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People often use price as a proxy for quality, resulting in a positive correlation between prices and product liking, known as the “price–quality” (P–Q) heuristic. Using data from three experiments conducted at a winery, this article offers a more complex and complete reference-dependent model of the relationship between price and quality. The authors propose that higher prices set higher expectations, which serve as reference points. When expectations are met or exceeded, we observe the familiar P–Q relationship. However, when price is high and quality is relatively low, the product falls short of consumers’ reference point and the P–Q relationship is reversed; thus, people evaluate a low-quality product with a high price more negatively than a low-quality product with a low price. Using the results of a field experiment, the authors discuss implications for pricing considerations and profitability.

Keywords: price–quality, reference-dependent preferences, subjective quality assessment, expectations

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A Reference-Dependent Model of the Price–Quality Heuristic

Suppose you are the owner of a winery. Pricing your wines is one of the most important decisions you face. Intuition asserts that a product’s price and quality are positively correlated. Finding evidence counter to this basic intuition is often difficult, especially when product attributes are objective and easy to evaluate (e.g., the weight of a laptop). Substantive literature has shown that this intuition carries over when it is difficult to evaluate a product’s quality and that increasing its price increases its attractiveness (Rao and Monroe 1989).

In this article, we investigate new aspects of the price–quality (P–Q) relationship, focusing on the interaction

between a product’s price and quality and how it affects subsequent subjective quality assessment (SQA) and profitability. In line with previous research, we show that high prices increase expectations before someone tastes the wine. When a (high-quality) product meets these expectations, SQA and demand increase. However, when quality falls short of expectations, high prices result in lower SQA and lower demand than when the price is low.

Evidence suggests that consumers’ liking of products is positively correlated with price (e.g., Allison and Uhl 1964; Plassmann et al. 2008). Building on these findings, our theoretical framework asserts that people often form expectations regarding the quality of a product before consumption, and the extent to which consumption confirms these expectations affects their experience and postconsumption evaluations. Thus, a low-quality product consumption that follows a high price (and high expectations) may disappoint consumers and thereby negatively affect their overall assessments of that product. In other words, we show that the effect of higher prices on liking depends on whether expectations are met. First, we show these results formally using a model of reference-dependent preferences and present evidence supporting the assumptions of our framework.

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We then provide empirical support for our proposition and model. Finally, we show how price, expectations, quality, and consumption affect sales and profits.

THE P-Q HEURISTIC

Consumers often lack the time, expertise, or inclination to judge a product's quality. Consequently, they use available cues (Aaker 1991; Hoch and Deighton 1989; Janiszewski and Van Osselaer 2000; Waber et al. 2008), such as the product's country of origin (Leclerc, Schmitt, and Dubé 1994), how heavily it is promoted (Raghubir 1998), and—most relevant to the current research—its price (Gerstner 1985; Huber and McCann 1982; Rao and Monroe 1989; Riesz 1979). More often than not, extrinsic parameters influence people's liking of a product. The pleasure from consuming products depends not only on sensory input (e.g., smell, taste) but also on extrinsic attributes such as price or brand name (Almenberg and Dreber 2011; Goldstein et al. 2008). The evaluability hypothesis further supports this argument (Hsee 1996; Hsee et al. 1999) in proposing that even when consumers have direct experience of products, extrinsic cues may influence their preferences. In the context of the current research, this proposition is consistent with the assumption that consumers' liking of products increases with price.

Two recent functional magnetic resonance imaging studies demonstrate this effect. McClure et al. (2004) find that when participants believe the soft drink they are drinking is their favorite brand, they judge it as tastier compared with the same drink without that specific brand name (Allison and Uhl 1964). Plassmann et al. (2008) show that changing the price of wine influences the pleasure participants derive from drinking it. Participants in their experiment tasted the same wine under different price information. The results show that enjoyment was greater among participants in the higher price conditions.

PRICE, REFERENCE POINTS, AND SQA

Satisfaction is strongly linked to expectations. Studies demonstrate how the interaction between expectations and perceived or actual experience influences satisfaction—if a product meets expectations, satisfaction follows. However, if a product falls short of expectations, consumers are likely to be dissatisfied (Diehl and Poynor 2010; Oliver 1980; Spreng, MacKenzie, and Olshavsky 1996). Relatedly, social judgment theory (Sherif 1963; Sherif and Hovland 1961) predicts assimilation of the experience toward the expectation when the experience is ambiguous and the difference between expectation and disconfirmation is not too extreme; when that gap is substantial, we should observe a contrast. The essence of these findings provides the basis for our theoretical model.

THE MODEL

We next present a model of reference-dependent preferences supporting our experimental results and discuss the factors driving these results. We consider consumers who are uncertain about the quality of a wine, which for simplicity we assume could be either high q_H or low q_L . Consumers begin by observing the bottle and price of the wine. Before tasting the wine, they form expectations regarding its quality on the basis of cues available to them. Let α be the

probability that the wine quality is high. Given that all cues except the price p were kept constant in the experiment, we let this probability be an increasing function of the price $\alpha(p)$, which captures consumers' use of the P-Q heuristic discussed previously. Specifically, the expected quality of the wine is $q_L + \alpha(p)(q_H - q_L)$, which increases with respect to price p .

To validate this positive effect of price information on quality expectations in our context, we ran a pretest in the winery with which we collaborated on all of the experiments reported herein (see Appendix A). The owner of the winery approached visitors who entered the winery store, greeted them, and asked, "Do you want to take part in a short survey in return for waiving your wine tasting fee?" Visitors who agreed were told, "Please inspect this bottle of Cabernet Sauvignon and indicate, using the scale below, the degree to which you expect to like the wine." The scale was labeled 1 = "not at all," and 7 = "very much." Using a between-participants design, we manipulated the price of the wine to be \$10, \$20, or \$40 ($N = 133; 46, 45, \text{ and } 42$, respectively).

As we predicted, a one-way analysis of variance revealed a main effect of price ($F(2, 130) = 20.82, p < .01$). Planned contrasts showed that average expected liking increased from the \$10 condition to the \$20 condition ($M_{\$10} = 3.46, SD_{\$10} = 1.19$ vs. $M_{\$20} = 4.53, SD_{\$20} = 1.47; t(130) = 3.83, p < .01$) and from the \$10 condition to the \$40 condition ($M_{\$40} = 5.28, SD_{\$40} = 1.34; t(130) = 6.42, p < .01$). The difference between the \$20 and \$40 conditions was also significant ($t(130) = 2.62, p = .01$). These results support the assumption that before tasting the wine, consumers' expectations of quality are positively correlated with price.

In our investigation, instead of relying solely on the P-Q heuristic, consumers could also taste the wine. Tasting the wine provides additional information about its quality but does not necessarily fully reveal it. Our model captures this additional piece of information with a noisy signal s of the wine quality (either high h or low l). The signal precision can vary with the quality of the wine: $\beta_H = \Pr[s = h|q_H]$ and $\beta_L = \Pr[s = l|q_L]$, which are larger than .5 and smaller than 1. A precision of .5 would mean that a signal reveals no information and is identical to a coin flip, whereas a precision of 1 would correspond to a signal that perfectly reveals quality. We assume that consumers' signals are not perfect (β_H and $\beta_L < 1$) and not too noisy (β_H and β_L are not too close to .5), suggesting that they learn some useful information when tasting the wine but do not learn the wine quality with certainty.¹ Finally, consumers update their beliefs about the wine quality using their signal. The probability of the high-quality wine increases and becomes $\alpha_H(p)$ after a high signal and decreases to $\beta_L(p)$ following a low signal.

In our framework, people form their evaluations relative to some reference point (Kahneman and Tversky 1979). This reference point influences both consumers' choices and the utility they derive from consumption: the difference between their reference point and consumption experience affects their assessment of the product value. When consumption exceeds that reference point, enjoyment increases; when it falls short of the reference point, people experience

¹We present support for this assumption in the pretest preceding Experiment 1.

disappointment. As a result, differences in reference points can change the value difference between outcomes and may consequently reverse the preference order between options (Tversky and Kahneman 1981). Importantly, building on extensive research showing that people are more sensitive to losses than gains (Kahneman and Tversky 1979), we further predict stronger effects in reported SQA when participants experience disappointment relative to their reference points.

Using the language of Koszegi and Rabin (2006; KR hereinafter), a person's utility from consuming the wine depends not only on the quality q of the wine consumed but also on its comparison to a reference point r . In addition to consumption utility $m(q)$ (i.e., the value derived from drinking the wine), a person's overall utility is also affected by the consumption experience in comparison to a reference point $n(q|r)$ —the gain-loss utility. The overall reference-dependent utility from consuming the wine of quality q is therefore

$$(1) \quad U(q|r) = m(q) + n(q|r).$$

We consider the case in which consumption utility $m(q) = q$ is composed of the wine quality; the person's gain-loss utility is $n(q|r) = \eta(q - r)$ when q exceeds r , and $-\lambda\eta(r - q)$ when q falls short of r ($\eta \geq 0$ and $\lambda \geq 1$). This gain-loss utility satisfies the properties of Kahneman and Tversky's (1979) value function incorporating loss aversion when $\lambda > 1$.

For reference-dependent preferences to be useful, the reference point must be defined. Kahneman and Tversky's (1979) original account does not determine the reference point. As a result of keeping the reference point as a free parameter, the model could be reconciled with a large set of behaviors. In our context, a natural reference point is the belief a person holds about wine quality before tasting the wine: q_H with probability $\alpha(p)$ and q_L with probability $[1 - \alpha(p)]$. Following KR's model, consumers would then compare the quality of the wine they tasted with all qualities in the reference distribution. Similarly, the reference-dependence literature (Bell 1985; Gul 1991; Loomes and Sugden 1986) has proposed that consumers would compare the quality of the wine they tasted with the average quality in the reference point. Sprenger (2011) designed studies to distinguish these two types of preferences, which enabled him to show that they differ in the level of risk aversion they predict. Because these two preference models tend to deliver the same predictions, and because our investigation does not focus on risk aversion, we define the expected quality $q_L + \alpha(q_H - q_L)$ as the reference point.²

How does the price of the wine affect the satisfaction level of consumers with reference-dependent preferences? A higher price generates a higher reference point, which in turn affects both consumption utility and the gain-loss utility. First, consumers update their beliefs on the basis of their signals and expectations, which is their reference point. A higher reference point means that their updated beliefs remain higher after any signal. Thus, a higher price leads to a higher consumption utility. Second, the reference point also affects people's gain-loss utility. If the wine falls short

of expectations, an increase in r might produce a larger loss. In such instances, the net effect of the higher price is more ambiguous and depends on the relative size of the two effects.

Our proposed model of reference-dependent preferences makes the following predictions about consumers' SQA (for an illustration, see Figure 1). Because SQA varies with price the same way as with α , Results 1 and 2 are also valid when the price of the wine increases.³ We refer to consumers' SQA when tasting low- and high-quality wines as SQA_L and SQA_H , respectively.⁴

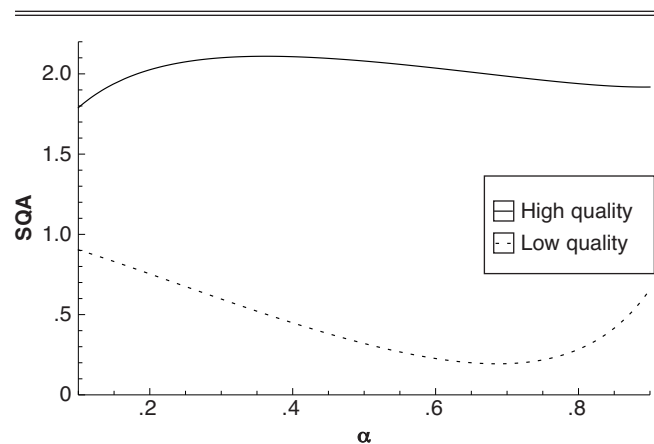
Result 1: For loss-averse consumers ($\lambda \geq \lambda^*$), SQA_L decreases and then increases with respect to α , the probability of a high-quality wine.

When the wine quality is low and consumers are loss averse, Result 1 shows that starting from a price that induces low expectations and then increasing the price results in decreasing reported SQA. Indeed, when consumers taste the low-quality wine, they are more likely to receive a low signal: the wine falls short of expectations, resulting in a negative gain-loss utility. The higher the price, the more pronounced the loss triggered by disappointment. This negative gain-loss utility overshadows the effect of a higher consumption utility. Note that if consumers' preferences do not incorporate gain-loss utility ($\eta = 0$), SQA_L would only reflect the P–Q heuristic and thus would increase with respect to price, highlighting the critical role of the loss generated by disappointment in explaining the decrease in SQA_L . Similarly, if consumers learn nothing

³ $\partial SQA / \partial p = (\partial SQA / \partial \alpha)(\partial \alpha / \partial p)$, and the pretest supports the assumption that $\partial \alpha / \partial p > 0$.

⁴For proofs for these results, see Appendix B.

Figure 1
SQA FROM THE MODEL



Notes: This figure represents the SQA as a function of α (the probability of a high-quality wine before tasting the wine). We use the following parameters: the loss-aversion parameter $\lambda = 2.5$ (see Abdellaoui, Bleichrodt, and Paraschiv 2007), weight of the gain-loss utility function $\eta = 1$ (equal weight between consumption utility and gain-loss utility), and $\beta_h = \beta_l = .9$ (10% chance of not identifying the quality of the wine correctly). Finally, note that the scale for SQA depends entirely on the normalization chosen for the quality levels. We use $q_l = 1$ and $q_h = 2$. This case corresponds to $\lambda > \lambda^*$.

²Figure B1 in Appendix B illustrates the closeness of these two types of reference-dependent preferences. For empirical tests of the model, see Abeler et al. (2011), Heffetz and List (2011), and Sprenger (2011).

when tasting the wine, their signal would be pure noise ($\beta_1 = \beta_h = .5$), and SQA_L would increase as price increases. Showing experimentally that SQA_L decreases as price increases aligns with this theoretical prediction and supports the proposition that consumers' reference-dependent preferences are influenced by the information they obtain from tasting the wine.

Result 2: SQA_H increases, decreases, and then increases with respect to α , the probability of a high-quality wine.

If a consumer tastes a high-quality wine, the effects of price on SQA are not as clear-cut. Recall that for the high-quality wine, many consumers receive a high signal. When the price is low, increasing it improves both consumption utility and the gain-loss utility because the updated quality increases more quickly than the reference point. Ultimately, the size of the gain associated with the gain-loss utility term decreases because consumers update their beliefs only slightly upward after receiving a high signal. Although increasing the price continues to increase consumers' consumption utility, this increase is insufficient to overcome the decrease in gain-loss utility. Overall, when price is initially low and increases, SQA_H increases and then decreases. However, if consumers could perfectly identify each wine's quality after tasting it ($\beta_1 = \beta_h = 1$), SQA_H would necessarily decrease with respect to price. In that case, consumption utility would be flat and equal to q_h , whereas the gain-loss utility would decrease as price increases. Result 2 is therefore driven partly by consumers' inability to fully evaluate the wine quality.

Considering Results 1 and 2 together, the model predicts that when the initial price point induces beliefs of low quality, the SQA of loss-averse consumers concurrently increases for a high-quality wine and decreases for a low-quality wine. A key element of this prediction is that, for the same change in price, SQA_H increases while SQA_L decreases. Finally, consumers with reference-dependent preferences could exhibit both increasing and decreasing SQA when the quality is high and low, respectively.

A final prediction of the model pertains to the difference between SQA_H and SQA_L . Specifically, our model predicts that consumers' SQA of both wines would be equal when they believe that the wine quality is low ($\alpha = 0$) before tasting, on the basis of the (price) information. As the price increases and people begin to believe the wine quality might be higher, the difference between SQA_H and SQA_L increases.

Result 3: $SQA_H - SQA_L$ increases and then decreases with respect to α , the probability of a high-quality wine. This difference is equal to 0 when people are certain that they know the wine quality ($\alpha = 0$ or 1).

These nonmonotonic results hold in a wide range of parametric settings because we do not impose any restriction on the gain-loss coefficient (η), the loss-aversion coefficient (λ), or the signal precision (β_1 and β_h) for Results 2 and 3. Result 1 holds in the case of loss-averse consumers ($\lambda \geq \lambda^*$). For lower levels of loss aversion, SQA_L initially increases when α is very close to zero and then decreases and increases.

We devote the remainder of this article to testing our predictions in three experiments that differ in two important

ways from previous work on the P-Q effect. First, whereas virtually all articles investigating this effect hold the product constant, vary prices, and observe positive correlation between price and liking, we desired a setting that would allow us to manipulate a product's quality as well.⁵ Second, testing our prediction in the field enabled us to further observe actual purchases under different price and quality combinations and to determine whether the proposed reference-dependent model predicts demand. Because of income effects, using consumers' SQA as a proxy for demand may be inaccurate; even if consumers prefer the expensive wine, they may not necessarily purchase more of it (Heffetz and Shayo 2009).

THE EXPERIMENTS

The Setup

We conducted all studies in a small California winery. As in most wineries in that area, visitors can taste different wines and choose to buy from the selection. The winery typically offers a tasting of six of its wines for a \$10 fee. We conducted all studies on Mondays, Tuesdays, and Wednesdays, relatively low traffic days.

The Wines

Our winery had two Cabernet Sauvignons: 2004 and 2005. Although in this region, the two years are typically comparable in quality, this specific winery changed the process of winemaking between the years, resulting in a better wine in 2005. Together, the lower-quality 2004 Cabernet and the higher-quality 2005 Cabernet enabled us to test the same product yet vary its quality.

As a first step, we aimed to validate the difference in the wine's quality from consumers' perspective. To this end, we conducted a pretest in which we offered winery visitors ($N = 100$) a free blind tasting of five of the winery's red wines (this tasting always preceded the regular tasting; for materials, see Appendix A). Next, visitors ranked the wines (1 = "best," and 5 = "worst," with an average wine scoring 3). The two tasting treatments differed only with respect to the included Cabernet Sauvignon: half our participants tasted the 2004 Cabernet, and the other half tasted the 2005 Cabernet.

The 2004 Cabernet scored 3.64 (the worst of the five wines), whereas the 2005 wine scored 2.06 (the best of the five wines). The difference is significant at the .01 level, suggesting that people have some ability to distinguish the qualities of these wines, which supports our model's assumption that consumers receive informative signals when tasting the wines. We base our notion of good/high-quality/2005 and bad/low-quality/2004 Cabernet on the results of this pretest.

EXPERIMENT 1: THE EFFECT OF PRICE ON SQA

In Experiment 1, we test how price and quality influence people's SQA of the wines. Building on the proposed reference-dependent model, we expected SQA of the low-quality wine to decrease with price according to Result 1

⁵For research that also considers price and quality, see Broniarczyk and Alba (1994), Pechmann and Ratneshwar (1992), and Vanhouche and Van Osselaer (2009).

and SQA for the high-quality wine to increase at low price levels according to Result 2.

Design

As in the initial pretest, the winery owner approached winery store visitors over the course of a few hours every morning during a week ($N = 166$), greeted them, and asked, “Do you want to take part in a short survey in return for waiving your wine-tasting fee?” He then poured wine into the visitor’s glass and said, “This is a bottle of our 2004 [2005] Cabernet Sauvignon, which costs \$X, please taste it and indicate, using the seven-point scale below, the degree to which you like it (1 = ‘not at all,’ and 7 = ‘very much’).” This design resulted in a 2 (wine: low quality, high quality) \times 3 (price: \$10, \$20, \$40) between-participants design.

Results and Discussion

Figure 2 presents participants’ SQA of the two wines as a function of price. A 2 (quality: low, high) \times 3 (price: \$10, \$20, \$40) analysis of variance revealed a main effect of quality ($F(1, 160) = 24.90, p < .01$) and a significant interaction of quality and price ($F(2, 160) = 3.13, p < .05$). The effect of price was nonsignificant ($F(2, 160) = .76$), indicating that price alone did not affect people’s SQA of the wine. Instead, the results of Experiment 1 support our predictions by documenting that the effect of price on SQA depends on the wine’s quality.

Planned contrasts showed that when the wines were priced at \$10, the difference in SQA was not statistically different ($SQA_L = 3.67, SD = 1.47, SQA_H = 4.11, SD = 1.47; t(56) = 1.14, n.s.$). However, planned analyses of visitors’ responses when the wines were priced at \$20 ($SQA_L = 3.40, SD = 1.87; SQA_H = 4.70, SD = 1.58$) and \$40 ($SQA_L = 2.87, SD = 1.79; SQA_H = 4.80, SD = 1.27$) revealed significant differences ($t(51) = 4.59, p < .01; t(53) = 2.79, p < .01$, respectively). Considered in light of our theoretical predic-

tions, these results suggest that when the wine is priced at \$10, consumers are almost certain that it is low quality before tasting it. When the wine is priced at \$20 and \$40, consumers are more uncertain about the wine quality and update their beliefs after tasting it.

Consistent with the nonsignificant effect observed for price, a comparison of people’s responses under different prices showed that liking of the wines did not differ when the wine was priced at \$10 versus \$20 or at \$20 versus \$40. For both the low- and high-quality wines, the effect of price on liking was only marginally significant when comparing the \$10 and \$40 price levels ($t(75) = 1.69, p = .09; t(85) = 1.82, p = .07$, respectively). These results are consistent with the model predictions and with the proposition that consumers have reference-dependent preferences that are updated when they learn new information (i.e., by tasting the wine).

The results of Experiment 1 are novel in that they provide the first evidence for the interaction of the P–Q heuristic with the quality of the product. Consistent with previous findings, we replicate the familiar P–Q relationship using the high-quality wine but show that it does not apply to the low-quality wine. In line with our theoretical results, these findings lend support to reference-dependent preferences in the context of a product of uncertain quality.

EXPERIMENT 2: THE EFFECTS OF EXPECTATIONS ON SQA

Building on Experiment 1’s results in the context of the expectations pretest, which showed that people’s quality expectations increase with price, we predicted that people tasting the high-quality Cabernet would be more likely to indicate that it met or exceeded their expectations than people tasting the low-quality Cabernet. We further expected that those tasting the low-quality wine would be more likely to report disappointment after trying it. We test these predictions in Experiment 2.

Design

We asked winery visitors ($N = 238$) to taste the wine under the same six conditions described in Experiment 1 and used the same 2 (wine: low-quality, high-quality) \times 3 (price: \$10, \$20, \$40) between-participants design. However, instead of asking participants how much they liked the wine after tasting it, the winery owner asked them to “indicate whether the wine met, exceeded, or fell short of your expectations.”

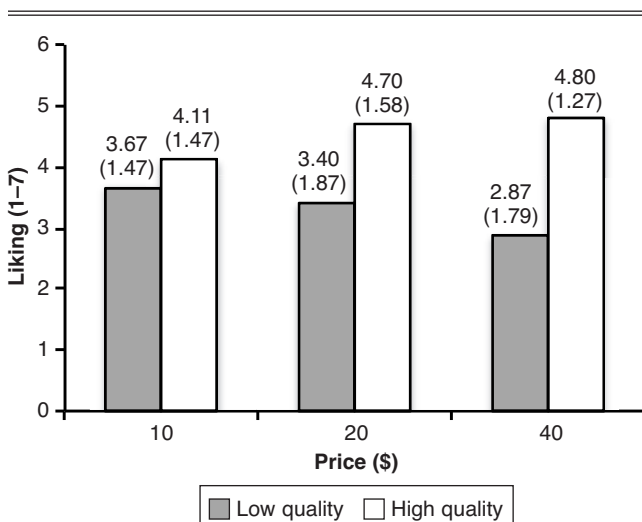
Results and Discussion

Table 1 provides the distribution of responses in the six conditions. To analyze the data, we created dummy variables for \$20 and \$40 (D_{20} and D_{40} , respectively) and a dummy variable for the high-quality wine (D_{High}). We then ran an ordered logit regression of participants’ evaluations on these dummy variables and on the interactions between price and quality dummies ($D_{20}D_{High}$ and $D_{40}D_{High}$). We used the \$10 low-quality wine as the comparison base condition.

The ordered logit regression showed that price negatively affected participants’ evaluations of the low-quality wine. The coefficients for the price dummies D_{20} and D_{40} are $-.79$ and -1.38 , with p -values of $.069$ and $.002$, respectively. Notably, although participants’ evaluations of the two wines

Figure 2

SQA AS A FUNCTION OF PRICE AND QUALITY (EXPERIMENT 1)



Notes: Participants first saw the price of the product and then tried it. After tasting the wine, they indicated the extent to which they liked it. The figure presents the means (standard deviations in parentheses).

Table 1
PARTICIPANTS' EVALUATIONS OF THE WINES (EXPERIMENT 2)

| | <i>Fell Short</i> | <i>Met</i> | <i>Exceeded</i> |
|---------------------|-------------------|------------|-----------------|
| <i>High quality</i> | | | |
| \$10 | 7.5% | 60% | 32.5% |
| \$20 | 12.5% | 37.5% | 50% |
| \$40 | 7.5% | 52.5% | 40% |
| <i>Low quality</i> | | | |
| \$10 | 22.5% | 50% | 27.5% |
| \$20 | 42.5% | 37.5% | 20% |
| \$40 | 55% | 32.5% | 12.5% |

Notes: This table summarizes the proportion of participants responding that the wine fell short, met, or exceeded their expectations. Each row corresponds to one treatment with 40 participants.

did not differ at \$10 (the coefficient of D_{High} is .49, n.s.), the price \times quality interaction reveals a highly significant effect: the coefficients for $D_{20}D_{High}$ and $D_{40}D_{High}$ are positive and significant (1.23, $p = .043$, and 1.59, $p = .008$, respectively). We further estimated the predicted probabilities of each response (i.e., fell short, met, or exceeded expectations) in each condition. Figure 3 presents the probabilities and 95% confidence intervals. The probability of reporting that the low-quality wine fell short of expectations increases with price (top left graph), whereas the probability of indicating it exceeded expectations decreases with price (bottom left graph). For the high-quality wine, the probabilities are fairly insensitive to price. These results support our proposition that the price of the wine influences whether the wine exceeds or falls short of consumer expectations and, importantly, the magnitude of that effect.

The data presented thus far show that higher prices lead to higher expectations (pretest) and, notably, that the interaction of quality and price influence subsequent evaluations (Experiments 1 and 2). Next, we test our predictions in a naturally occurring setting that enables us to observe how the interaction of price and quality affects consumers' purchase decisions and the firm's sales and profits.

EXPERIMENT 3: OBSERVING DEMAND AND PROFITS IN THE FIELD

In Experiment 3, we take our predictions to the field and test how price, expectations, and quality affect actual demand (i.e., sales), revenue, and profits. As in Experiments 1 and 2, we varied the price of the 2004 and 2005 Cabernet Sauvignons to be \$10, \$20, or \$40 and observed sales. Importantly, winery visitors were unaware that they were taking part in an experiment.

Design

We conducted the experiment in the same winery, using the same 2 (wine: low quality, high quality) \times 3 (price: \$10, \$20, \$40) between-participants design. We ran each condition over two different days to account for potential day effects. For each condition, we recorded all bottle purchases of the first 100 groups of visitors, totaling 600 observations.⁶

⁶The majority of groups in our data were couples, but some were larger. Controlling for the size of the group does not change the qualitative results we report. We base all of the following analysis on groups as a unit.

The owner of the winery greeted visitors and described the tasting procedure (\$10 to sample six different wines). After paying, visitors approached the counter, where they met the person who administered the tasting. The same employee administered the tastings on all days and was instructed not to discuss the Cabernet price variations and the experiment with visitors.

The standard tasting process in this winery (and others) is as follows: visitors receive a printed page with the names and prices of nine wines available for tasting, ranging in price from \$8 to \$60 per bottle and are asked to choose six wines to taste. As in most wineries, the list is constructed "from light to heavy," starting with white wines, moving to red wines, and concluding with dessert wines. The Cabernet Sauvignon was always seventh on this list. Tastings take between 15 to 30 minutes, and the employee conducting the tasting encourages visitors to snack on offered crackers between tastings. At the end of the tastings, visitors decide whether to buy any of the wines available in the winery store.

Results and Discussion

Price did not affect visitors' decision to taste the Cabernet Sauvignon. Across all treatments, more than 80% of visitors chose to taste the Cabernet Sauvignon.

Demand for wines. Figure 4 presents the number of bottles purchased per condition.⁷ As shown, the demand function for the high-quality wine is nonmonotone (the quantity purchased increased when the price increased from \$10 to \$20 and then decreased when the price increased to \$40), whereas the demand function for the low-quality wine is downward sloping.

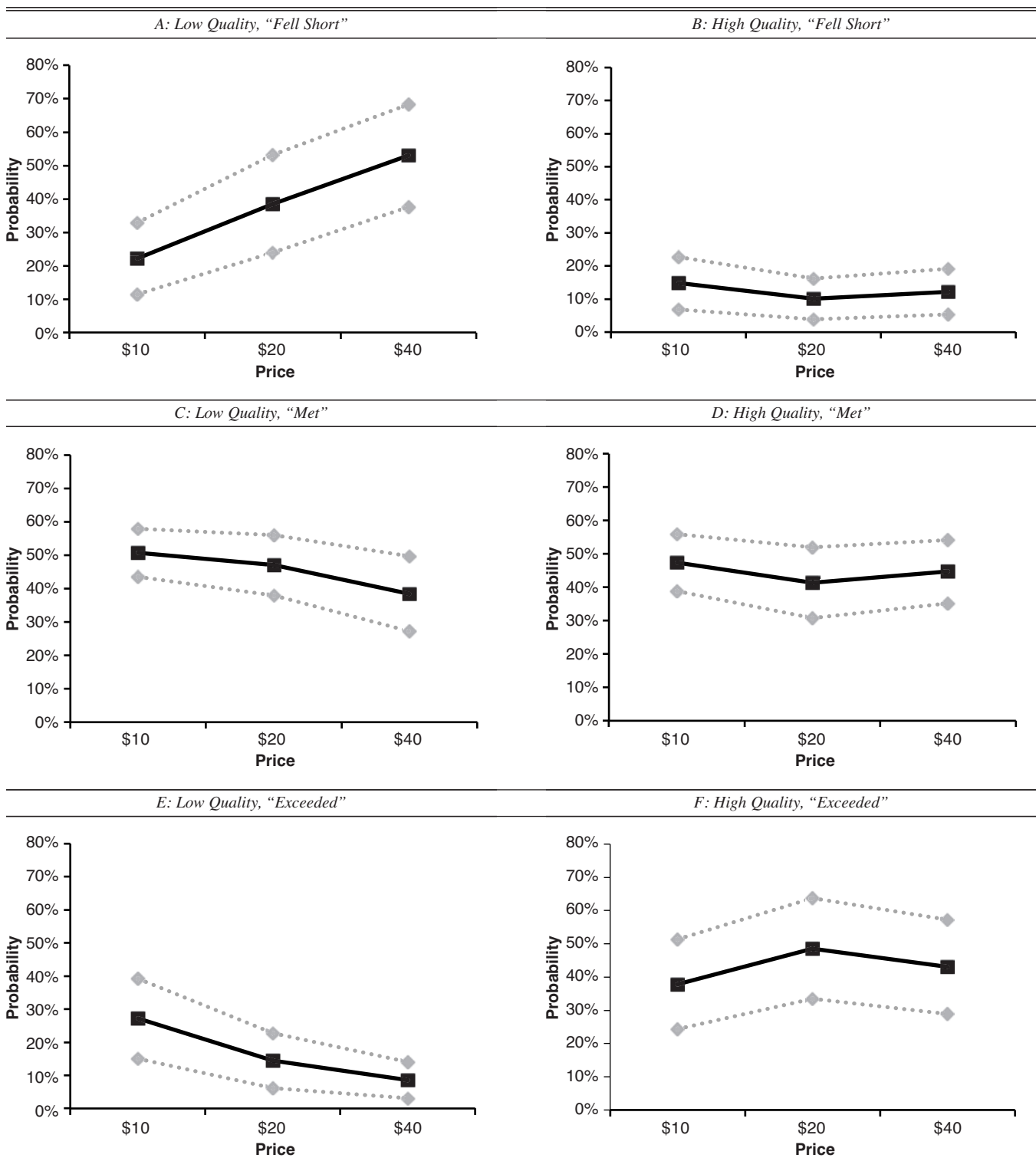
Visitors in the low-quality treatment purchased 44 bottles at \$10 each, 19 bottles at \$20 each (Mann-Whitney U test; $z = 1.55$; $p = .06$), and only 5 bottles at \$40 each ($z = 2.26$, $p < .05$ for the comparison with \$10, n.s. for the comparison with \$20). In contrast, visitors in the high-quality treatment purchased 73 bottles at \$10 and 113 at \$20 ($z = 1.89$, $p < .05$), in support of an upward-sloping demand function. Note that demand decreased to 28 bottles when the high-quality wine was priced at \$40 ($z = 3.05$, $p < .01$ for the comparison with \$20; n.s. for the comparison with \$10).

Number of groups buying the Cabernet. Visitors often buy more than one bottle of wine. The following analysis observes the distribution of wine purchases (Cabernet Sauvignon only) per group as a function of price and quality. This analysis is important because it tells us whether a handful of outliers drive demand. Table 2 presents the complete distribution of the number of bottles purchased, by treatment.

In total, 18 groups in the low-quality treatment purchased the Cabernet (one or more) at \$10, 11 groups purchased the wine at \$20, and 5 groups purchased it at \$40. The differences between the \$10 and \$20 treatments and the \$20 and \$40 treatments are nonsignificant (test of the equality of proportions using normal approximation to the binomial distribution; $z = 1.41$, n.s.; $z = 1.56$, n.s., respectively). The

⁷The winery owner provided us with the aggregate sales data rather than the entire distribution. Thus, the tests in Experiment 3 compare means and not distributions.

Figure 3
EVALUATION OF THE WINES (EXPERIMENT 2)



Notes: This figure represents the predicted probabilities of participants' responses (i.e., fell short, met, or exceeded expectations) in each condition, based on the ordered logit regression. The dotted lines represent the 95% confidence interval.

difference between the \$10 and \$40 treatments, however, is highly significant ($z = 2.88, p < .01$).

In contrast, an analysis of group purchases in the high-quality treatment reveals a significant difference between

the \$10 and \$20 treatments (20 vs. 38 groups, respectively; $z = 2.80, p < .01$). Thirteen groups purchased the wine in the \$40 treatment. This number is not significantly different from the \$10 treatment ($z = 1.33, n.s.$) but is significantly

Figure 4

THE DEMAND FUNCTION: NUMBER OF BOTTLES SOLD PER TREATMENT (EXPERIMENT 3)

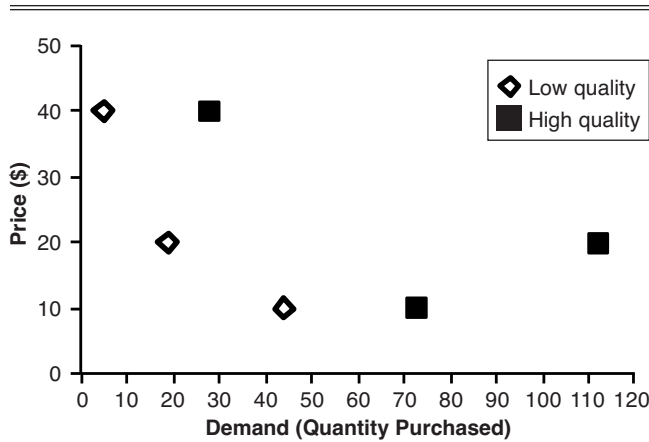


Table 2

NUMBER OF BOTTLES SOLD (EXPERIMENT 3)

| Number of Bottles Sold | Treatment | | | | | |
|------------------------|-----------|---------|---------|---------|---------|---------|
| | \$10 LQ | \$20 LQ | \$40 LQ | \$10 HQ | \$20 HQ | \$40 HQ |
| 0 | 82 | 89 | 95 | 80 | 62 | 87 |
| 1 | 13 | 9 | 5 | 10 | 26 | 8 |
| 2 | 2 | 1 | 0 | 5 | 3 | 4 |
| 3 | 1 | 0 | 0 | 0 | 2 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 1 | 1 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 1 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 1 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 2 | 0 | 0 | 4 | 5 | 1 |

Notes: LQ = low quality; HQ = high quality.

smaller than the number of groups that purchased a Cabernet in the \$20 treatment ($z = 4.06, p < .01$).

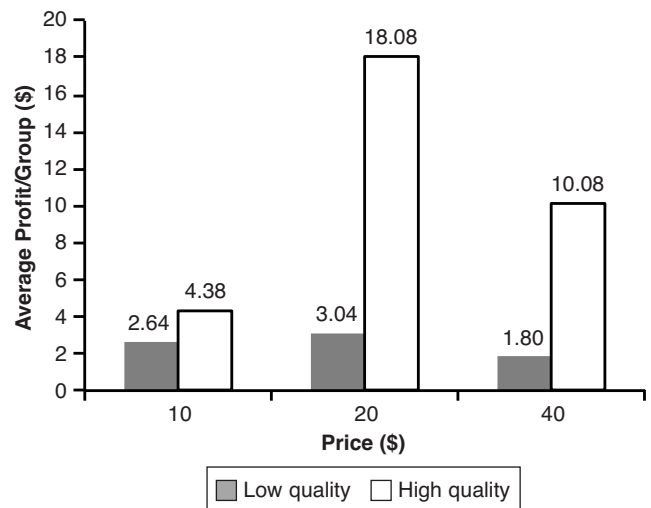
Profits from Cabernet sales. Although sales volume is important, the winery owner is primarily interested in maximizing profits from Cabernet sales. Profit per treatment is represented by $(p - c) \times q$. The price of the bottle p depends on the treatment. The cost of the bottle c is known and fixed in our case: any bottle of the Cabernet Sauvignon not sold in the winery is sold to a wholesaler for \$4. Finally, q represents the number of bottles sold per treatment. Figure 5 depicts the profits per group of consumers for the Cabernet Sauvignon.

When the high-quality Cabernet was priced at \$20, profits more than quadrupled relative to the \$10 profits. As a side note, the winery owner had originally planned to price the high-quality Cabernet at \$10, which is how he priced the 2004, low-quality Cabernet. Although sales under the \$40 price tag were relatively low, profits from these sales were more than double those at the \$10 price.

Overall profits. Finally, we consider the winery's profits from all wine sales per treatment. The owner considers the

Figure 5

PROFIT PER GROUPS OF CONSUMERS (EXPERIMENT 3)



Notes: The winery owner was unwilling to disclose the entire sales data and instead provided us with means only. This figure represents the average profits generated from sales of the experimental wines (2004 and 2005 Cabernet Sauvignons) per group of consumers.

number of customers as exogenous and tries to maximize the profits from each customer. If, for example, customers come to the winery with a fixed budget, increasing the price of the high-quality wine to \$20 may simply shift their spending from other wines to the Cabernet Sauvignon, which is clearly less desirable than the alternative—increasing overall spending. Our final analysis tests the difference in total profits per treatment.

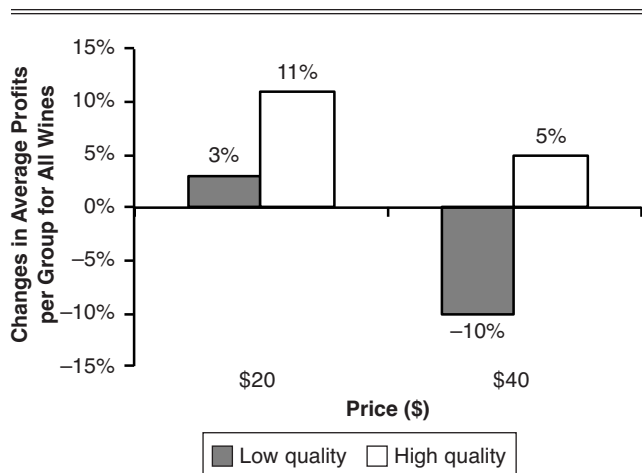
Figure 6 presents the change in the store's average total profits per group relative to the profits in \$10 treatments. The owner calculated the *total* store profits at the end of each day, incorporating the revenue and costs associated with all wine sales (experimental wines and other wines) that day for the 100 groups in each treatment. Increasing the price of the low-quality wine from \$10 to \$20 produced a 3% increase in profits, whereas increasing the price to \$40 resulted in a decrease of 10% in profits compared with the profits generated by the \$10 treatment. For the high-quality wine, increasing the price from \$10 to \$20 increased profits by 11%. Increasing the price from \$10 to \$40 resulted in a 5% increase in profits. The results illustrate that by increasing the price of the 2005 Cabernet Sauvignon, the winery generated some demand expansion that was sufficient to overcome any demand cannibalization that might have occurred, resulting in an overall profit increase.

GENERAL DISCUSSION

To date, work on the relationship between price and quality assessment has reported that higher prices result in increased liking (Rao and Monroe 1989), positively affect perceived and actual efficacy (Shiv, Carmon, and Ariely 2005), and increase experienced utility (McClure et al. 2004; Plassmann et al. 2008). The current research puts an important boundary on the standard P-Q effect and demonstrates an important cognitive process that is more pro-

Figure 6

CHANGE IN STORE PROFITS PER GROUP (EXPERIMENT 3)



Notes: The winery owner was unwilling to disclose the entire sales data and instead provided us with means only. This figure represents the change in the average total store profits per group relative to the profits in the \$10 treatment. The owner calculated the total store profits per group at the end of each day, incorporating the revenue and costs associated with all wine sales (experimental wines and other wines) that day.

nounced when a product falls short of, rather than exceeds, expectations (loss vs. gain). In doing so, we provide a more complete model of the relationship between price and perceived quality and a better understanding of the process underlying the effect.

We show that expectations are important drivers of the relationship between price and quality. High prices increase expectations and set a reference point against which people evaluate their consumption experiences. If consumption meets or exceeds this reference point, we observe the traditional P–Q effect, and SQA increases with price. However, our framework makes the unique prediction that if the product falls short of consumers’ price-based expectations, higher prices might produce lower SQA.

Our results are consistent with the predictions of a model with reference-dependent preferences (Koszegi and Rabin 2006; Loomes and Sugden 1986) when a product’s quality is difficult to evaluate. Our model shows that both gain-loss utility and quality uncertainty play key roles in generating this type of P–Q relationship. Our findings are also consistent with work on the interaction between expectations and experience (e.g., Diehl and Poynor 2010), which states that people use various available cues to form expectations/reference points against which they evaluate subsequent experiences. In the context of the current work, when high quality validates price-based expectations, we observe assimilation: the price reinforces liking, and SQA increases. However, when an experience or a product fails to meet the same price-based expectations, we observe a contrast: expectations are disconfirmed, consumers experience disappointment, and SQA decreases. In this case, a higher price results in greater disappointment.

We presented results of three studies that test the predictions made by the model. As often is the case, our choice of experimental method comes at a cost. Specifically, to fit the model to the data and estimate the loss aversion parameter,

or alternatively to find the maximum SQA or the maximum profit, would require testing more than three price levels. This was not the goal of the current study, in which we focused on the qualitative predictions of the model—the treatment effect.

We opened this article by asking how a winery owner should approach the task of pricing wines. The results of our experiments suggest that the winery owner had failed to choose profit-maximizing prices for the wines used in our experiments. Specifically, the 2004 Cabernet was priced at \$10, and the winery owner planned to offer the better 2005 Cabernet for the same price. After this experiment, the owner happily adopted the results and changed the price to \$20. We believe that in addition to its scholarly contribution, this research highlights the importance of field experimentation.

APPENDIX A: EXPERIMENTAL MATERIALS

General

The setup. We conducted all studies in a small California winery. As in most wineries in that area, visitors can taste different wines and choose to buy from the selection. The winery typically offers a tasting of six of its wines for a \$10 fee. We conducted all studies on Mondays, Tuesdays, and Wednesdays, relatively low traffic days.

The wines. Our winery had two different Cabernet Sauvignons: 2004 and 2005. Although the two years are typically comparable in quality in this region, this specific winery changed the process of winemaking between the years, resulting in a better wine in 2005.

Pretest: 2004 and 2005 Cabernet Sauvignon (Introduction)

To measure people’s price-based expectations, the owner of the winery approached visitors who entered the winery store, greeted them, and asked if they would be interested in participating in a short survey in return for waiving their wine tasting fee. Visitors who agreed were asked to inspect a bottle of Cabernet Sauvignon and indicate the degree to which they expected to like it. Using a between-participants design, we manipulated the price of the wine to be \$10, \$20, or \$40 (N = 133; 46, 45, and 42, respectively).

Instructions. Participants who entered the winery were greeted by the owner, who then asked them, “Do you want to take part in a short survey in return for waiving your wine tasting fee?” Visitors who agreed were asked to rate the Cabernet and given a printed page with the following instructions:

Please inspect this bottle of Cabernet Sauvignon, and indicate, using the scale below, the degree to which you expect to like the wine.

1 2 3 4 5 6 7
Not at All Very Much

Randomization. The different treatments were run on different weekdays. The owner approached each new visitor with the offer to take part in the survey. Response rates were not reported to us, but the decision to participate was made before participants knew about the treatment they would be in and thus should be orthogonal to our results. All visitors who agreed to participate completed the experiment. The owner ran the study for the entire duration of the day, with occasional breaks as needed.

Pretest: Price-Based Expectations (the Experiments)

The winery owner asked visitors who indicated that they were interested in tasting wines if they would be interested in participating in a free blind testing of five of the winery’s red wines. The owner informed participants that this tasting was independent of the regular wine tasting. Although we asked the owner to use the exact wording throughout the experiment, we had no control over the way he approached the participants. Importantly, this was independent of the treatment.

The winery owner poured wine from bottles marked A, B, C, D, and E. The 2004/2005 Cabernet wine was randomly assigned to one of the letters. Participants received a sheet of paper with the following text:

You are going to taste five different red wines. We would like you to rank the wines by assigning a number to each. Use 1 to indicate which wine you think is the best, 5 to indicate which wine you think is the worst, and 3 to the mid-level wine (neither very good or very bad).

- Wine A _____
- Wine B _____
- Wine C _____
- Wine D _____
- Wine E _____

Randomization. The owner approached all guests as they entered the winery and stopped after reaching 100 participants.

Experiment 1

The owner approached visitors as they entered the winery and asked, “Do you want to take part in a short survey in return for waiving your wine-tasting fee?” Those who agreed were asked to approach the counter.

Wine (2004 or 2005 Cabernet Sauvignon, depending on the treatment) was poured into a glass, and the owner said:

This is a bottle of our 2004 [2005] Cabernet Sauvignon, which costs \$X (*price varied according to the treatment*). Please taste it and indicate, using the 7-point scale below the degree to which you like it, where 1 means you don’t like it at all, and 7 means you like it very much.

Please indicate the extent to which you like this wine (1 = “not at all,” and 7 = “very much”).

- | | | | | | | |
|------------|---|---|---|---|---|-----------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | | | | | Very Much |
| Not at All | | | | | | |

Randomization. The owner approached all guests as they entered the winery. The experiment was run over several days, and the treatment was changed after each participant according to a treatment/randomization table. The owner stopped after a predetermined number of participants.

Experiment 2

Experiment 2 followed the same procedure of Experiment 1, with one change in instructions: participants were asked to indicate how the wine measured relative to their expectations (as opposed to asking for their liking of the wine):

This is a bottle of our 2004 [2005] Cabernet Sauvignon, which costs \$X (*price varied according to the treat-*

ment). Please taste it and indicate whether it fell short, met, or exceeded your expectations.

Please choose the answer that best fits your experience tasting this wine.

- This wine fell short of my expectations.
- This wine met my expectations.
- This wine exceeded my expectations.

Randomization. The owner approached all guests as they entered the winery. The experiment was run over several days, and the treatment was changed after each participant according to a treatment/randomization table. The owner stopped after a predetermined number of participants.

Experiment 3

The winery visitors were unaware that they were taking part in an experiment. The stopping criterion was to stop collecting data after 100 groups.

APPENDIX B: PROOF FOR RESULTS 1 AND 2

Using Bayes’s rule, the beliefs about the wine quality after tasting the wine are

$$\alpha_h(p) = \beta_h \alpha / [\beta_h \alpha + (1 - \beta_h)(1 - \alpha)], \text{ and}$$

$$\alpha_l(p) = (1 - \beta_h) \alpha / [\beta_l (1 - \alpha) + (1 - \beta_h) \alpha].$$

Note that β_l and β_h larger than .5 implies $\alpha_h(p) > \alpha(p) > \alpha_l(p)$. A high signal generates a gain, whereas a low signal creates a loss relative to the pretasting expectations, which serve as the reference point. The utility after tasting the wine is thus

$$U_h = q_L + \alpha_h(p)(q_H - q_L) + \eta[\alpha_h(p) - \alpha(p)](q_H - q_L), \text{ and}$$

$$U_l = q_L + \alpha_l(p)(q_H - q_L) - \lambda\eta[\alpha(p) - \alpha_l(p)](q_H - q_L).$$

The SQA the experimenter observed depends on the treatment condition and is

$$SQA_H = \beta_h U_h + (1 - \beta_h) U_l, \text{ and}$$

$$SQA_L = \beta_l U_l + (1 - \beta_l) U_h.$$

Because we are interested in finding how SQA varies with price and α is an increasing function of price, we need to find the sign of $dSQA_H/d\alpha$ and $dSQA_L/d\alpha$. It can easily be shown that

$$\begin{aligned} dSQA_H/d\alpha &= (q_H - q_L)\{-\eta[\beta_h + \lambda(1 - \beta_h)] \\ &+ \beta_l(1 + \lambda\eta)(1 - \beta_h)^2/[\beta_l - (\beta_h + \beta_l - 1)\alpha]^2 \\ &+ (1 - \beta_l)(1 + \eta)\beta_h^2/[1 - \beta_l + (\beta_h + \beta_l - 1)\alpha]^2\}, \text{ and} \end{aligned}$$

$$\begin{aligned} dSQA_L/d\alpha &= (q_H - q_L)\{-\eta(1 - \beta_l + \lambda\beta_l) \\ &+ \beta_l^2(1 + \lambda\eta)(1 - \beta_h)/[\beta_l - (\beta_h + \beta_l - 1)\alpha]^2 \\ &+ (1 - \beta_l)^2(1 + \eta)\beta_h/[1 - \beta_l + (\beta_h + \beta_l - 1)\alpha]^2\}. \end{aligned}$$

$$\text{Define } \lambda^* = 1 + 1/[\eta(\beta_h + \beta_l - 1)].$$

Given that $d^2SQA_L/d\alpha^2$ is negative and then positive when β_l and β_h are close to 1, $dSQA_L/d\alpha$ decreases and then increases with respect to α . If $\lambda \geq \lambda^*$, SQA_L decreases and

then increases. If $\lambda < \lambda^*$, SQA_L increases, decreases, and then increases with respect to α .

Similarly, given that $d^2SQA_H/d\alpha^2$ is negative and then positive when β_l and β_h are close to 1, $dSQA_H/d\alpha$ decreases and then increases with respect to α . Because $\lambda \geq 1$, SQA_H increases, decreases, and then increases with respect to α .

$SQA_H - SQA_L$ is a concave function of α that is equal to 0 when α is equal to 0 or 1. It thus increases and then decreases with respect to α .

Note that if we use the KR preferences instead, we would have

$$U_h = q_L + \alpha_h(p)(q_H - q_L) - \lambda\eta\alpha(p)[1 - \alpha_h(p)](q_H - q_L) + \eta[1 - \alpha(p)]\alpha_h(p)(q_H - q_L), \text{ and}$$

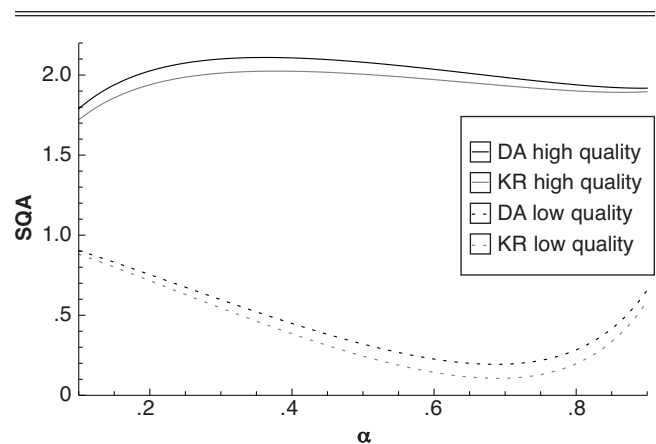
$$U_l = q_L + \alpha_l(p)(q_H - q_L) - \lambda\eta\alpha(p)[1 - \alpha_l(p)](q_H - q_L) + \eta[1 - \alpha(p)]\alpha_l(p)(q_H - q_L).$$

The predictions based on these preferences are qualitatively identical to the ones in the article, as Figure B1 illustrates.

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Figure B1
DISAPPOINTMENT AVERSION VERSUS KR



Notes: This figure represents the SQA using either the disappointment-aversion (DA) formulation used in the current research or the KR formulation. We use the following parameters: the loss-aversion parameter $\lambda = 2.5$ (see Abdellaoui, Bleichrodt, and Paraschiv 2007), weight of the gain-loss utility function $\eta = 1$ (equal weight between consumption utility and gain-loss utility), and $\beta_h = \beta_l = .9$ (10% chance of not identifying the quality of the wine correctly). Finally, note that the scale for SQA depends entirely on the normalization chosen for the quality levels. We use $q_l = 1$ and $q_h = 2$.

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