The Effect of Price Dispersion and Price Volatility in an e-Market on Consumers' Intentions to Join Group Buying

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Abstract

Based on the economics theory of information and the transaction utility theory, this paper investigates whether the market price dispersion and price volatility affect a consumer's intention to join group-buying transactions using the transaction utility, which compares the consumer's internal reference price and the predicted final price of group buying. The experimental data indicate that price volatility has no influence on consumers' behavior. However, it shows that consumers consistently perceive a higher internal reference price as well as a higher predicted final price of group buying in a market with narrow price dispersion. Consumers also perceive a higher transaction utility in a market with narrow price dispersion, except in the best case. Furthermore, the transaction utility in the most-probable case is the highest irrespective of the price dispersion. This is consistent with the transaction utility in the most probable case being most strongly correlated with the intention to join group buying. Overall, consumers exhibit a higher intention to join group buying in a market with narrow price dispersion, and our results also show that the percentage of subjects joining group buying is much higher in a market with narrow price dispersion than in one with wide price dispersion.

Keywords: Price dispersion, price volatility, online group buying, transaction utility, reference price

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電子市集價格分布與價格波動對消費者加入集體購物意願之影響

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摘要

本研究以訊息經濟學與交易效用理論為基礎，藉由比較消費者內部參考價格與預期價格的差異，探討市場價格分布與價格波動如何影響消費者加入集體購物的意圖。實驗結果顯示市場價格波動對於消費者的行為沒有顯著影響，而在價格分布較窄的市場中，消費者感受到較高的內部參考價格以及預期最終價格。除了最佳情況價格外，消費者在價格分布較窄的市場中同時也擁有較高的交易效用。進一步來說，無論市場價格如何分布，消費者在最有可能價格的組別中擁有最高的交易效用；迴歸分析結果亦顯示消費者在最有可能價格的組別中，其加入團購的意圖最高。整體來說，消費者在價格分布較窄的市場中加入團購的意圖最高，實際加入的比例亦高於市場價格分布較寬的情況。

關鍵詞：價格分布、價格波動、線上集體購物、交易效用、參考價格

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1. Introduction

Many innovative and interesting business models have emerged in recent years with the advent of electronic commerce, one of which is the online group-buying model. Group buying (also referred to as group shopping, customer/buyer coalition, collective bargaining) is a mechanism allowing consumers to take advantage of volume discounts by shopping together and has been a standard business practice for a long time. In group buying, the volume is usually accumulated from the orders of multiple buyers rather than from a large order of a single buyer. It is also viewed as a type of dynamic pricing mechanism or a means to create economies of scale for suppliers, and bring financial incentives (i.e., volume discounts) to consumers (Kauffman and Wang 2001; Tsvetovat et al. 2000). The almost unlimited communication and coordination specialties of the Internet increase the potential of the group-buying model in an electronic market (e-market) by allowing more buyers to be recruited. Mercata and Accompany (later changed to Mobshop) pioneered online group-buying in 1998 (Kauffman and Wang 2001). Unfortunately, these pioneers failed later. However, it is surprising that group-buying businesses have been trying to make a comeback recently and have great successes. Groupon (www.groupon.com) in the United States and iHergo (www.ihergo.com.tw) are good examples.

The most popular group-buying model currently on the Internet involves a price curve, in which the price decreases as the volume increases to different tiers (Kauffman and Wang 2001). For some websites, joining group buying entails promising to purchase at the present price or at a lower price if the final volume reaches a lower price tier. An alternative is to allow a buyer to set a reserve price when joining group buying, where the buyer does not have to purchase unless the final price is lower than the reserve price. This allows consumers to base their decision to participate on an evaluation of the price they are willing to pay and the final price of group buying (Chen et al. 2009; Li et al. 2010). However, since the final price is uncertain in group buying until the last moment, buyers will usually compare the price they are willing to pay with the predicted final price of group buying. In a word, while consumers are able to enjoy volume discount in group buying, they also face price uncertainty that would influence their decision to purchase from group buying. In addition, consumer's intention to join group buying may also be influenced by other price information in the marketplace as the consumer might be price sensitive due to the online price dispersion (Pan et al.

2004).

Kauffman and Wang (2002) pointed out that online group-buying websites usually face the competition from other online merchants. The fierceness of online price competition results in many companies using low prices as the strategy to attract consumers. The product prices may change rapidly or dramatically as a result. Facing different price competition on the market, what should the price curve be? Generally, unless group-buying websites lower the price in order to reach the threshold of transaction gains and losses, it is difficult to attract buyers (Han et al. 2001). In addition, it is getting easier for consumers to search and compare prices on the Internet despite being exposed to an increasingly huge amount of product and price information. How does such price information affect consumers' intentions to join group-buying transactions?

There is considerable evidence that the shopping intention is affected by external price information (Biswas and Blair 1991; Grewal et al. 1998; Urbany et al. 1988). Urbany, Bearden and Weilbaker (1988) suggested a process model of reference price effects that assumes that when consumers are exposed to an external reference price, such as an advertised reference price, they judge its believability with their own initial price expectation (i.e., the internal reference price). If this comparison is perceived as a positive transaction utility, it increases the likelihood of a purchase (Thaler 1985). Furthermore, Pan, Patchford and Shankar (2004) reviewed the empirical and analytical literature on online price dispersion, which is variation in prices across sellers of the same item, and concluded that price dispersion is larger on the Internet and consumers usually expect to find inexpensive stores when they face a market with wider price dispersion. According to the economics theory of information proposed by Stigler in 1961, consumers' expected savings from a given search are also positively correlated with the price dispersion (Stigler 1961; Urbany 1986). In addition, Han, Gupta and Lehmann (2001) found that consumers build their internal reference price based on the history of product price. Hence, many financial studies have proven that the price volatility, which is a measure of fluctuation in observed prices over a time period (Benini et al. 2002), will increase the range of price acceptable to consumers (Winer 1986; Dickson and Sawyer 1990).

Since a group-buying transaction involves time delay and uncertainty before the final price is realized (Anand and Aron 2003), it is great interest to determine the relationship among the performance of group buying, price dispersion, and price volatility. In fact, there are many websites which allow the consumers to compare the

prices when searching product/services. These examples include airline ticket, hotel, car rental, etc. In other words, they provide search results ranked by price. The range of listed prices of search result indicated the price dispersion. Researchers indicated that price dispersion will impact the internal reference price and thus the transaction utility (Bailey 1998; Brynjolfsson and Smith 2000; Pan et al. 2004). Now, we even can find websites who collecte all group-buying activities from all kinds of group-buying websites. For example, GoodLife (buy.goodlife.tw) collects all half-price or even cheaper group-buying businesses from more than 20 group-buying websites. You can search the products by category, which may impact the internal reference prices even the products are not exactly same.

Based on the above discussion, this paper will explore following research questions: First, how do market price dispersion and price volatility affect the consumers' internal reference prices and their prediction about the final price of group-buying transactions? Second, given that the final price of group buying is uncertain before the end and that there are several types of internal reference price, how do consumers evaluate their transaction utility (gains or losses) of joining group buying? How do price dispersion and price volatility of a market affect the consumers' perceived transaction utilities? Finally, how do consumers' transaction utilities affect their intentions to join group buying?

We first review the related literature, and then propose the conceptual model and present the hypotheses. Based on the research model and hypotheses, an online experiment is designed, and the hypotheses are examined using data analysis. Finally, we conclude our findings and propose several future research areas.

2. Price concern of buyers in group buying

No matter consumers buy products online or offline, price is always a critical factor in their decision making. Kauffman and Wang (2001) pointed out that participants of group buying are even more price sensitive.

From the viewpoint of group-buying market microstructure, Kauffman and Wang (2001) observed that there are four important factors that affect the behaviors of buyers: positive participation externality, price, price level, and cycle ending. The first aspect of consumer behavior is the group-buying mentality. This indicates that the current number of orders will have a positive influence on the purchasing decision of a potential buyer. When there are more buyers joining the group buying, its attraction to potential

buyers will be larger. Similar to the idea of Kauffman and Wang (2001), Lerman and Shehory (2000) proposed the consumer coalition. Consumers' decision to join the coalition is based on the number of buyers in that coalition. Lager coalitions have more power to get lower final price. As the result, bigger coalitions have higher attraction for consumers to participate in. The price effect indicates that there will be a higher demand when the price drops in the group-buying context. It is because consumers get instant price discount compared to last price level at the point of time. Moreover, Kauffman and Wang (2001) believed that if potential buyers anticipate a price drop in the near future, this will motivate them to join group buying.

The third factor affecting consumer behavior is the price level, which relates to there being more orders placed immediately before and after each price drop. This is also called the "price threshold effect." Kauffman and Wang (2002) explained that when the number of orders needed to reach the next price tier is smaller than some threshold number of bids, a potential shopper will predict that the price will decrease in the near future. If the consumer is not risk-averse and his reserve price is no less than the next price tier, he would simply place his order. On the other hand, if the consumer is risk-averse, he may wait with placing his order unless the price actually drops. Finally, significantly more orders will be added during the last period of the group-buying cycle. As the explanation of Kauffman and Wang (2001), it is because that as the approach of deadline, potential consumers will stop waiting and seeing. Since the possibility to extend the number of joiners is decreasing when the ending time is approaching, the final price becomes predictable at the moment. Therefore, consumers will take action rather than waiting.

Obviously, the predicted final price of group buying is a critical factor for consumers' decision to join group buying. Since the group buying keeps changing the price until last minutes, it is thought to be predicted based on the external price information and/or previous shopping experiences.

3. Market price and group buying

Traditionally, the extent of searching is negatively correlated with its cost. This results in the sellers' pricing behaviors being affected by buyers' searches, and in price dispersion in the market (Stigler 1961; Urbany 1986). Price dispersion occurs when different sellers offer different prices for the same good in a given market. However, the use of Internet-based shopping bots and search engines lowers the searching cost and

hence increases the amount of searching. As consumers explore more vendors, it is expected to reduce both the average price paid and the price dispersion of the market. However, Bailey (1998) and Brynjolfsson and Smith (2000) found considerable price dispersion on the Internet, for which there are two leading explanations: (1) differences in perceived or actual retailer quality, and (2) incomplete consumer searching due to limited consumer awareness of the available retailers (Smith et al. 1999).

If the online market price is highly variable, will group-buying websites survive? According to Stigler (1961), the expected savings (in terms of how much less a consumer considers that they would pay) from a given search are positively correlated with the price dispersion, which is variation in prices of the same item across sellers, holding fixed the item's characteristics. In other words, a wider price dispersion results in a lower expected price. Gottlieb (2000) considered that group-buying mechanisms attract those consumers who will not pay the full price at an ordinary shop but are willing to wait for the price to fall.

As the definition of price volatility, it is the change of price in a period of time (Benini et al. 2002). Urbany (1986) found that when consumers have certain price beliefs, they will conduct fewer searches and less sensitive about the change of searching cost. It means that consumers will buy a product immediately when the price is certain or has low volatility. Rao and Sieben (1992) and Kalyanaram and Little (1994) found the correlation between price volatility and consumers' latitude of price acceptance. Furthermore, Dickson and Sawyer (1990) and Winer (1986) proved price volatility enlarges consumers' range of acceptable prices. It means the higher the price volatility, the larger the range of consumer price acceptance. Han et al. (2001) explained the reason that price volatility makes consumers be more sensitive about the gain (i.e. product price is lower than internal reference price) and less sensitive about the loss. Comparing to standard online shopping, consumers should pay more attention to the group-buying stores under the high price volatility. It is because group-buying stores provide low price to increase their gain as much as possible.

Does price dispersion and price volatility of a market affect the buyers' expected savings, and then impact on their decisions to join group buying? We have attempted to determine the relationship among the price dispersion and price volatility of e-market and the behavior of potential consumers in relation to group buying.

4. Transaction utility and reference price

In the theory of economics or consumer behavior, people make their consumption decisions based on the objective of utility maximization. Tsvetovat et al. (2000) believe that reducing the purchase price and increasing utility are the major incentives for customers to form a coalition. However, group buying involves decision making with risk or uncertainty because the final price is unknown until the group-buying transaction is closed (Anand and Aron 2003). Consumers confront the choice of outcomes by considering probabilities (Gottlieb 2000; Kauffman and Wang 2002; Sandoval and Kawamoto 2001).

Kahneman and Tversky (1979) had developed the "prospect theory" as an alternative to the expected utility theory. This theory describes the individual choice under uncertainty. Thaler (1985) embedded the prospect theory in a new concept of "transaction utility" and applied it to marketing and consumer behavior. He argued that the perceived gains and losses of a transaction are calculated using reference points. In his transaction utility theory, he defined the total utility from a purchase as the sum of acquisition utility and transaction utility. The acquisition utility depends on the expected pleasure gained from purchase and use of the product minus the displeasure of having to pay for it, whereas the transaction utility depends on the price the individual pays compared with certain reference prices. In other words, acquisition utility mainly depends on the product itself, while the transaction utility mainly depends on reference prices and comparisons between them.

Reference prices have recently been classified into external and internal reference prices (Lowengart 2002). An external reference price may be a price in an advertisement or the shelf price of a similar product, whereas an internal reference price may be the price that the buyer remembers and expects, or the buyer's belief about the price of a product in the same market.

What is the relationship between the external and internal reference prices, and how do reference prices affect consumer behavior? According to transaction utility theory, adaptation-level theory and assimilation-contrast theory, Urbany et al. (1988) suggested a process model of the effects of reference prices. Their model assumes that when consumers are exposed to external reference prices, they judge the believability of this information using their own initial price expectation (i.e., the internal reference price). If they perceive a positive transaction utility based upon a comparison between the sale price and the internal reference price, this increases the likelihood of purchasing.

Biswas and Blair (1991) suggested that exposure to an external reference price can change his previous price beliefs of a consumer encounter and also the response. He compares the offered price with his revised beliefs, and thereby recognizes the perceived saving and benefits of shopping around, both of which are important determinants of shopping intention.

For consumers facing the choice of group buying, their external reference price is based on their perceptions or beliefs about the price curve of group buying. In contrast to the traditional transaction model that has a fixed price, the group-buying price will not be finalized until the deadline or when the lowest price tier is reached. Therefore, consumers can only compare the predicted final price of group buying with their internal reference prices based on their perceptions of the condition of the market.

5. Conceptual model and hypotheses

This paper shows how price dispersion and price volatility affect the intentions of consumers to join group buying based on the transaction utility theory and prospect theory. Fig. 1 shows the research conceptual model. We modify the process model of reference price effects proposed by Urbany et al. (1988) and Biswas and Blair (1991) to describe the effects of price dispersion and price volatility on group buying in a competitive e-market. In the model, the consumers are assumed to generate or modify their internal reference prices according to market price information. In addition, the consumers make final price predictions of group buying according to the market condition and the price curve. Thaler (1985) considers that consumers will calculate transaction utilities by comparing their internal reference prices and the price predictions of group buying. A higher utility will increase the likelihood that a consumer will join group buying.

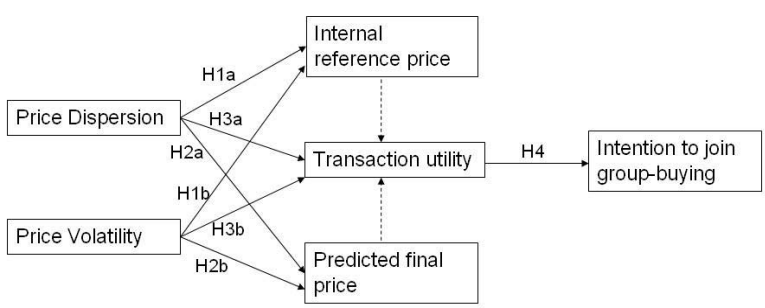

Figure 1：Research Model

Table 1 summarizes all the internal reference prices, the predicted final prices of group buying, and transaction utilities examined in hypotheses 1, 2, and 3. Because consumers generally assign different probabilities for the transaction utility of Best case, Worst case, and Most-probable case, the Expected value (EVU) of transaction utility is calculated as the weighted average of the preceding three types of utility.

Based on the research purpose and conceptual model, three hypotheses are examined as described below.

H1a: The internal reference prices (average market price, lowest market price, aspiration price, and reserve price) generated by customers are lower in an e-market with wide price dispersion than in one with narrow price dispersion.

H1b: The internal reference prices (average market price, lowest market price, aspiration price, and reserve price) generated by customers are lower in an e-market with high price volatility than in one with low price volatility.

Hypothesis 1a is based on the economics theory of information and transaction utility theory. When consumers confront an e-market with wide price dispersion, they may expect to find cheaper stores (Stigler 1961; Tsvetovat et al. 2000). Further, from the aspect of transaction utility theory, when a consumer encounters an external reference price claim, he may change his previously internal price beliefs (Biswas and Blair 1991; Urbany et al. 1988). Based on the categories of internal reference price proposed by Lowengart (2002), we examine four types of internal reference prices: average market price, lowest market price, aspiration price, and reserve price.

As indicated by Dickson and Sawyer (1990) and Winer (1986), the price uncertainty will increase the range of price acceptability of consumers. Consumers have higher range of price acceptability when they face a price uncertain market. Moreover, Han et al. (2001) found that consumers create their own price perception or internal reference price based on the history of product price. If the history shows high price volatility of the product, consumers will be more sensitive to the gain (i.e. the price is lower than expectation), but less sensitive to the loss. In other words, higher range of consumers' price acceptability with high price volatility means consumers will pay more attention on the low price products. Therefore, consumers' internal reference price will be lower.

H2a: The predicted final prices (the best, worst, most-probable, and expected final prices) of group buying generated by customers are lower in an e-market with wide price dispersion than in one with narrow price dispersion.

H2b: The predicted final prices (the best, worst, most-probable, and expected final prices) of group buying generated by customers are lower in an e-market with high price volatility than in one with low price volatility.

Hypothesis 2a is derived from the economics theory of information proposed by Stigler in 1961 (Stigler 1961). It claimed that a consumer's expected savings from a given search are positively correlated with the price dispersion (Stigler 1961; Urbany 1986), with consumers expecting to find inexpensive stores when they face wide price dispersion in the market. Therefore, we believe that the predicted price of group buying generated by consumers is higher in an e-market with narrow price dispersion than in one with wide price dispersion. However, in contrast with a posted price transaction, the final price of group buying is uncertain until the purchase is completed. Therefore, there is some risk involved in making the decision to join group buying. Therefore, we examine the predicted final price in four cases of group buying: the best, worst, most-probable, and expected prices; where the last is based on the other three predicted final prices because consumers may not make a decision based on predictions only.

Table 1 summarizes all the internal reference prices, the predicted final prices of group buying, and transaction utilities examined in hypotheses 1, 2, and 3. Because consumers generally assign different probabilities for the transaction utility of Best case, Worst case, and Most-probable case, the Expected value (EVU) of transaction utility is calculated as the weighted average of the preceding three types of utility.

According to Alvarado and Rajaraman (2000), volatility plays an important role in the estimation of risk of markets. As argument of Benini et al. (2002), "*price volatility is a measure of the dispersion or fluctuation in prices observed over a time period, e.g. hourly, daily, weekly, or yearly.*" Han et al. (2000) indicated that consumers will change their price consciousness and internal reference price base on the price volatility. In other words, consumers will modify their belief about the product price and use it as the reference of future purchasing. Therefore, when the product in the group buying has high price volatility in e-market, it is more probably for consumers to predict a lower price in the future. As the result, we propose that consumers will predict a lower final price in if the product has high price volatility in e-market.

Table 1：Measurement of internal reference price, predicted final prices of group buying, and transaction utility

	Price and utility	Measurement
Internal reference price	Perceived average market price	Consumer perception of the average retail price.
	Perceived lowest market price	Consumer perception of the lowest price in the market.
	Aspiration price	The price the consumers would like to pay.
	Reserve price	The highest acceptable price that consumer is willing to pay.
Final price forecast of group buying	Most-probable final price (P_{MPGB})	Predicted final price with the highest possibility.
	Best final price (P_{BPGB})	Predicted final price with the largest volume of orders.
	Worst final price (P_{WPGB})	Predicted final price with the smallest volume of orders
	Expected price (P_{EVGB})	The expected price, based on the best, worst, and most-probable prices of group buying.
Transaction utility	Best case (BTU)	=aspiration price － best price of group buying
	Worst case (WTU)	=reserve price － worst price of group buying
	Most-probable case (MTU)	=lowest market price － most-probable price of group buying
	Expected value (EVU)	$=\frac{BTU \times P_{BPGB} + WTU \times P_{WPGB} + MTU \times P_{MPGB}}{P_{BPGB} + P_{WPGB} + P_{MPGB}}$

H3a: The consumer's transaction utility will differ significantly between markets with different price dispersions.

H3b: The consumer's transaction utility will differ significantly between markets with different price volatility.

This study explored how price dispersion affects consumers' intentions to join group buying based on their transaction utilities, which result from comparisons between the subjects' internal reference prices and their predictions about the final price

of group buying. Based on the process model of reference price effects proposed by Urbany et al. (1988), the perception of a positive transaction utility by the customer will increase the likelihood of him making a purchase. Therefore, after examining hypothesis 1 and 2, we examine if the price dispersion and price volatility affect the transaction utility in hypothesis 3a and 3b.

Based on the four predictions of the final price of group buying, there are also four types of transaction utility: the best, worst, most-probable, and expected cases. For the best case, the consumer may compare the final price with his aspiration price (i.e., his preferred price). For the worst case, the consumer may compare the final price with his reserve price (i.e., his highest acceptable price). Furthermore, based on Urbany et al. (1988) and Biswas and Blair (1991), the consumer may expect that joining group buying will result in a price lower than the lowest market price. Therefore, for the most-probable case, the transaction utility is the comparison between the lowest market price and the most-probable final price of group buying. Finally, the expected value based on the above three types of transaction utility and related probabilities are also examined.

H4: A higher consumers' perceived transaction utilities (best, worst case, most-probable, and expected cases) of group buying will lead to a higher intention to join group buying.

In the process model proposed by Urbany et al.(1988), an increase in the perceived transaction utilities will increase the likelihood of a purchase. Biswas and Blair (1991) considered that a higher perceived saving resulting from the comparison between the offered price and price beliefs will increase the shopping probability.

6. Experimental methodology

6.1 Experimental design and manipulation

The experiment was implemented with a 2×2 design by manipulating the price dispersion and price volatility of an e-market. In other words, the price dispersion and price volatility are the two fixed factors. As suggestion of Kauffman and Wang (2002) that high tech and high unit price products are the better choice of group buying, we adopted MP3 player as the object of the experiment. In order to simulate the e-market in the real world, we designed an experimental e-market. In this e-market, there were 15

stores selling a Delta MP3 player which is simulation of iPod Mini of Apple Incorporation, with one of the 15 stores adopting a group-buying model. We used the simulated brand "Delta" to eliminate the effect of brand image. The price dispersion was manipulated by assigning different prices to the remaining 14 stores. Because the price dispersion affects consumers' internal reference prices and therefore changes the price threshold of transaction gains and losses (Han et al. 2001), to make sure the manipulation of price curves, we conducted a pilot test to understand consumers' perception about the price in different price dispersion markets. Different price curves for the group-buying stores were designed based on the result of the pilot test to simulate different price dispersion markets.

Table 2 lists the price curves of group-buying stores in different e-market manipulations based on the results from a pilot survey of the price threshold of transaction gains and losses. Figure 2 shows the price volatility information of different groups. In the high price volatility group, the price change is NT 300 per month in the past half year; on the other hand, in the low price volatility group, the price change is NT 150 per month in the past half year. The dotted line shows the trend of price changing and the other lines indicates the price volatility of the past 6 months.

Table 2：Price curves of the group-buying store in e-markets with different price dispersions (values are in NT$)

orders	Price Dispersion	
	Narrow	Wide
1~7	7900	8010
8~14	7625	7900
15~21	7400	7810
22~28	7250	7730
More than 29	7125	7660

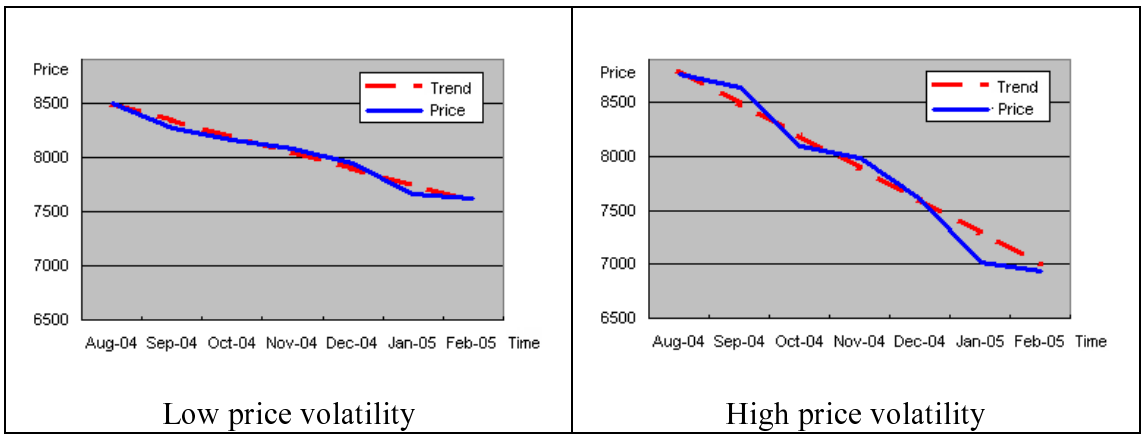

Figure 2：Price volatility information (values are in NT$)

For the remaining 14 stores, the means of their prices were the same in the different e-markets even though their price ranges differed. The price range of the e-market with the widest price dispersion was NT$ 1,600 (from NT$ 7,360 to NT$ 8,960), whereas that for the narrowest dispersion was NT $400 (from NT$ 7,960 to NT $8,360). The subjects were not informed about the price range, but they could freely browse every store. These price ranges and their means are based mainly on a survey of the real online prices of Delta MP3 players done before the experiment. Every subject was asked to buy a birthday gift (a Delta MP3 player) for a very close friend from the e-market. The subjects were told that the quality, posted price, and brand reputation were the same for every store, and that they could buy the gift from any store in the e-market. In order to encourage subjects to make the decision as seriously in the experiment if in the real world, we designed an incentive mechanism based on both the performance and luck of the negotiators. The performance was measured based on the discount and transaction utility they obtained, and the accuracy of their predictions about the final price of group buying. Only subjects who achieved a sufficiently high performance were candidates to receive substantial prizes (e.g., iPod Mini and iPod Shuffle). After the winners of these substantial prizes were confirmed, the other subjects were candidates for the prizes as convenience store coupons. All of the prize winners were decided by lottery. This two-stage incentive mechanism ensured that everyone had a chance to get a prize as long as they finished the experiment, but only good performers had a chance to get a substantial prize.

6.2 Experimental process

In order to simulate the online shopping behavior in the real world, this online experiment allow the subjects 10 days to shop around the e-market and make a decision. The experimental e-market even designed a search mechanism which allowed subjects to search the products based on price. The subjects had full freedom to browse the e-market during the 10-day period and to decide whether or not to buy the gift from the group-buying store and, if not, from which other store to buy it.

Every subject had to complete three questionnaires during the experiment. They had to complete the first questionnaire about demographic data and the shopping experience. The subsequent procedure was divided into two stages – evaluation and decision – based on the consumer decision process described by Kotler (1988). During the evaluation stage, the shopping scenario was presented to the subjects, who browsed the 15 online stores (including the one adopting the group-buying model). The incentive mechanism was also presented to the subjects. The subjects also had to complete the second questionnaire about their internal reference price, price predictions of group buying, and intention to join group buying. The second stage involved deciding from which store to buy the gift. After making the decision, the subjects had to complete the third questionnaire about their satisfaction with and predicted final price of group buying.

6.3 Subjects

One hundred and fourteen graduate subjects were recruited from a management school, and were randomly assigned to the e-markets with different price dispersions and price volatility. Finally, a total of 88 subjects finished the entire experiment and completed all the questionnaires. In other words, there were 88 valid data sets. The subjects included both part-time and full-time students. Their mean age was 30 years. An overall profile of the subjects is given in Table 3. 61.4% of them were male, and 87.5% had online shopping experience. Most of them have income less than NT20,000 per month as more than half of the subjects are students. The number of subjects of each group is shown as Table 4.

Table 3：Profiles of subjects

		Number of subjects	Percentage
Gender	Male	54	61.4%
	Female	34	38.6%
Monthly income (NT)	Less than 20000	45	51.1%
	20,000~40,000	18	17.0%
	40,000~60,000	18	20.5%
	60,000~80,000	7	8.0%
	80,000~100,000	1	1.1%
	More than 100,000	2	2.3%
Online shopping experience	Less than 3 times	41	46.6%
	4~6 times	22	25%
	7~9 times	10	11.4%
	More than 10 times	4	4.5%
	None	11	12.5%
Total		88	100%

Table 4：Number of subjects in experimental groups

Number of subjects		Price volatility		Total
		Low	High	
Price dispersion	Narrow	22	23	45
	Wide	20	23	43
Total		42	46	88

7. Data analysis and discussion

7.1 Data-reliability verification

The items of construct *intention to join* were modified from Gupta, Su and Walter (2004). The reliability of using a Likert scale to measure the intention to join the group buying was assessed using Cronbach's alpha. The value of Cronbach's alpha was 0.936, which is well above the reliability standard value of 0.7 for basic research suggested by Nunnally (1978). The subjects' age, education level, MP3 player experience, income, and degree of price consciousness did not differ significantly between the four

manipulated groups. Therefore, the effects of these external variables could be ruled out.

7.2 Results

The final results of the subjects' shopping decisions are listed in Table 5, which indicates that 36.4% of them joined the group buying in the market with narrow price dispersion while only 11.4% joined in the market with wide price dispersion. From the other hand, 57.1% of subjects joined the group buying under the low price volatility situation, and only 39.1% joined the group with the high volatility. Apparently, the subjects had different preference with different price changes.

Table 5：Shopping decision of all subjects

Number of joining group buying / Number of *not* joining group buying		Price volatility		Total
		Low	High	
Price dispersion	Narrow	18 / 4	14 / 9	32 / 13
	Wide	6 / 14	4 / 19	10 / 33
Total		24 / 18	18 / 28	42 / 46

7.2.1 Effects on internal reference price.

A 2×15 MANOVA (see Table 6) reveals that only the price dispersion significantly affected the internal reference price (Wilks' lambda = 0.249, $F = 62.427$, $p<0.01$). In terms, hypothesis 1b, 2b, and 3b are not supported by the result. We may find the explanation from the price information and product type. In the experiment, we offered subjects the price volatility information about the past 6 months and the subjects have 10 days to make decision. It is merely impossible for the electronic products (i.e. mp3 player in our case) to have severe price volatility in such a short period of time. Therefore, subjects may not be conscious of the existence of price volatility. Even they perceived it, subjects may ignore it because of the tiny possibility.

Next, an univariate ANOVA was conducted to test the effect of price dispersion on internal reference price, predicted final price, and transaction utility. Table 7 indicates that all internal reference price, predicted final price, and transaction utility differed significantly between the markets with distinct price dispersion. However, the transaction utility of best case (BTU) is the only exception.

Table 8 indicates that in a market with wide price dispersion, consumers exhibit a lower average market price, and lower market, aspiration, and reserve prices. Thus, hypothesis 1a is strongly supported. These results are similar to the findings of Urbany et al. (1988) and Biswas and Blair (1991). When consumers are exposed to an external reference price, they judge this information and modify their own internal reference price. The mean market price was the same in all of our e-markets, but found that consumers perceived a significant lower mean market price in e-markets with a wider price dispersion. These findings are consistent with Stigler's (1961) viewpoint. In his economics theory of information, the expected savings are positively correlated with the price dispersion.

Table 6：The MANOVA test of price dispersion and price volatility

Independent Variables	Wilk's Λ	F-vale	P-vale
Price dispersion	0.14	47.95	0.00***
Price volatility	0.89	0.84	0.61

Significance level: ***, $p<0.01$

Table 7：The effects of price dispersion on internal reference price, predicted final price, and transaction utility

Dependent Variables	df	MS	F-vale	P-vale
Internal reference price				
Average Market Price	1	1650119.86	24.30	0.00***
Lowest Market Price	1	7021049.64	187.17	0.00***
Aspiration Price	1	3524203.75	23.73	0.00***
Reserve Price	1	3862300.40	22.56	0.00***
Predicted final price				
Most-probable final price	1	2793967.92	79.92	0.00***
Best final price	1	4638673.99	313.91	0.00***

Worst final price	1	1117797.59	29.98	0.00***
Expected final price	1	2459465.63	88.97	0.00***
Transaction utility				
Best case	1	76436.68	0.48	0.49
Worst case	1	824489.69	5.74	0.02**
Most-probable case	1	956894.18	13.59	0.00***
Expected value	1	445221.13	11.06	0.00***

Significance levels: *=p<0.10; **=p<0.05; ***=p<0.01

Table 8：Means and standard deviation of different internal reference price, predicted final price, and transaction utility

Dependent Variables	Narrow Dispersion		Wide Dispersion	
	mean	std.	mean	std.
Internal reference price				
Average Market Price	8098.22	212.72	7821.86	299.39
Lowest Market Price	7923.11	236.61	7354.88	132.31
Aspiration Price	7565.11	448.81	7160.47	323.01
Reserve Price	7864.20	439.87	7439.42	390.95
Predicted final price				
Best final price	7686.22	71.74	7226.16	155.74
Worst final price	7940.22	104.39	7713.95	251.44
Most-probable final price	7773.78	110.81	7416.28	239.47
Expected final price	7798.60	94.76	7463.60	214.20
Transaction utility				
Best case	-121.11	468.97	-65.70	325.55
Worst case	-76.02	420.03	-274.53	337.42
Most-probable case	149.33	277.44	-61.40	247.66
Expected value	22.45	185.14	-123.37	219.53

7.2.2 Effects on the predicted final prices of group buying.

As indicated by Table 6 and Table 7 that the price dispersion has a significant effect on consumers' predictions on the final price of group buying. Similar to the effects on the internal reference price, subjects facing an e-market with wide price

dispersion exhibit a significant lower predicted final price of group buying. The difference is significant irrespective of whether the prediction is based on the most-probable, best, or worst case of the group-buying transaction. It is also significant if the prediction is the expected value of the above three types of predicted final price of group buying. Thus, hypothesis 2a is strongly supported. It is in agreement with the viewpoint of Kauffman and Wang (2002). In a market with a narrow price dispersion market, consumers generate a higher predicted final price of group buying.

7.2.3 Effects on transaction utility.

Table 6 indicates that the price dispersion significantly affects the transaction utility in all except the best case. All the transaction utilities (see Table 8) are negative except both the most-probable case and the expected value in the market with narrow price dispersion. The outcome partially supports hypothesis 3a that the consumer's transaction utility will differ significantly between markets with different price dispersion. Since consumers will modify their own price consciousness when receiving distinct price information (Biswas and Blair 1991; Han et al. 2001), the transaction utility based on the price consciousness will surely change accordingly.

7.2.4 Transaction utility and intention to join group buying.

Table 9 presents the correlation between intention and all types of transaction utility. The table indicates that only the most-probable and expected transaction utilities are significantly correlated with intention. Therefore, the hypothesis 4 is partially supported. Why are the best and worst transaction utilities not related to intention? For the best case, the consumer may not think it will happen whereas for the worst case, the consumer would not accept it. In addition, from Table 8 we can see that the transaction utility in the most-probable case is the largest irrespective of the price dispersion. In short, the transaction utility based on the most-probable condition has the highest explanatory power in predicting the intention to join group buying. This outcome is in agreement with the findings of Urbany et al. (1988) and Biswas and Blair (1991). The above results are consistent with those indicated in Table 5. In the market with the narrowest price dispersion, 32 of the 45 subjects joined group buying. In contrast, in the market with the widest price dispersion, only 10 subjects joined group buying.

Table 9：The correlation matrix of intention, internal reference price, predicted final price, and transaction utility

Variable: Intention to join group buying	Pearson correlation	P-vale
Transaction utility		
Best case	-0.160	0.14
Worst case	0.085	0.43
Most-probable case	0.364	0.00***
Expected value	0.216	0.04**

Significance levels: **=p<0.05(2-tailed); ***=p<0.01(2-tailed)

8. Conclusions

Our study investigated the effects of price dispersion and volatility on consumers' internal reference price, predicted final price, and transaction utility in the group buying. The result indicates price dispersion is the only influential variable. Consumers consistently perceive a higher internal reference price as well as a higher predicted final price of group buying in a market with narrow price dispersion. Consumers also perceive a higher transaction utility in the market with narrow price dispersion, except in the best case. Furthermore, the transaction utility in the most-probable case is the highest irrespective of the price dispersion. This is consistent with the transaction utility in the most-probable case being most strongly correlated with the intention to join group buying. Overall, consumers exhibit a higher intention to join group buying in a market with narrow price dispersion, and our results also show that the percentage of consumers joining group buying is much higher in a market with narrow price dispersion market than in one with wide price dispersion.

Although the effects of price dispersion and volatility on search and purchase decision have been extensively examined in previous studies, to our knowledge, none of them involve the online group buying (Lewis 2008; Baye and Morgan 2009; Geman and Ohana 2009; Gerardi and Shapiro 2009). The performance of online group-buying, moreover, in different price dispersion and volatility environments is not well scrutinized either. As consumers are getting more price-sensitive due to the price-based search mechanism almost available in every e-market, group-buying model is a win-win business model for both sellers and buyers. It not only lets the buyers pay less but also

lets sellers save marketing and transaction cost through big orders. In other words, group-buying business model can be a good strategy to get better profit without the risk of leading to price competition. For management of any online group-buying websites, therefore, this research is helpful for them to understand the multiple ways in which the variation of market product prices is likely to be a critical determinant of the performance of online group buying. As the result indicates that all the transaction utilities are negative except both the most-probable case and the expected value in the market with narrow price dispersion, it implies that group-buying business model is more appropriate for the market with narrow price dispersion. If the sellers facing a market with wide price dispersion are thinking of applying group buying business model, they need to design the price curves carefully and/or provide different incentives to attract consumers.

There are still limitations of this study. In order to make the experiment simulate a real world situation, we chose a 10-day online experiment. However, in doing so we lost some controllability. For example, subjects may not notice the price volatility in such a short time period even we intended to choose an electronic product which has higher price volatility usually. Under this situation, we cannot confirm that the price volatility does not impact the group-buying behavior. Second, the experiment was done online. Even we designed an experimental e-market which has 15 stores, it is still possible that the subjects did the experiment based on the information outside the experimental e-market. Finally, among the subjects, there are more than half that are males. However, in reality, there are more females joining group-buying activities. In addition, in terms of monthly income, there were only 37.5% of subjects who have income between NT20,000 and 60,000. However, full time employees are the major consumers who join group-buying activities in reality. So, the interpretation of this research results should be limited based on the sample of this research.

Future work is needed to improve the external validity of our approach. First, we may also benefit from analytical models that include various types of prices and utilities based on literature to bring economic insights and to foster more theoretic contributions. Second, it is of interest to determine the price curves for different price dispersions. It is impractical to use the same price curve in markets with different price dispersions, and hence it is necessary to determine if the performance difference results from the price dispersion rather than the price curve. Third, the presentation of price volatility could be changed as well. We only provided static volatility information. If we present it in dynamic way, it may attract more attention from subjects. Finally, based on the research

of Girard, Korgaonkar and Silverblatt (2003), product types indeed influences consumers' purchasing orientation. Whether the group-buying performance varies between different product categories should also be explored.

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