

# An Empirical Study for Revealing Online Shoppers' Behavioral Reactions to Latent Pricing Mistakes

Shueh-Cheng Hu and I-Ching Chen

**Abstract**—Online merchants mistakenly tag ultra-low prices on their products or services from time to time. It is difficult to completely avoid such kind of mistakes that usually result in monetary loss and other negative consequences. Fortunately, pricing mistakes in online stores could be revealed through tracking shoppers' abnormal reactions. Thus, in order to disclose latent pricing mistakes within their storefronts, online merchants must learn how shoppers respond to these pricing mistakes. Due to the significance of the issue and the lack of corresponding resolutions, the present work conducted an empirical investigation of online shoppers' behavioural responses when they encounter ultra-low price tags. The research findings not just profile how general online shoppers would respond under the particular circumstance, the implications also induce a set of data indicators that can practically aid online merchants in disclosing those adverse mistakes promptly.

**Index Terms**—online merchant, pricing mistake, price sensitivity, shopper's behavior.

## I. INTRODUCTION

Due to convenience, competitive prices, and many other merits, more and more consumers purchase billions of dollars worth of products and service each year online. Accordingly, B2C electronic commerce is growing by leaps and bounds, even in the recession. Not only enjoying faster growth, comparing to conventional commerce channels, Internet commerce has more potential for future growth. In view of the advantages, many enterprises and individuals jump on the wagon to invest or develop electronic commerce related business, and many people operate online merchants.

Just like managing a conventional store, managing an online store will face many similar kinds of risks. However, online merchants need to face a risk that is specific to online stores: pricing mistakes. It is very difficult to define one common range of pricing mistakes for different products and services, because there are many factors affecting pricing strategies of various products and services, such as costs, tax rates, promotion budgets, and so on. In this article, pricing mistakes refer to the prices that are much lower than their corresponding reference prices [1] from consumers'

perspective, and thus most consumers tend to believe that these prices are mistakenly tagged by sellers.

Tagging ultra-low prices mistakenly brings online merchants to a dilemma: absorbing financial loss; i.e. honouring the mistakenly priced goods/services, or facing relentless blame from customers and even penalty from government. The former response usually will bring significant financial loss, especially to those merchants selling high-priced items such as computers and travel packages. To avoid financial loss, the cost of taking the latter approach might be ruined customer loyalty, impaired reputation, and tarnished brand image because some disappointed and indignant customers will broadcast negative and even biased opinions online.

Doubtlessly, every online merchants hope that they can fully avoid the troublesome issues associated with pricing mistakes. Unfortunately, many pricing mistakes including that one found in the Venetian hotel were caused by pure carelessness [2], which has never been and unlikely would be completely avoided in imperfect human societies and organizations. Many other pricing mistakes were attributed to defective information systems, just like the ones found at the Apple and Dell's online stores. However, faulty computer programs and data errors still stemmed from human's faults, and that is why many corresponding mistakes including some fatal airline accidents still could be found in today's highly digitized societies. In addition, the application of elegant online pricing mechanisms [3] very likely to exacerbate the above situations due to their sophistication and complexity.

When it is impractical to completely avoid pricing mistakes, a rational alternative for online merchants is to develop a mechanism for detecting pricing mistakes and taking prompt actions to constrain the consequential loss. Fortunately, although online pricing mistakes are difficult to avoid completely, it is easier to disclose them through their symptoms because shoppers' behaviors within online storefronts could be efficiently collected and analyzed by merchants' information systems. In other words, shoppers' abnormal responses likely to indicate the existence of latent pricing mistakes and thus are worthy to receive more attention.

Since the significance of the issue and there was rare relevant research, the present work conducted a comprehensive investigation of shoppers' reactions to pricing mistakes at online stores. The investigation aimed to profile general online shoppers' responses and accordingly to develop a set of data indicators, which can reveal latent pricing mistakes at online storefronts and thus can help merchants in protecting themselves proactively.

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## II. PRIOR RESEARCH

Generally speaking, customers are very sensitive to the difference between actual selling price of a particular item and its reference price [1, 4]. The difference is perceived as a gain when selling price is lower than the corresponding reference price by customers. Consequently, many marketing strategies focus on marking down prices to attract more purchasers and generate higher revenue. Mazumdar, Raj, and Sinha conducted a thorough survey regarding research of reference price, including how reference prices are formed, how reference prices are retrieved and used, and their effects on purchasing intention and behavior [5].

The study by Han, Gupta, and Lehmann indicated that when a product's price was lowered down marginally, customers' reaction will not be significant [1]. By contrast, while the price of a specific product or service is lowered below a particular threshold, customers will respond much more actively. In his article that explore the difference between two price discount strategies, Teng provided a comprehensive review of research investigating the impact of price discount on shoppers' perceived value and purchase intentions [6].

Besides, the prospect theory that was presented by Kahneman & Tversky also pointed that the economic appeal of a discount monotonically increases as a function of its size [7]. The prospect theory also was verified by the study exploring the relationship between promotion activities and purchase acceleration phenomenon [8], which stated that discounted prices can propel consumers to take quicker purchase actions than they used to.

Even with different goals, methods, or perceptions, many prior theoretical and empirical research point one common fact: price discount will intensify shoppers' purchase intention, which in turn will drive shoppers to purchase faster and more. By contrast, there is rare study investigating how shoppers will respond in terms of particular behavioral aspect while they encounter amazing discount.

## III. EMPIRICAL RESEARCH

The present research aimed to obtain a comprehensive understanding of shoppers' behavioral reactions when they encounter pricing mistakes in online stores through conducting an empirical study.

### A. Participants

The subjects of the survey were, in part, recruited from undergraduate students with majors in "International Business", while they were taking a mandatory course: "Electronic Commerce". Furthermore, to broaden the sampling population, friends and family members of the recruited students were also invited. 257 of the 313 participants completed the survey effectively. Among the 257 effective respondents, 52 persons, accounted for 20 percent of all effective respondents, expressed that they had no experience of online shopping. However, their response to the survey still were taken into account while conducting the subsequent questionnaire and data analysis. That is because people without online shopping experience at that time still will likely to encounter online pricing mistakes in the future

and take consequent actions

### B. Measurement Instruments and Procedure

The goal of the survey is collecting consensual opinions on which behavioral aspects are the best representatives so that they can generally reflect how shoppers respond to pricing mistakes in online stores. On the basis of this goal, the measure called Modified Borda Count (MBC) [9] was applied accordingly. Generally speaking, the Borda system and its variations aim to pick broadly acceptable candidates, thus are classified as consensus-based positional voting systems because each rank on the ballot is worth a certain number of points. After a thorough mathematical comparison between the Borda count, plurality voting, and negative voting, Apesteguia et al. found the natural link between utilitarianism and the Borda count [10]. This important finding justifies the applicability of the MBC in many contexts where seeking the commonest consciousness (or greatest interests) of the greatest number of participants is the goal. Practically, Borda count and its variations have been successfully adopted in elections of various domains including political [11], resource allocation decision [12], sports and entertainment [13], and others.

Before conducting the survey, an introduction to the 3-phased purchasing model was presented through a graphical illustration and its supplementary textual description, as shown in Fig 1. The 3-phased model helps survey participants to easily delimit phases during a whole course of encountering and responding pricing mistakes. As a result, subjects could answer all questions without misconception nor obscureness. In the model, the pre-purchase phase starts from knowing a message about a huge-discounted product or service item. The in-purchase phase begins when a shopper starts to put items in focus to shopping cart. The post-purchase phase starts when the shopper finished a transaction and obtained an order number, and it ends while the involved online merchant officially announces their resolution of the pricing mistake.

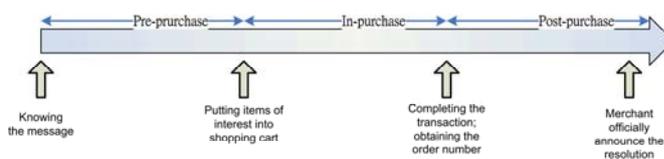


Fig. 1. The 3-phase purchasing model.

In each phase of the purchasing model, participants collectively pick the most 10 representative behavioral aspects, respectively. After checking all candidates, each participant picked the most representative traits and aspects by ranking each candidate from 1 to  $m$ ,  $m$  is less than or equal to the number of all candidates. According to the rules of the MBC, each candidate then receives points for their ranking in reverse order: the first ranked candidate earns  $m$  points, the second ranked one earns  $m-1$  points, and so forth. The last ranked one earns 1 point. All other unranked options earns zero point. After voting, the earned points are then added up and the candidate earning the highest points is then ranked as the most representative one, the second highest is ranked as number two, and so forth. There are total 3 ranking questions in the survey to ask participants to identify the most

representative behavioral reactions in pre-, in-, and post-purchase phase, respectively.

C. The Most Representative Aspects

To make the further analysis and development more concise and practical, it is necessary to pick the most significant traits and aspects while prune others based upon commonness. Table. I summarizes the MBC points earned by individual behavioral aspects in each phase and the ratios of the individual earned points to the total points earned by all items in the same phase.

According to the Pareto principle [14] and power analysis, the most significant behavioral aspects in each phase were identified. Table II, III, and IV show the power analysis results of behavioral aspects in the pre-, in-, and post-purchase phase, respectively. The Pareto principle, also known as the 80/20 rule, and the power analysis aim to identify the most significant components from all

constituents [15], the most significant components refer to the most representative ones in the context of this research. The Pareto principle has been successfully applied not only in general resource allocation issues [16], but also in formal research methodology such as the interactive qualitative analysis (IQA) to capture consensual opinions from a focus group [17].

The most significant behavioral aspects identified via power analysis should be good signs of latent pricing mistakes, such as the "contact friends to reconfirm the message", "broadcast the message", "discuss the event with friends", and "allocate space". However, if these behavioral aspects could not be traced by online merchants' information systems, they would not be valuable to online merchants. In consequence, these aspects still were pruned off since they are not traceable.

TABLE I: THE MOST REPRESENTATIVE BEHAVIORAL ASPECTS

pre-purchase		in-purchase		post-purchase	
behavioral aspects	MBC points earned (%)	behavioral aspects	MBC points earned (%)	behavioral aspects	MBC points earned (%)
register asap for qualification	439 (17.43)	buy the particular product only	430 (19.25)	repetitively check the order's status	437 (17.90)
repetitively check the product info on Web	428 (16.99)	buy the particular product excessively	389 (17.41)	discuss the event with friends	421 (17.24)
take action (buy) immediately	419 (16.63)	complete the transaction asap	359 (16.07)	repetitively check the merchant's announcement	406 (16.63)
contact friends to reconfirm the message	291 (11.55)	repetitively check the product's availability	237 (10.61)	allocate space	267 (10.93)
broadcast the message	230 (9.13)	contact friends to reconfirm the message	221 (9.89)	cancel the order	205 (8.39)
check account balance	180 (7.15)	hesitate to place the order	155 (6.94)	contact friends to reconfirm the message	191 (7.82)
remind the merchant to correct	178 (7.07)	call for participation	141 (6.31)	read relevant news on media	176 (7.21)
call for participation	173 (6.87)	remind the merchant to correct	139 (6.22)	arrange the shipping	157 (6.43)
sleeplessness	162 (6.43)	check account balance	132 (5.91)	contact the merchant to confirm the order	156 (6.39)
others	19 (0.75)	others	31 (1.39)	others	26 (1.06)

TABLE II: PRE-PURCHASE PHASE BEHAVIORAL ASPECTS IN DESCENDING ORDER OF EARNED POINTS WITH PARETO AND POWER ANALYSIS

	behavioural aspects during pre-purchase	MBC points earned (descending)	cumulative points	cumulative percentage (aspects)	cumulative percentage (points)	power
B1	register asap for qualification	439	439	10	17.43	7.43
B2	repetitively check the product info on Web	428	867	20	34.42	14.42
B3	take action (buy) immediately	419	1286	30	51.05	21.05
B4	contact friends to reconfirm the message	291	1577	40	62.6	22.6
B5	broadcast the message	230	1807	50	71.73	21.73
B6	check account balance	180	1987	60	78.88	18.88
B7	remind the merchant to correct	178	2165	70	85.95	15.95
B8	call for participation	173	2338	80	94.82	14.82
B9	sleeplessness	162	2500	90	99.99	9.99
B10	others	19	2519	100	100	0

TABLE III: IN-PURCHASE PHASE BEHAVIORAL ASPECTS IN DESCENDING ORDER OF EARNED POINTS WITH PARETO AND POWER ANALYSIS

behavioral aspects during in-purchase	MBC points earned (descending)	cumulative points	cumulative percentage (aspects)	cumulative percentage (points)	power
B1 buy the particular product only	430	430	10	19.25	9.25
B2 buy the particular product excessively	389	819	20	36.66	16.66
B3 complete the transaction asap	359	1178	30	52.73	22.73
B4 repetitively check the product's availability	237	1415	40	63.34	23.34
B5 contact friends to reconfirm the message	221	1636	50	73.23	23.23
B6 hesitate to place the order	155	1791	60	80.17	20.17
B7 call for participation	141	1932	70	86.48	16.48
B8 remind the merchant to correct	139	2071	80	92.7	12.7
B9 check account balance	132	2203	90	98.61	8.61
B10 others	31	2234	100	100	0

TABLE IV: POST-PURCHASE PHASE BEHAVIORAL ASPECTS IN DESCENDING ORDER OF EARNED POINTS WITH PARETO AND POWER ANALYSIS

behavioral aspects during post-purchase	MBC points earned (descending)	cumulative points	cumulative percentage (traits)	cumulative percentage (points)	power
B1 repetitively check the order's status	437	437	10	17.9	7.9
B2 discuss the event with friends	421	858	20	35.14	15.14
B3 repetitively check the merchant's announcement	406	1264	30	51.77	21.77
B4 allocate space	267	1531	40	62.7	22.7
B5 cancel the order	205	1736	50	71.09	21.09
B6 contact friends to reconfirm the message	191	1927	60	78.91	18.91
B7 read relevant news on media	176	2103	70	86.12	16.12
B8 arrange the shipping	157	2260	80	92.55	12.55
B9 contact the merchant to confirm the order	156	2416	90	98.94	8.94
B10 others	26	2442	100	100	0

IV. DATA INDICATORS FOR REVEALING SHOPPERS' ABNORMAL BEHAVIORAL REACTIONS

To online merchants, unusual but emphatic responses from shoppers implies that something significant but deviate from normal cases did occur. Unlike psychological traits (feelings) that are not observable through information systems, the respondents' most intensive behavioral reactions in the 3 phases can further induce a number of key data indicators that aid online merchants in disclosing latent pricing mistakes. The induced indicators in each phase and the corresponding rationales are described as follows.

A. Pre-purchase

(1) Access rate (access frequency per unit time) of an item's information: once people encountered or were informed that there is a magnificent-discounted item in a particular online merchant, their first feeling usually is "it is too wonderful to believe", and later they will feel curious about whether the good message is true or not, and how big exactly the discount is. The excitation and curiosity will drive them to intensively dig further details about the particular item, and this kind of information seeking activities often will repeat more times than usual until they confirm what they saw or heard is true or false. Consequently, if the access rate of a particular item's information soar above its prior average without any

promotion or media exposure, the online merchant need to pay more attention to this phenomenon due to the high likelihood of irrationally low pricing.

(2) Time between entering store and filling shopping cart : Those who knew the message of pricing mistakes tend to put all attention directly on the particular item at that moment, which is different from the decision pattern in regular purchasing processes [18]: shoppers tend to look around product menus, then study and compare acceptable alternatives, and finally choose the fittest one among several candidates. Besides, under normal circumstances, most online shoppers tend to be more cautious with their purchasing activities, especially when they are looking for high-priced products or services, such as computers, consumer electronics, airline tickets, travel packages, and so on. This phenomenon could be well explained by the perceived risk of shoppers [19]. However, people who found an ultra-low priced item likely to show none perceived risk toward the pricing fitness of that particular item, which results in eagerness for owning it. The mentioned eagerness will drive online shoppers to take quick purchasing actions. Thus, if online merchants find there are many customers who start to put particular items into shopping cart right after their entrance to the online store, merchant staff had better to further check the following indicator.

(3) Commonness of items purchased by quick shoppers: when many shoppers thronged to an online store and quickly

pick products or services, as the above indicator can tell, if merchant staff find their purchase interests are common, they had better to reconfirm that these fascinating items are on sale indeed.

### B. In-purchase

(1) Average number of particular items in placed orders: under normal circumstance, shoppers purchase adequate amount of product or service because they eventually need to pay for what they purchased and they do not want to waste or a financial burnout. For example, it is rare to see a household consumer bought ten or more TV sets in one single order. However, when the selling price of an item drop much lower than its reference price, the scenario might be totally different: many customers bought much more than they actually need whenever they encountered an ultra-low priced product or service. The reasons behind this avarice is quadric-folded: the low selling price makes the same shopper's purchasing power much stronger than they used to be, this is in accordance with the findings of a study that investigated the relationships between consumers' perceptions of affordability and their actual purchase [20]. Second, over-purchased items can be easily handled through various ways, such as re-selling them via online auctions. Third, some shoppers tend to fully take advantage of the rarely happened discount, this phenomenon is in line with the prior research findings [21]. Besides, in many shoppers' opinion, this kind of mistakes and their consequent loss should be completely attributed to merchants, rather than shoppers.

These reasons could well explain why there were so many shoppers did not feel immoral or even embarrassed to "buy" tens of thousands of product vouchers which were mistakenly tagged as zero by the HOLA, a leading home ornament and furniture chain store in Taiwan [22]. The lesson that online merchants need to learn from this relentless consequence is that tracking average numbers of particular items in all orders is essential, so that the management information systems are able to issue alerts when there are many customers who place orders containing much more particular items than its average in prior orders.

(2) Average number of items in all placed orders: regarding the aspect of "purchasing the particular product only". The reason behind the this come from shoppers' eagerness to complete the transactions linked with pricing mistakes before merchants making corrections. The eagerness will drive shoppers to focus on and purchase items of greatest interest only, rather than spending more time to look around storefronts, which will lead to purchase of other items. Consequently, when online merchants find there are fewer items in placed orders during the past hours than its long-term counterpart, they had better to check the price tags of these single-minded shoppers' concentrated items.

### C. Post-purchase

(1) Average access rate (access frequency per unit time) of placed orders: according to the past experience, merchants probably will not honor the orders involved in pricing mistakes. Thus, once shoppers obtained the sequence numbers of orders containing ultra-low priced

items, the most obvious psychological trait is anxiety, which will make shoppers frequently go back to the involved merchant's Web site and check the order status and the latest updated information to see if there is any official announcement regarding the resolutions. This phenomenon implies that it is worthy to track average access rate of placed orders, so that a pricing mistake alarming mechanism is able to issue corresponding alert when there are many customers intensively check their in-process orders. To confirm the existence of pricing mistakes, merchant staff need to further check the following indicator.

(2) Commonness of items in intensively checked orders: when many shoppers collectively feel anxiety, as the above indicator can tell, if their anxiety originate from common items, it is necessary to make sure these desirable items are indeed high profiled or promoted, instead of being tagged mistakenly.

## V. CONCLUSION

To devise strategies and mechanisms that can effectively cope with possible online pricing mistakes, online merchants must get a comprehensive understanding of abnormal behavioral reactions of shoppers when they encounter pricing mistakes. This paper presents an empirical research investigating how online shoppers' respond to ultra-low prices.

The value of the present work is identifying the most common behavioral aspects of online shoppers when they encountering ultra-low prices. These aspects could be tracked and analyzed by e-commerce information systems, and thus can reveal latent pricing mistakes at online storefronts. When online merchants can promptly detect mistakenly tagged prices by tracking key data indicators that reveal shoppers' behavior of interest, online merchants will have better chance to reduce the consequential damage.

Factors in different facets including cultural, social, and educational collectively shape people's value, which in turn guide or restrain their behaviors including in contexts of online shopping. Therefore, the same method used in this study might generate different outcomes in different contexts. Thus, one worthy extended work will be the comparison between behaviors of shoppers in different nations/regions. The findings should be valuable to cross-nation and global online merchants, so that effective mechanisms for coping with pricing mistakes in different areas could be developed accordingly.

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