The Cross-Price Effect on Willingness-to-pay Estimates in Open-ended Contingent Valuation

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Abstract

Pricing decisions for new product are always challenging due to limited information such as market needs and competition. Contingent valuation is a widely used technique to elicit value for new products or non-market goods. Previous literature has shown that potential buyers use a reference product to form their opinion about the value of a new product (Monroe and Della Bitta, 1978). Therefore, pricing decision is an interactive process. Based on the extensive marketing literature about cross-price effect, we investigate the impact of reference price on consumer willingness-to-pay (WTP) for multiple similar products in an open-ended contingent valuation context. Two generalizations of the cross-price effect: the neighborhood price effect and the asymmetric price effect are examined. Our results show that the cross-price effect on WTP is prominent and the neighborhood price effect also holds in contingent valuation. However, we don't reach any conclusion about the asymmetric price effect based on our limited information.

Introduction

Economists and policy-makers are often faced with problems concerning the market value elicitation of new-products or non-market resources. Contingent valuation (CV), as one of the most important valuation methods, is usually employed by asking consumers hypothetical questions in surveys to estimate willingness-to-pay (WTP). CV applies to a wide range of issues such as environment preservation (Hanemann, 1994; Alvarez-Farizo, 1999; Carlsson and Martinsson, 2006), health care (O'Brien and Gafni, 1996; Gafni, 1991;) or food products (Hu et al., 2011; Moon, Balasubramanian, and Rimal, 2007; Markosyan, Wahl, and McCluskey, 2007).

One of the most important applications of value elicitation methods is pricing decisions. By eliciting value from the consumer side, the profit-maximizing price is determined. Most studies using contingent valuation focused on only one product. That is, participants are asked to bid for a product without explicit articulation of the prices of its competitive products. Since similar goods, especially close substitutes, are merely independent. The evaluation of one single good without considering its correlation with others has been shown to yield biased estimates (Caulkins et al., 1985; Burt and Brewer, 1971; Gum and Martin, 1975).

Economists use cross-price elasticity to measure one product's competitive impact on another. The cross-price effect, which describes the impact of the price change of one product on the market share of another, has been discussed extensively in literature (Sethuraman, Srinivasan, and Kim, 1999; Sethuraman and Srinivasan, 2002; Sethuraman, 1996). Cross-price effect plays a vital role in marketing studies, especially in studies on price promotion effect. Researchers have found that the dominant impact of price change is on brand switching (Bell, Chiang, and Padmanabhan, 1999; Gupta 1988; Chiang 1991). Therefore, understanding the patterns of cross-price effects enables retailers to set up appropriate pricing and promotion strategies to compete with other products in the market.

One problem with open-ended contingent valuation is the difficulty for consumers to name their own price. Numerous studies have concluded that preferences are reference dependent (Munro and Sugden, 2003) and consumers referred to a reference point when shaping their own valuation of a product (Monroe, 1977). The influence of price information on subsequent bids in repeated trial auctions, which is termed "bid affiliation", has been confirmed by several studies (List and Shrogen, 1999; Corrigan and Rousu, 2006 etc). Chernev (2003) suggested that the articulation of reference prices beforehand imposed a structure that was consistent with the nature of decision task and thus could simply consumer choices.

In this study, in a survey-based contingent valuation context, consumers were asked to name their WTP for six types of orange juice products. We designed six sets of reference price information for three juice types to aid consumer decision making, as well as to explore the cross-price effect on WTP estimates. Additionally, we examined two generalizations of the cross-price effect: neighborhood price effect and asymmetric price effect, in terms of their generalizability to consumer subjective valuation of a product in a hypothetical value elicitation environment.

The neighborhood price effect states that brands with closer prices have larger cross-price effect than brands priced farther apart (Sethuraman, Srinivasan, and Kim, 1999). In this light, we hypothesize that the cross-price effect on WTP estimates between products within the same price/quality tier should be stronger than the effect between products in different tiers. The asymmetric price effect states that when higher-priced products discount, they impact the lower-priced products more than the reverse (Blattberg and Wisniewski, 1989). That is to say, the asymmetry of cross-price effect favors the higher priced products (Sethuraman, Srinivasan, and

Kim, 1999). Here, we try to explore whether the cross-price effect in contingent valuation is in favor of the higher priced product or the asymmetry reverses.

Reference prices can be either external or internal (Kalyanaram and Little, 1994). Due to the complexity of internal reference prices (Yadav and Seiders, 1998), which is hard to control and measure in a survey context, we use external reference prices in this study. Therefore, despite the significant role played by internal reference price in decision making (Yadav and Seiders, 1998; Kalyanaram and Winer, 1995 etc.), our study mainly concentrate on external reference prices without controlling for internal reference prices. However, the mechanism of how market price affects consumer valuation should remain the same.

Most of the previous studies on cross-price effect used real transaction data, such as store level data (Sethuraman, Srinivasan, and Kim, 1999; Sethuraman and Srinivasan, 2002), survey-based purchase history information (Brown, 1986), and real transaction in field experiments (Arnot, Boxall, and Cash, 2006). Its impact was usually assessed via market share or brand switching. The real transaction data and market share information for new products/non-market resources are usually not available. Additionally, research about the price effect on WTP was limited to the own-price effect (subsequent bid affiliation due to posted price effect for a single product) in experimental auctions for new products (List and Shrogen, 1999). Therefore, the cross-price effect on WTP for those un-priced/non-market products remains unverified. Our study contributes to the literature by investigating the cross-price effect on WTP estimates in a hypothetical value elicitation context: open-ended contingent valuation. Understanding price competition and market structure is critical for a successful entrance into the market for new products. Even non-market goods, such as recreation sites, are usually correlated with each other. Therefore, value elicitation methods should also consider the interaction between the product of

interest and its substitutes. Our study is expected to provide valuable insights to researchers in regard to the future design of contingent valuation, as well as to retailers or policy-makers with respect to their value-based pricing strategies for new products or non-market goods.

Literature Review

Generally, CV can be implemented via three major methods: open-ended, sequential bids, and close-ended. Although the open-ended format is questioned by many economists (Cummings et al., 1986; Dwyer et al., 1977), open-ended approach is more practical, especially in mail surveys and thus is widely in use by researchers (Brookshire et al. 1983; Hanemann, 1994; Cummings et al. 1986 etc.). Kealy and Turner (1993) found that there was no difference between WTP estimates from closed-ended and open-ended contingent valuation in the context of private goods.

Chernev (2003) found that consumers preferred "price selection" (i.e. "select your price") over "price generation" (i.e. "name your price") and the difficulty associated with "name your price" value elicitation strategy resulted from the absence of a reference price range. Preferences are reference-dependent (Munro and Sugden, 2003). Instead of having a fixed value, consumers construct their assessment of a product contingent on choice contexts (Tversky and Simonson, 1993; Payne et al., 1992; Bettman, Luce, and Payne., 1998). For new products, the pricing is challenging with limited information, such as market demand, competition etc. Generally, potential buyers use a reference product to form their opinion about the value of a new product (Monroe and Della Bitta, 1978). Therefore, providing reference prices in contingent valuation not only assists participants make decisions, but also enables researchers to measure how consumers value un-priced items with market prices of existing products.

The relationship between price information and consumer decision making has been widely studied (Kalyanaram and Winer, 1995; Monroe and Lee, 1999; Briesch et al., 1997 etc.). The reference price effect has been shown empirically to affect purchase quantity (Krishnamurthi, Mazumdar, and Raj, 1992), as well as purchase timing (Bell and Bucklin, 1999). Thaler (1985) incorporated the reference price into the value elicitation model. In the value elicitation context, Drichoutis, Lazaridis, and Nayga (2008) provided concrete evidence as to how reference prices affected bids in a 2nd price Vickrey auction. Corrigan and Rousu (2006) found that posted price in experimental auctions had statistically and economically significant impact on subsequent bids. List and Shogren (1999) suggested that affiliated private values existed in repeated 2nd price auction for new goods. Muller and Ruffieux (2011) showed that bidders revised their bids after learning about field price and the extent of revision was determined by the distance between the field price and the bidders' previous price expectation. All of these articles only considered the own-price effect.

Similar products interact with each other in the market. The pattern of the cross-price effects has been widely discussed. For example, Arnot, Boxall, and Cash (2006) studied the effect of the price change of fair trade coffee on the probability of purchasing conventional coffee. Brown (1986) indicated significant substitute relationships between various types of juice using survey-based data about purchase history information. Gaynor, Li, and Vogt (2006) found that consumers switched to outpatient care in response to the increase of drug price. Sethuraman (1995) investigated how national brands and private-labels affected each other through price discount. All of these studies, despite using different products as vehicles, all confirmed the cross-price effects and further insights were offered. An interesting study by Hall,

Kopalle, and Krishna (2010) concluded that there was interaction between own-price effect and cross-price effect.

Important generalizations of cross-price effect include the neighborhood price effect and the asymmetric price effect. Sethuraman, Srinivasan, and Kim (1999) concluded that the neighborhood price effect existed based on either cross-price elasticity or absolute cross-price effect. They also found that a brand was affected the most by its immediately higher-priced brand, followed by its immediately lower-priced brand.

Compared with the relatively less attention paid to the neighborhood price effect, the asymmetric price effect has been extensively discussed. Blattberg and Wisniewski (1989) found that through price competition, higher quality/price brands stole market share from other brands in its own price/quality tier as well as brands in the lower tier, but brands in lower price/quality tier did not take significant share from the tier above. Allenby and Rossi (1991) investigated the promotion of national brands and store brands and concluded that the former yield more effect. Sethuraman and Srinivasan (2002) showed that the asymmetric effect reversed when the absolute change of market share instead of the percentage change was considered. Bronnenberg and Wathieu (1996) found that the direction of the asymmetric promotion effect depends on whether the quality gap between the brands was sufficiently large compared with the price gap. Sethuraman, Srinivasan, and Kim (1999) reached a series of empirical generalizations about the asymmetric price effect and neighborhood price effect. They found that the asymmetry only held with cross-price elasticity and disappeared with absolute cross-price effect. The neighborhood price effect was also stronger than the asymmetric price effect.

Most of these studies focused on the cross-price effect on market share and brand switching, which are realized performance measure. In this study, we perform a detailed analysis

of the cross-price effect on consumer WTP in contingent valuation to explore how consumers encode price information of other products when they are evaluating the target product in a hypothetical valuation environment.

Orange Juice Market in China

The orange juice market is complicated by the diversity of products in the market. For instance, orange juice products are basically categorized into Not-From-Concentrate (NFC)[1], Frozen-Concentrated-Orange-Juice (FCOJ)[2], and Orange-Juice-Drink with less than 100% juice content (OJD)[3]. The production and shipping cost differ significantly across product types. FCOJ and NFC are generally more expensive than OJD with NFC being the most expensive among these three. NFC has been favored for its freshness, natural taste, and high quality, but it has not been consumed widely in China due to its high cost. FCOJ is gaining popularity because of its high juice content and relatively lower price compared with NFC. Currently, the most popular juice type in China is OJD. OJD is further divided into different types according to its juice content (e.g. OJD 10%, OJD 25%, OJD 50% etc.).

In this study, we include six types of orange juice products for the elicitation of WTP in the contingent valuation: 1) OJD10 (Orange juice drink with juice content >=10%), 2) OJD25 (Orange juice drink with juice content>=25%), 3) OJD50 (Orange juice drink with juice content >=50%), 4) OJD75 (Orange juice drink with juice content>=75%), 5) 100% FCOJ,

[1] NFC is orange juice processed and pasteurized by flash heating immediately after squeezing the fruit without removing the water content from the juice.

[2] FCOJ is orange juice obtained from concentrated orange juice (COJ) that is reconstituted with water. COJ is orange juice made by removing, through evaporation, the water from the orange juice of fresh, ripe oranges that have been squeezed in extraction machines.

[3] OJD is sweetened beverage that is made from diluted orange juice containing no less than 10% orange juice content with other ingredients added such as sweetener and acidulant.

6)100% NFC. Based on the market prices and production procedure, the four types of OJD are considered more similar than they are with FCOJ or NFC while FCOJ and NFC are treated as closer substitutes. With these six product varieties, the measurement of cross-price effect and its generalizations becomes possible.

The Survey

Paper intercept surveys were conducted from March to June in 2012 in Beijing, Shanghai, Shenzhen, and Zhengzhou in China. These four cities represent the diverse types of cities in China. Beijing is the political and traditional cultural capital city of China. Shanghai is the financial and commercial center. Shenzhen is characterized by a large number of immigrants from the other cities and Zhenzhou is a less developed city in central China. Grocery shoppers were randomly stopped at the entrance of major shopping stores in these cities. In order to be qualified for the survey participation, the participant should be the main shopper for his/her household.

Each participant received 15-20 RMB ($2.41-$3.22) cash to motivate engagement and improve the quality of the survey results. In the survey, besides the contingent valuation questions, each participant was asked a series of questions regarding their knowledge about orange juice as well as the demographics such as gender, age, income, education, employment status, marital status, number of children in the family, monthly expenditure on food etc. The participants could choose either to provide their responses via paper and pencil or verbally. All survey answers were recorded and field notes were taken for later reference.

Knowledge of the product evaluated may influence valuation because more knowledge of the product might enable consumers to apply more information or give more thoughts in the evaluation process. Therefore, researchers have been controlling for this factor in studies (Lusk 2003; List 2001a). We also measured consumer knowledge about orange juice products by

asking participants 4 sets of questions including whether they knew the difference between fruit juice and fruit drink, agreement/disagreement with statements, judgment (True/False) about definitions, and the ability to recognize different types of orange juice products. The sum of correct answers of the above 4 sets of questions was used as an index to measure consumer "knowledge" of orange juice products. To make the index reflect the actual knowledge more accurately, different weights were assigned to different questions according to their difficulty level. A detailed explanation about the calculation method for knowledge index is provided in the appendix. About 365 people participated in the surveys in each city and a total of 1,454 questionnaires were collected. A total of 1186 valid responses (i.e. positive and reasonable WTPs, variation in WTPs for different juice products etc.) are used for the analysis.

In the continent valuation, we provided the consumers with reference prices of only three orange juice products: OJD10, FCOJ, and NFC to explore the neighborhood price effects (e.g. whether the reference price of OJD10 has the strongest impact on the WTP for OJD25 among these juice types), as well as the asymmetric price effect.

Six versions of surveys, which included six different combinations of the market price information of the three orange juice products, were designed. Researchers have shown that the impact of information is correlated with the way it is framed (Thaler, 1980; Munro and Hanley, 1999). Therefore, we presented the reference price in two ways, trying to determine the impact of reference price format on the WTP estimates. One way is to provide consumers with an exact price (2.3 RMB, 5.6 RMB, and 15 RMB) and the other is to provide them with a price range (2-4.5 RMB, 3-10 RMB, and 9-20 RMB) for each orange juice product. A summary of the six different designs are illustrated in Table 1. Survey Version S1 does not contain any price information. S2 contains an exact reference price for each of the three juice product. The rest

four versions with reference price range were generated with a fractional factorial design maximizing D-efficiency.

At the beginning of each survey version, we provided definitions of the three types of orange juice products: OJD, FCOJ, NFC, to each survey participant. The contingent valuation question for Version P1 is as follows:

If you want to purchase a 450 ML bottle of orange juice or orange juice product, this orange juice (product) is of high quality and the brand is your favorite, how much are you willing to pay for each of the following orange juice (product)?

Market price for your reference:

Orange juice product with juice content >=10% (OJD 10): ***2-4.5 RMB***

100% not from concentrate (NFC) orange juice: ***9-20 RMB***

- *100% NFC orange juice: _____RMB*
- *OJD with >=75% juice content: _____RMB*
- *OJD with >=10% juice content: _____RMB*
- *100% FCOJ: _____RMB*
- *OJD with >=50% juice content: _____RMB*
- *OJD with >=25% juice content: _____RMB*

The other 5 versions are the same except for the reference price part. To avoid the potential effect of a single order of product listing on results, we presented the orange juice products randomly to the consumers. In each city, each participant only took one survey version, which was randomly assigned among the participants.

The Model

To account for the potential correlation between the six bids for each consumer due to unobserved individual effect, MANOVA is employed to test the existence of reference price effect, impact of reference price format, and cross-price effect. For a detailed analysis of cross-price effect and neighborhood price effect, a seemingly unrelated regression (SUR) model is estimated. SUR increases the efficiency of the estimates by considering the correlation between dependent variables across multiple equations. Since WTPs are non-negative, we use logged WTPs as dependent variables. Survey Version S2 is excluded in this model because none of the individual effect of fixing the price information for each of the three juice type is estimable according to the survey design. Thus, including S2 becomes redundant as estimation of the neighborhood effect of fixed reference price is not possible. Additionally, market price varies across stores, cities, etc., and the acceptable price for a product is also likely to be a range for buyers (Monroe and Della Bitta, 1978). Therefore, the range format of reference price conforms more to the real market situations.

The model is specified as follows:

$$WTP = \begin{pmatrix} WTP_{OJD10\%} \\ WTP_{OJD25\%} \\ WTP_{OJD50\%} \\ WTP_{OJD75\%} \\ WTP_{FCOJ} \\ WTP_{NFC} \end{pmatrix} = \begin{pmatrix} X_1 & 0 & 0 & 0 & 0 & 0 \\ 0 & X_1 & 0 & 0 & 0 & 0 \\ 0 & 0 & X_1 & 0 & 0 & 0 \\ 0 & 0 & 0 & X_1 & 0 & 0 \\ 0 & 0 & 0 & 0 & X_2 & 0 \\ 0 & 0 & 0 & 0 & 0 & X_2 \end{pmatrix} \begin{pmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \\ \beta_5 \\ \beta_6 \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \\ \varepsilon_6 \end{pmatrix} = X\beta + \varepsilon \qquad (1)$$

Where X_1 is a matrix of independent variables which include dummies indicating whether the reference price range of OJD10, FCOJ, and NFC are available to the consumer or not, survey city, gender, education level, employment status, knowledge index of orange juice, age, and log(food expenditure per month). X_2 is a matrix including the same set of independent variables plus log(income) as we expect that income should have an impact on WTP for the orange juice

with relatively higher price. β_1 to β_6 are the vectors of coefficients for each single equation and ε_1 to ε_6 are the corresponding vectors of error terms.

Results

The demographic information of the survey participants are summarized in Table 2. The larger percentage of females is reasonable as the survey targeted at main household shoppers. More than half of the sample are people below 25. This relatively young sample might be due to the locations of our surveys (popular shopping stores), which attract more young people. The percentage of household without children is consistent with the number of people below 25.

Reference price effect

We first compare the WTP estimates from Survey Version S1, S2, and S3 according to the MANOVA results, which are shown in Table 3. Reference price information for OJD10 in either format does not change the bid for OJD10. The reason might be that consumers used their internal reference price (based on memory or advertisement etc.) for the judgment (Yadav and Seiders, 1998).

For FCOJ and NFC, however, the reference prices in both formats affect the bids. Both bids for FCOJ in S2 and S3 are significantly lower than the FCOJ bid in S1 while both bids for NFC in S2 and S3 are higher than that in S1. The opposite direction of change for these two juice products is as expected because the reference price in S2 and the mean reference price in S3 (6.5 RMB) for FCOJ are both lower than consumer bid in S1 and the reference prices for NFC (mean=14.5 RMB in S2) are both much higher than consumer bid in S1 for NFC. Therefore, we conclude that consumers' valuation of products depends on the reference price of these products, no matter what the formats of these prices are.

The only significant order of all the three bids is for NFC. Since the mean of the price range for NFC in S3 (14.5 RMB) is almost identical to the mean in S2 (15 RMB) while the bid in S3 is significantly lower than that in S2. This result indicates that reference price uncertainty negatively impacts consumer WTP for the product.

Cross-price effect

From Table 3, we find that the bids for OJD25, OJD50, and OJD75 in S2 are all significantly lower than those in S1 even if there was no reference price information provided for these juice products. This finding indicates that consumers also used the market prices of other similar products as reference when they were bidding for a product without price information. Considering the fact that the reference prices for OJD10 and FCOJ in S2 were both lower than the corresponding consumer bid, we conjecture that consumers lowered their bid for OJD25, OJD50, and OJD75 based on the market price information of OJD10 and FCOJ. However, which impact is stronger needs further test procedure to confirm.

The estimation results of the SUR in Equation (1) are summarized in Table 4. From the SUR results, which allow us to analyze the reference price effect of each individual juice product, we conclude that the cross-price effect is prominent. The results show that providing the OJD10 market price information significantly reduced consumer bids for all the six types of orange juice products. The significantly negative coefficient of OJD in the equation for Log(WTP10) suggests that the reference price range for OJD10 was below consumers' expectation. This expectation adjustment also significantly reduced the WTP for the other juice types. Similarly, the NFC price information, which was much higher than consumer anticipation, significantly raised the bids for all the other juice products. However, the price information of FCOJ only reduced the bids for

itself and NFC. The implication is that the extent to which reference price impacts WTP might be related with the similarity of products.

Compared with Zhengzhou, consumers in Shanghai had lower WTPs for FCOJ and consumers in Shenzhen had lower WTPs for NFC and higher WTPs for OJD50. Consumers in Beijing had lower WTP for four of the juice types (OJD10, OJD25, OJD50, and FCOJ). The survey in Zhengzhou was conducted in June while the survey in Beijing, Shanghai and Shenzhen were conducted in March, April and July, respectively. Therefore, the higher WTP estimates in Zhengzhou for some of the juice products are reasonable because of the higher temperature even though Zhengzhou is a less developed city with lower living cost and income than Shanghai and Beijing.

The knowledge index is significantly negative for OJD10 and OJD25 and significantly positive for FCOJ and NFC. This finding shows that more knowledge about orange juice products drives the consumption of fresher juice products and products with more juice content. Females are willing to pay more than males for NFC. Age positively affects the WTPs for three of the juice products. People who had college degree or above are less willing to pay for the products with low juice contents. These demographic impacts are all as expected as females generally pay more attention to healthy living and older age and higher education are generally correlated with more disposable income. Food expenditure per month, without surprise, has positive impact on WTPs for some of the juice products. However, neither income nor employment status has significant effects on any of the bids.

Neighborhood cross-price effect

The neighborhood price effect states that brands with closer prices have larger cross-price effect than brands priced farther apart (Sethuraman, Srinivasan, and Kim, 1999). Based on the attributes and average market prices of the six juice types in China (3 RMB for OJD10; 5.4 RMB

for FCOJ; 17.6 RMB for NFC; There is no market price information available for OJD25, OJD50, and OJD75), we assume that the reference price of OJD10 will affect OJD products more while the price of NFC will have a greater impact on FCOJ. We further test this assumption by conducting a series of tests about the equality of cross-price effect on WTP for these orange juice products.

Since the dependent variable in the SUR model is log(WTP), the estimated coefficients of OJD10, FCOJ, and NFC are interpreted as the percentage changes in WTP estimates after the reference price range of the corresponding product is provided. Therefore, the coefficient estimates can be viewed as reference price "elasticity" of WTP. Using the percentage change in WTP for comparison eliminates the influence of market price difference across juice products and allows us to measure the responsiveness of WTP to reference price availability in a unitless way. Table 5 and Table 6 show the P-value of each pair of comparison for the cross-price effect of OJD10, FCOJ, and NFC.

According to Table 5, it's a bit surprising that the own-price effect of OJD10 is weaker than its cross-price effect, but the result is consistent with Table 3, which shows that the bids for OJD10 across Survey Version S1, S2, and S3 don't vary. The cross-price effects of OJD10 price information on OJD25, OJD50, and OJD75 are significantly stronger than those on NFC. For FCOJ, since the coefficients in SUR have different signs, we base the comparison on magnitude because the strength of effect should not depend on its direction. The upper triangle of Table 6 illustrates the P-values of tests for the impact of FCOJ. The own-price effect of FCOJ is stronger than its cross-price effect on all OJDs. Its cross-price effect on NFC is stronger than that on OJD10, OJD25, and OJD50. Therefore, providing the reference price of FCOJ affects the WTP estimates for NFC more than it affects OJD. The lower triangle of Table 6 lists the P-value of

the tests for NFC. The own-price effect of NFC also exceeds its cross-price effect. Its cross-price effect has a stronger impact on FCOJ than on OJD10, OJD25, and OJD50 and the impact on OJD75 is stronger than that on OJD25.

All in all, based on the comparison of the cross-price effects of the three orange juice reference price ranges, we conclude that the cross-price effect of a juice product is stronger on the product with similar prices (or closer substitutes) than on products that are less similar. Therefore, our result, which is in the context of contingent valuation, is consistent with the results from previous literature discussing the neighborhood price effect using real transaction data.

Asymmetric price effect

Table 7 shows the relative strengths of cross-price effects between three juice types: OJD10, FCOJ, and NFC. Three product-pairs are compared. The statistical tests suggest that there is no significant difference in the cross-price effects between OJD10 and NFC. The impact of NFC on FCOJ is stronger than the reverse. However, the cross-price effect between OJD10 and FCOJ favors OJD10. Therefore, we get opposite results in regard to which direction the asymmetry favors and there appears to be no asymmetry between OJD10 and NFC. The inconsistent results might be due to the limited difference between the quality gap and the price gap of the three orange juice products (Bronnenberg and Wathieu, 1996). However, since we only offered reference price for three juice types, it would be rash to reach any conclusion at this point (e.g. Sethuraman and Srinivasan (2002) based their conclusion on the analysis of 530 brand pairs from 19 product categories.). More information needs to be collected and analyzed for future research on the asymmetric reference price effect in value elicitation studies.

Conclusion

In this study, we extend previous literature by studying the cross-price effect on WTP estimates in the context of open-ended contingent valuation, in which consumers were asked to name their WTP for six orange juice products. The reference prices for three juice types were provided. Our results are consistent with previous literature in that consumers shape their valuation of products with the aid of reference points. Additionally, we conclude that the cross-price effect on WTP estimates in hypothetical valuation context is prominent. To be specific, consumers adjusted their valuation of products without price information based on the available prices of other products. Two of the most important generalizations of cross-price effect: the neighborhood effect and the asymmetric price effect, are also examined. We conclude that the neighborhood price effect, which states that the cross-price effect is stronger on products with closer prices than on those priced farther apart, also holds for WTP estimates in open-ended contingent valuation. However, we get inconsistent results in regard to the direction of the asymmetric price effect. Considering the studies by Sethuraman, Srinivasan, and Kim (1999), Bronnenberg and Wathieu (1996), and Sethuraman and Srinivasan (2002), which found that the asymmetry of cross-price effect was not unconditional, we conclude that our result is not a surprise because of the ambiguity of the asymmetric price effect found in previous studies.

Previous literature on cross-price effect mainly focused on its impact on market share and brand choice. Our study contributes to the literature by examining the cross-price effect on WTP estimate, which is driven by subjective attitude, in contingent valuation. By exploring how consumers encode market prices of existing products when they are evaluating a similar new product, our results carry valuable implications for sellers in terms of setting up optimal pricing strategy for new products. For non-market goods, our results help policy-makers understand the interaction between un-priced resources and their priced substitutes. In addition, we empirically

verify the existence of neighborhood price effect on consumer WTP. The result indicates that products in the same quality/price tier should receive more attention from product managers in pricing decisions.

Other interesting topics for future research include the impact of varying reference price mean and range on consumers' bidding behavior and the asymmetric reference price effect in both hypothetical and non-hypothetical valuation environment.

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Table 1. Reference Price in Each Survey Version

Survey Version	Reference Price for Juice Products		
	OJD 10 (RMB)	FCOJ (RMB)	NFC (RMB)
P1	2-4.5	N/A	9-20
P2	N/A	3-10	9-20
P3	2-4.5	3-10	N/A
S1	N/A	N/A	N/A
S2	2.3	5.6	15
S3	2-4.5	3-10	9-20

Table 2. Demographics of Survey Participants (N=1050)

Independent Variable	Percentage (%)
Female	60.57
Age (<=25)	54.48
Age (26-40)	33.33
Age (>40)	12.19
Shenzhen	30.10
Shanghai	21.62
Beijing	27.33
Zhengzhou	20.86
College degree + post-graduate	50.48
Income (<5,000)	37.18
Income (5,000-10,000)	33.27
Income (10,000-20,000)	18.78
Income (>20,000)	10.77
No child	60.90
One child	15.55
Two children or above	23.55
	Mean (RMB per month)
Food expenditure	1115.28

Note: The unit of income is RMB per month

Table 3. Comparison of the Impact of Different Reference Price Format

Survey Version		OJD10	OJD25	OJD50	OJD75	FCOJ	NFC
S1 (N=202)	Reference Price	*N/A*				*N/A*	*N/A*
	Mean Bid	3.146	3.818	4.630	5.730	7.019	7.521
S2 (N=211)	Reference Price	*2.3*				*5.6*	*15*
	Mean Bid	3.342	3.454	4.105	5.160	6.219	10.012
S3 (N=167)	Reference Price	*2-4.5*				*3-10*	*9-20*
	Mean Bid	3.069	3.719	4.289	5.142	5.991	8.969
Significant Difference			S1>S2*	S1>S2**	S1>S2*	S1>S2* S1>S3**	S2>S3>S1**

Note: ** indicates significance at 5% level and * indicates significance at 10% level. The Units for reference price and mean bid are RMB.

Table 4. SUR Estimation Results

Independent Variables	Dependent Variable: Log(WTP for juice products)					
	LogWTP10	LogWTP25	LogWTP50	LogWTP75	LogWTPfcoj	LogWTPnfc
Intercept	1.078**	1.153**	1.304**	1.382**	1.424**	1.367**
OJD10	-0.110**	-0.209**	-0.209**	-0.226**	-0.184**	-0.117**
FCOJ	-0.027	0.040	0.000	-0.044	-0.135**	-0.132**
NFC	0.139**	0.107**	0.133**	0.204**	0.237**	0.556**
Shanghai	-0.049	-0.015	-0.039	-0.071	-0.096*	-0.094
Shenzhen	0.045	0.052	0.079*	0.016	-0.042	-0.165**
Beijing	-0.139**	-0.080*	-0.094**	-0.066	-0.125**	-0.087
Knowledge	-0.014**	-0.007**	0.002	0.006	0.010**	0.008*
Female	-0.031	-0.003	0.005	0.019	0.035	0.086**
Age	0.004**	0.001	0.002*	0.001	0.004**	0.000
Collegeorabove	-0.082**	-0.053*	-0.039	-0.032	-0.039	-0.050
Employ	-0.036	-0.010	-0.051	0.012	0.013	-0.005
Logfexp	0.014	0.025**	0.024**	0.035**	0.020	0.049**
Logincome					0.018	0.013
Sample Size	955	955	955	955	955	955
Adjusted R^2	0.060	0.065	0.069	0.069	0.075	0.180
Equation P-value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001

Note: ** indicates significance at 5% level and * indicates significance at 10% level. OJD10%, FCOJ, and NFC are dummy variables indicating whether the reference price range for each of the orange juice product is provided to consumers (=1 if provided; =0 otherwise). Shanghai, Shenzhen, and Beijing are dummies representing the city in which the survey was conducted. Employ=1 if the consumer is employed either full time or part time. Logfexp=log (food expenditure on food per month). Logincome=log(income per month). Dummies for Zhengzhou and male are omitted for identification purpose.

Table 5. P-values of Tests for Equality of Reference Price Effect of OJD10

	OJD10	OJD25	OJD50	OJD75	FCOJ	NFC
OJD10		0.030**	0.030**	0.016**	0.142	0.900
OJD25			0.995	0.710	0.611	0.066*
OJD50				0.716	0.608	0.067*
OJD75					0.414	0.039**
FCOJ						0.218
Significant Difference	OJD25>(OJD10, NFC); OJD50>(OJD10, NFC); OJD75>(OJD10, NFC)					

Note: ** indicates significance at 5% level and * indicates significance at 10% level.

Table 6. P-values of Tests for Equality of the Reference Price Effect of FCOJ and NFC

		Impact of Reference Price of FCOJ					
		OJD10	OJD25	OJD50	OJD75	FCOJ	NFC
Impact of	OJD10		0.775	0.576	0.725	0.038**	0.050**
	OJD25	0.489		0.376	0.930	0.058*	0.076*
Reference	OJD50	0.909	0.547		0.361	0.008**	0.011**
	OJD75	0.183	0.039**	0.136		0.087*	0.108
Price of NFC	FCOJ	0.054*	0.008**	0.036**	0.524		0.960
	NFC	0.000**	0.000**	0.000**	0.000**	0.000**	

	FCOJ	NFC
Significant Difference	FCOJ>(OJD10, OJD25, OJD50, OJD75); NFC>(OJD10, OJD25, OJD50)	OJD75>OJD25; FCOJ>(OJD10, OJD25, OJD50); NFC>(OJD10, OJD25, OJD50, OJD75, FCOJ)

Note: The upper triangle is for FCOJ and lower triangle is for NFC. ** indicates significance at 5% level and * indicates significance at 10% level.

Table 7. Asymmetric Price Effect

	NFC on OJD10	OJD10 on NFC	NFC on FCOJ	FCOJ on NFC	FCOJ on OJD10	OJD10 on FCOJ
Cross-Price Effect	0.139	0.117	0.237	0.132	0.027	0.184
P-value of Test for Equality	0.676		0.061*		0.002**	
The asymmetry of cross-price effect favors:	N/A		High-priced product		Low-priced product	

Note: The cross-price effect is measured as percentage change in WTP (absolute value) after reference price is provided. ** indicates significance at 5% level and * indicates significance at 10% level.

Appendix

The sum of correct answers of four set of questions was used as an index to measure consumer "knowledge" of fruit and orange juice. Different weights were assigned to different questions according to their difficulty. If the question was easy, more weight (score of 2) was assigned, while if the question was difficult, less weight (score of 1) was assigned. If the participants were not able to answer the question and chose "*I do not know*", they would score 0 for that question. For example, if the participants knew there was difference between orange juice and orange juice drink, they scored 2. Otherwise, they got -2. For the definition (True/False) question, the participants gained a score of 1 or 2 according to the difficulty level if they answered the question correctly and -1 or -2 if the opposite, while they were assigned 0 for "I don't know". For the statement questions, if the participants strongly agreed/disagreed with a true statement, they got a score of 2 and -2 respectively. Agreement/disagreement with a true statement led to a score of 1 and -1 respectively. If the participants answered "Neither agree nor disagree", they got 0. For the recognition of different types of orange juice, if the participants recognized the juice and made the correct choice, they gained 1 point; otherwise, they got 0. In this way of calculating index of knowledge, the maximum possible score of this index is 24 (if a respondent answered all questions right), and the minimum possible score of this index is -24 (if a respondent answered all questions wrong).