting of our research to match with the unique characteristics on the Internet in order to examine the joint effect in popularity information. In addition, we have also included different inferences (quality evaluation vs. social comparison) into the research model to examine its possible moderating effect. We hope the empirical findings of this research have shed additional light in understanding the complicated effect of popularity information on the Internet and provide meaningful theoretical and managerial implications.

5.3 Theoretical Implications

Different from the traditional research on popularity information that was based solely on one inference, this research has considered two possible inferences and incorporated them with characteristics common on the Internet. The empirical findings of this research show: When breadth of appeal and sales volume are congruent, consumers have a higher tendency to purchase a broad-appeal over a narrow-appeal product. Moreover, the average percentages of purchase decisions allocated to broad-appeal and narrow-appeal choices are similar to that in the baseline, suggesting the effect of popularity is not apparent in this condition. These results match the belief in Tucker and Zhang's (2011) research that popularity information does not positively affect consumers' purchase decisions if its high sales volume is driven by its naturally wide appeal to the mainstream market.

On the other hand, when breadth of appeal and sales volume are incongruent, results with the quality inference show that the percentages of choosing a narrow-appeal product are significantly higher than those in the condition of congruence, which also matches Tucker and Zhang's (2011) belief. Yet, this research has gone beyond Tucker and Zhang's (2011) research scope by incorporating the social inference into the research model and making comparisons with the quality inference. Results with the social inference show that the percentage of purchasing a narrow-appeal product in the condition of incongruence is also significantly increased when compared to the condition of congruence. However, the magnitude of increase is not as strong as when the quality inference is dominant because some consumers choose the broad-appeal product in this condition. These different findings from different dominant inferences may clarify the mixed evidence in the literature that popularity information may boost the sales for a broad-appeal product as described in the concept of "winner-takes-all" or a narrow-appeal product as described in the concept of "long-tail" (Brynjolfsson et al., 2011; Brynjolfsson et al., 2010). Our research provides legitimate explanations for these divergent situations and allows the effect of popularity information to be more generally applied in the context of online purchases.

Finally, much research in the Marketing literature has focused on understanding how online social influences could be exerted by different roles and channels on the Internet (Bickart and Schindler, 2001; Chevalier and Mayzlin, 2006; Zhu and Zhang, 2010). Our research has furthermore made contributions in understanding how online social comparison could be exerted by celebrities and general consumers through popularity

information and how such interpretation influences consumers' purchase decisions differently from the quality inference. Future research may follow this up and continue exploring online social comparison with popularity information.

5.4 Managerial Implications

The empirical results of this research provide practical implications for e-businesses as to how they could incorporate relevant strategies using popularity information to promote products with differing breadth of appeals. First, when breadth of appeal and sales volume are congruent, e-businesses do not need to do much if intending to promote a broad-appeal product because consumers already have a higher tendency to purchase a broad-appeal over a narrow-appeal product. Releasing popularity information in this condition does not seem to exert a strong influence.

Second, when breadth of appeal and sales volume are incongruent, the effect of popularity information becomes apparent and e-businesses' strategies should be aligned with the effect. If intending to promote a broad-appeal product, e-business should provide cues to stimulate consumers' social inference. Many methods may be used to induce the social inference. For example, celebrity endorsements have long been used as an effective tactic to induce consumers' social comparison because celebrities serve as an effective attention-getter and reference group identifier (Lockwood and Kunda, 1997; Wei and Lu, 2013). Besides, e-businesses could strategically supply social-related information, such as number one sales on the Internet or most wanted product by celebrities and etc., on the website or actively deliver this kind of information to potential consumers through emails. Moreover, e-businesses can emphasize the large breadth of appeal of the broad-appeal product with the intention to stimulate consumers' interests to treat the large breadth of appeal as their reference group and follow that group's purchase decisions. By doing so, consumers hopefully would pay less attention to the higher sales volume of the narrow-appeal product but focus more on the large breadth of appeal of the broad-appeal product.

On the other hand, if intending to promote a narrow-appeal product, e-businesses may prepare consumers either with the quality or social inference. Our empirical results show that both inferences may significantly boost the sales for the narrow-appeal product in comparison to the condition of congruence, yet the quality inference may exert a stronger impact than the social comparison. Thus, e-businesses may consider prioritizing the quality inference to receive a better effect from promoting a narrow-appeal product. In order to induce the quality inference as a primary inference, e-businesses could invite

opinion leaders to share the functional specifications of the product either through a store event or through blogs. In addition, e-businesses may emphasize the high sales volume of the narrow-appeal product to stimulate consumers' inference of high quality. With the right kind of inference in mind and the right strategies aligned, the effect of popularity information may be maximized and consumers' purchase intentions may be affected as intended.

5.5 Limitations

This research contains some limitations that warrant future research. First, the methodology chosen for this study is a laboratory experiment, which is often criticized on its external validity. Thus, caution needs to be taken when generalizing findings. Future research could re-validate the findings in a real shopping website or through a field study. Second, although previous studies have reported that product type may impact consumers' purchase behavior, we do not treat the product type as a contingent factor in this research because it is not within the scope of this research. Based on the recommendations provided by Lynch (1982), conducting an experiment with homogenous product type would allow researchers to focus their observations on the main causal relationship. Therefore, we intentionally kept the product type in the experiment homogenous to food-related products only. In order to minimize the impact of product type, all the selected products are low-cost and could be frequently consumed by different levels of consumers. Nevertheless, we still did not eliminate the possibilities that product type in some conditions may become a contingent factor that influences the dependent variable or its homogeneity may affect the internal validity of the experiment. Due to those conditions, additional studies expanding to different product categories would be helpful.

Third, the selections between two breadths of appeal are geared toward the taste of the Taiwanese/Chinese audiences, which may be different from audiences in other countries. For example, a cinnamon-flavored cookie is considered as a narrow-appeal product in the Taiwan market whereas it could be considered as a broad-appeal product in America because of its wide availability. Future research could consider selecting broad-appeal and narrow-appeal products that are more generalized to avoid the limitation of localization. Forth, although the sales volume we assigned to each pair of product is based on the principles used in the prior research (Tucker and Zhang, 2011), the volume (e.g., 64) is relatively small in many conditions in e-commerce. Future research could consider exploring different levels of sales volume with different products and examining whether

the effect of popularity information is consistent. Finally, the student population in this research is relatively high (48%). This leads to the result that the age distribution in this research is significantly lower compared to other research. However, responses were voluntary, thus, inevitably subject to self-selection biases. An additional K-S test was performed to examine the collected responses between the students and non-students, and the result showed no significance. Furthermore, students and young people are known as a major population for online purchases (Dai, Forsythe, and Kwon, 2014). Thus, it is legitimate to assume that there may be more student respondents to our online survey than of other age groups. Much research even aims to examine the student sample when conducting Internet-related studies (Kuo and Wu, 2012; Lin and Lekhawipat, 2014; Yeh and Li, 2014). This leads us to believe that our sample in this experiment is appropriate and reflects the characteristics of the target Internet users. An additional K-S test was performed to examine the collected responses between the students and non-students and the result shows no significant difference. Nevertheless, we still do not rule out the possibility that subjects' ages may sometimes exert influence on consumers' online purchase behavior. Therefore, generalization of our research, especially to older people, may have limitations. Future research conducted with different age groups is strongly recommended.

5.6 Future Research

There are many interesting future directions that could be derived from this research. For example, our research has mentioned that social comparison may be a possible drive to exert the social inference. Different kinds of social comparison may be triggered when consumers compare with someone similar (e.g., other consumers) or someone better (e.g., experts and celebrities) for different motivations. Future research could focus even more on this area and explore social comparison with different directions (e.g., someone similar, better-off, and worse-off) and different motivations (e.g., self-evaluation and self-enhancement). Another interesting direction would be to examine consumers' emotions when different kinds of inferences are induced. Particularly for the social inference, past literature has indicated that consumers perceive stronger happiness and disappointment when social inference (particularly when the effect of social comparison) is induced (Ackerman, MacInnis, and Folkes, 2000; Hoch and Loewenstein, 1991; Wu and Lee, 2008a, 2008b). Consistent with this prediction, the results of our manipulation check show that participants with the social inference feel marginally more disappointed when the

product is not purchased in comparison to the participants with the quality inference. Further study could investigate this in more depth by specifically assessing consumers' psychological states (e.g., happiness and disappointment levels that consumers perceive when the purchase is made or not made) with different inferences induced from popularity information.

Moreover, the key scope of this research is to examine how consumers may interpret popularity information when different kinds of inferences are induced. This suggests that the focus of this research is to inspect the characteristic of human conformity rather than uniqueness, although both aptitudes are part of human nature. Future research could perform an aptitude test to understand participants' level of conformity and focus attention on observing participants who obtain a high score of conformity. Finally, some other possible research avenues are to explore whether popularity information can be moderated by other marketing variables, such as brand name, price, or gender-specific products.

Appendix A: Sample Questions and Scenario for Quality Condition and Social Condition

Question: See below for two choices of cookies with similar price.

Scenario for Quality Condition

Imagine you have the need to purchase 2 snacks and 1 drink online. You discover the shopping website that you intend to shop on have reported the result of a purchase behavior survey they recently conducted. The survey targets various types of food connoisseurs, including chefs, food blog experts, professional food critics, etc. One common characteristic they share is that they are all highly sensitive to taste and have high standards regarding food quality. This makes everyone curious to find out what types of food people like them consume in private. Let's go check it out!

Congruent Condition

Chocolate-flavored cookies: The survey results show 64 food connoisseurs have purchased this product.

Cinnamon-flavored cookies: The survey results show 10 food connoisseurs have purchased this product.

If you have to choose one from these two to make a purchase, which one would you choose?

1) Chocolate-flavored cookies: purchased by 64 food connoisseurs.
2) Cinnamon-flavored cookies: purchased by 10 food connoisseurs. Incongruent Condition

Chocolate-flavored cookies: The survey results show 10 food connoisseurs have purchased this product.

Cinnamon-flavored cookies: The survey results show 64 food connoisseurs have purchased this product.

If you have to choose one from these two to make a purchase, which one would you choose?

1) Chocolate-flavored cookies: purchased by 10 food connoisseurs.
2) Cinnamon-flavored cookies: purchased by 64 food connoisseurs.

Scenario for Social Condition

Imagine you have the need to purchase 2 snacks and 1 drink online. You discover the shopping website that you intend to shop on have reported the result of a purchase behavior survey they recently conducted. The survey targets celebrities from various fields, including films/shows business, politics, gymnastics etc. One common characteristic they share is that they are all widely recognized and highly popular. This makes everyone curious to find out what type of food people like them consume in private. Let's go check it out!

Congruent Condition
Chocolate-flavored flavored cookies: The survey results show 64 celebrities have purchased this product.
Cinnamon-flavored cookies: The survey results show 10 celebrities have purchased this product.

If you have to choose one from these two to make a purchase, which one would you choose?
1) Chocolate-flavored cookies: purchased by 64 celebrities.
2) Cinnamon-flavored cookies: purchased by 10 celebrities.

Incongruent Condition
Chocolate-flavored cookies: The survey results show 10 celebrities have purchased this product. Cinnamon-flavored cookies: The survey results show 64 celebrities have purchased this product.

If you have to choose one from these two to make a purchase, which one would you choose?
1) Chocolate-flavored cookies: purchased by 10 celebrities.
2) Cinnamon-flavored cookies: purchased by 64 celebrities.

Appendix B: Questions for Manipulation Check

1. Please recall the condition while you were making a purchase decision just now. What level of impact did "Sales Volume" impact your purchase decision? (Note: Please reflect on the purchase decision you made just now during the experiment, not the general decision you regularly make)

Please fill in the level of impact you perceive:

Absolutely Not Affected	Not Affected	Somewhat Not Affected	Somewhat Affected	Quite Affected	Strongly Affected

2. Please recall the condition while you were making a purchase decision just now. What level of impact did "Product Quality" impact your purchase decision? (Note: Please reflect on the purchase decision you made just now during the experiment not the general decision you regularly make)

Please fill in the level of impact you perceive:

Absolutely Not Affected	Not Affected	Somewhat Not Affected	Somewhat Affected	Quite Affected	Strongly Affected

3. Please recall the condition while you were making a purchase decision just now. If the product you intended to purchase was out of stock and it could not be purchased either on other websites or in physical stores, do you think you would feel disappointed for not being able to make the purchase?

Please fill in the level of disappointment you perceive:

Absolutely Not Disappointed	Not Disappointed	Somewhat Not Disappointed	Somewhat Disappointed	Quite Disappointed	Strongly Disappointed

Appendix C: Demographic Information and Online Purchase Experience of Sampled Population

Item	Frequency	Percentage
Gender		
Male	88	44
Female	112	56
Age		
12-19	62	31
20-29	85	42.5
30-39	43	21.5
40-49	5	2.5
50-59	5	2.5
Occupation		
Student	96	48
Non-Student	104	52
Sample Size	200	

Appendix D: A Sample Page of the Experiment on the Website (Quality Inference in Incongruent Condition)


請試想您今天有需要上網購買兩種點心與一種飲品，您發現您所在的購物網上有公布他們對美食鑑賞家所進行的購物行為調查結果。他們調查的對象包羅萬象，包含主廚、部落格美食達人，專職美食評論家，等等。都是具有敏銳味覺，並且對吃非常有研究的人，所以大家會特別好奇像他們這種對吃極為考究的人，自己私下到底會買甚麼樣的食品呢？趕快來看看吧！

1. *

您要採購的第一項商品，是甜口味的點心。您發現以下兩種價格相仿的餅乾，。

a.【巧克力(Chocolate)餅乾】： 購物調查結果顯示，有 10 位美食鑑賞家曾經購買過這個產品。

b.【肉桂(Cinnamon)餅乾】： 購物查結果顯示，有 64 位美食鑑賞家曾經購買過這個產品。

如果您要從中選一，請問您會想要購買哪一種呢？

◎ 【巧克力(Chocolate)餅乾】: 10 位美食鑑賞家曾經購買 ◎ 【肉桂(Cinnamon)餅乾】: 64 位美食鑑賞家曾經購買

Next →

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