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Consumer knowledge affects valuation of product attributes: Experimental results for wine

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ABSTRACT

While a substantial literature on the effect of professional expertise in markets exists, consumers' "home-grown" knowledge has received little attention in economics. We combine data from a novel valuation experiment, in which participants received information about and bid on wines sequentially, with data on participants' wine knowledge to examine knowledge and bid updating. High knowledge participants did not value wines differently, but did update bids more with objective information, such as appellation and expert rating, than did low knowledge participants. Both low and high knowledge participants updated their bids significantly after taste-testing the wines. Our findings provide evidence that knowledge and preference are separable, and that knowledge captures a factor giving consumers the ability to process information to form expectations of product quality. Though both low and high knowledge consumers use sensory information, we find differences in preference for wines based on sensory information between low and high knowledge consumers. Our results suggest that knowledge is an important variable to consider in markets for complex, multi-attribute products.

1. Introduction

Between 1992 and 2009, U.S. consumer-packaged product introductions, defined as new food, beverage, and non-durable goods, increased from 15,718 to 46,036 per year (ERS, 2012). Choice proliferation complicates the relationship between consumers and products (see, e.g., Schwartz, 2004), as well as for academics, policymakers, and others interested in how choices underpin consumer demand. Proliferation also complicates regulation, labeling and informational systems (Verbeke, 2005). More options has been found to decrease the probability that any decision is made (Iyengar and Lepper, 2000), and has been shown to shift choices towards simpler or more easily justified options (Sela et al., 2009; Iyengar and Kamenica, 2010). These effects have been found in consumer markets (Iyengar and Lepper, 2000), retirement savings decisions (Iyengar et al., 2004; Iyengar and Kamenica, 2010), and health care choices (Hanoch et al., 2009). For many choices, an individual needs more than simple access to information about a product to make an informed decision; she must also possess knowledge to be able to interpret the information. As more options become available, the information an individual must interpret increases, and as individuals gain more knowledge about and experience with these options, the attributes relevant to their decisions, and even their preferences for attribute combinations, may evolve.

Recent decades have seen the development of an extensive literature examining the implications of boundedly rational consumers, limited cognitive capacity, and costly and/or strategically hidden information (see, for instance, the survey article by DellaVigna, 2009). A related area of study involves learning in a few specific settings: strategic games (e.g. Roth and Erev, 1995), learning from market interactions (e.g. List, 2003), and social learning (e.g. Conley and Udry, 2010). Though researchers have pointed out the importance of knowledge in food markets, in which credence attributes related to production method have become important (Verbeke, 2005), little research exists studying the effects of knowledge on consumer behavior in markets, the use of product information, or the relationship between knowledge and valuation.

In an experimental auction, we examine the relationship between consumer wine knowledge and wine valuation, as well as the effect of knowledge on bid updating when consumers receive new information. With so many products in the wine market and year-to-year variation in the sensory attributes of wines, reputations—for wineries and appellations—are important (Costanigro et al., 2010). Wine labeling policy, set for the American wine market by the Alcohol and Tobacco Tax and Trade Bureau

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(TTB), plays an important role in consumer choice and the formation of reputation by stipulating the conditions under which different label components can be used.

We define and measure wine knowledge using a wine knowledge quiz included in appendix B, which was developed by Frøst and Noble (2002) to classify individuals according to wine expertise. We also collect and evaluate wine experience, information-seeking, and habit-related variables to control for factors that may be correlated with knowledge. We analyze willingness to pay (WTP) for California Cabernet Sauvignon wines with data generated in an experimental auction designed to detect the marginal impact of attributes and information on WTP. Using measures of participants' wine knowledge, we employ these WTP data to study how knowledge, other wine experience variables, and demographic characteristics relate to valuation. We also assess how knowledge affects bid updating when new information is provided.

We find that wine knowledge shapes how experiment participants update their WTP for wine attributes, though it is not correlated with baseline bids for wine with minimal information. Other wine-related variables, such as the participant's claims about the average price they usually pay for wine, are correlated with valuation of wine at baseline, and significantly explain wine attribute valuation. The data indicate significant and systematic differences in WTP updating by participants of different knowledge levels after they receive information about wine attributes. We show that high knowledge consumers use objective information—especially appellation and winery name—more than low knowledge consumers to update their bids. Participants of all knowledge levels respond to sensory information and expert rating. We posit that knowledge gives consumers the ability to more accurately use information, leading to more refined expectations of the utility the wines will provide, though this is modulated by the nature of the information (Hsee and Zhang, 2010).

2. Information, Knowledge, and valuation

Economists have studied the effect of professional experts on markets for experience or credence goods, including wine (Ali et al., 2008; Hilger et al., 2011; Friberg and Grönqvist, 2012), movies (Reinstein and Snyder, 2005), and food safety (Jin and Leslie, 2003). Scant attention has been paid to the effect of consumers' own knowledge on choice or valuation. The most closely related literature has examined the effect of buyers' market experience on market outcomes, both in auctions for consumer goods and in investment decisions. Primarily a laboratory-based literature, authors have found that increased experience in the lab is correlated with better outcomes—namely a lower purchasing price (Kagel and Levin, 1986; Kagel, 1995; Rutström, 1998; Güth et al., 2003). A few field studies have been published as well, with mixed results on the relationship between experience and bidder success. Bajari and Hortacsu (2003) and Dewan and Hsu (2004), studying auction outcomes for heterogeneous goods, found an insignificant to negative relationship between bidder experience and outcomes in online auctions. However, Kostandini et al. (2011), analyzing auctions for a homogeneous good, estimated a positive relationship between experience and outcome.

A significant literature on retirement savings has examined biases and decision rules—Benartzi and Thaler (2007) summarize the literature—and the effect of the number of plans offered on plan choice (Iyengar and Kamenica, 2010). However, few have studied the moderating effect of knowledge or experience. Research on investment decisions has found that experience appears to reduce behavioral biases (Feng and Seasholes, 2005). In a hypothetical choice scenario, Agnew and Szykman (2005) measured participants' financial knowledge and found that those with higher levels of knowledge were more likely to actively make portfolio choices (opting out of the default) and were less likely to report feeling overwhelmed by the choice than were low knowledge participants.

Recently, a literature has developed examining the role of knowledge in nutrition label interpretation and use, and investigating determinants of nutrition knowledge. Grunert et al. (2010) studied consumer knowledge, interest in healthy eating, and nutritional label use among shoppers at UK food retailers, finding that interest in healthy eating primarily explained use of nutrition labels, but knowledge was importantly related to comprehension of nutrition labels. Miller and Cassady (2012) found that individuals' knowledge interacted with motivations to switch to a healthier diet to produce more accurate choices in a task comparing the healthiness of two products' nutrition labels. Cooke and Papadaki (2014) found that nutrition knowledge and interest in healthy eating predicted both nutrition label use and dietary quality among UK university students. Nutrition knowledge appears to play an important role in nutrition label use, and to be correlated with interest in healthy eating (Grunert et al., 2012). However, there are important differences in decision-making about food relative to other goods (Rangel, 2013), so the relationship among knowledge, motivation, and food choice may not apply in other settings.

Fields of study that consider cognitive or sensory processes have a history of studying perception and knowledge. The wine market is rich in information. In fact, journalists, wine writers, and academics regularly discuss consumer confusion in interpreting and using label information to make choices (Drummond and Rule, 2005). California wine-grape growers alone harvested approximately 120 varieties of wine grapes in 2014 (California Department of Food and Agriculture, 2015). The TTB recognizes more than 300 appellations, or growing areas, in the U.S., including American Viticultural Areas (AVAs), counties, and states, and has issued licenses to over 8000 wineries or wine blenders (TTB, 2015a; TTB, 2015b). Myriad sources generate wine reviews, including magazines (e.g. Robert Parker's Wine Advocate, the Wine Spectator), newspapers (the New York Times, the Wall Street Journal, etc.), blogs (e.g. Dr. Vino, Vinography), and crowd-sourced opinion (www.cellartracker.com). In addition, some wine attributes provide multiple dimensions of information. Appellations, for instance, provide information about different climatic and soil conditions, which may affect the sensory qualities of the wines (Ashenfelter, 2008; Ashenfelter and Storchmann, 2010); they also accrue reputations, which influence consumers' wine valuation (Cross et al., 2011).

Wine has been used as the setting for many studies in psychology and sensory sciences (see, for instance, Lawless, 1984; Solomon, 1990; Melcher and Schooler, 1996; Bende and Nordin, 1997; Ballester et al., 2008). These authors have typically separated subjects into binary expert and non-expert categories, studying differences in the way subjects process wine-related ideas and discriminate among wine samples. Solomon (1990) found that wine experts performed better on tests of both cognitive and sensory abilities than non-experts. Solomon (1997) studied wine description and categorization by expert, intermediate, and novice wine consumers, finding that specificity of tasting terms increased with expertise. Experts grouped wines differently and more consistently than non-experts, leading Solomon to conclude that expertise created structure in the way people thought about wines. Other research suggests that expertise is related to somewhat better sensory discrimination skills (Lawless, 1984; Bende and Nordin, 1997), but that much of the difference in performance is attributable to knowledge rather than greater sensory acuity (Melcher and Schooler, 1996; Hughson and Boakes, 2002; Ballester et al., 2008).

In addition, there is a sizeable experimental economic literature on wine and food valuation. Experimental economic studies on wine, largely conducted in the lab, have examined WTP under different information conditions, such as blind tasting of wines,

with label information only, and with tasting and label information. French consumers tasting five different bottles of Champagne blind did not, on average, value them differently, using hedonic ratings, or WTP bids (Lange et al., 2002). When participants had access to objective information in the label-only condition and the tasting-and-label conditions, however, they submitted significantly different ratings and WTP. Ratings and WTP bids were quite similar in both label-only and tasting-and-label conditions, suggesting that the objective label information dominated the sensory information. Using identical conditions (tasting only, label only, tasting and label), Combris et al. (2009) found little differentiation in WTP for low to mid-priced chardonnay and pinot noir wines in any of the conditions. However, by ranking the wines (from highest to lowest WTP bid by participant), they find significant differences in valuation. They conclude that preference heterogeneity drove their initial insignificant results.

In other cases, researchers have examined consumer valuation of wine attributes (typically focusing on one attribute of interest). Grebitus et al. (2013) examined consumer preferences for the distance that wines had traveled, which was part of a larger examination of differences in hypothetical and non-hypothetical valuation in experimental auction and choice experiment designs. In addition, there is a literature that uses strictly hypothetical valuation or choice scenarios to examine wine attributes. Loureiro (2003) employed a contingent valuation payment card method to study the premium consumers were willing to pay for environmentally friendly and local wines in a relatively new wine production area (Colorado). Though the average premium was very small, regular wine buyers—those participants who buy wine at least once a week—were willing to pay a premium. Loureiro (2003) argues that these participants may have more knowledge about the Colorado wine industry than others.

Other research, arising predominantly from the marketing literature, has explored the effect of back label information (Mueller et al., 2010a); common front-of-label or on-shelf wine attributes, such as brand, region, and awards (Lockshin et al., 2006); and packaging, labeling, and sensory attributes (Mueller and Szolnoki, 2010; Mueller et al., 2010b) on purchase intentions.

3. The experimental auction

To examine the effect of wine knowledge on consumer valuation, we conducted an experimental auction using the Becker-DeGroot-Marschak mechanism (BDM) and elicited bids from participants who received information sequentially about wine attributes (Becker et al., 1964). The BDM is widely used in valuation experiments, and prevents individuals' bids from being influenced by bids of other participants (Corrigan and Rousu, 2006).

We recruited 236 participants from Davis, California and surrounding areas, and conducted the research in a sensory laboratory at the University of California, Davis between April and July 2009.[1] Appendix A, figure 1 describes the steps of the experiment from recruitment to completion. Participants completed a survey on consumer characteristics, including income, demographic information (age, education level, and gender), and wine market experience (such as number of bottles purchased per month, average price spent per bottle, and whether the participant read wine literature).

After the completion of the experimental auction, participants took a wine knowledge quiz. We chose to use a wine knowledge quiz developed and validated by Frøst and Noble (2002) to measure objective wine knowledge. Previous studies on wine expertise (e.g., Solomon, 1990; Bende and Nordin, 1997; Solomon, 1997; Ballester et al., 2008) have predominantly placed subjects into binary categories based on some difference among subjects in wine-related activities, such as frequency of consumption or employment in the wine industry. These studies provide a precedent for this conceptualization of expertise. However, since we are specifically interested in the role of knowledge—rather than the proxy measures that experience or employment provide—in facilitating the use of objective information, we determined that Frøst and Noble's (2002) quiz offered the best opportunity to measure participants' objective wine knowledge.

In the published experimental economic studies on wine valuation, participants have received all information simultaneously, depending on the condition they were in (see, for instance, Lange et al. (2002) or Combris et al. (2009)). That is, if participants were in a label-only condition, they received all of the label information at once; if in a label and sensory information condition, they received the sensory sample and label information simultaneously. In order to study the relationship between consumer knowledge and valuation of wine attributes, we elected to provide information sequentially. This approach allows us to identify consumer response to a particular attribute, whereas a simultaneous information design would have confounded differences in valuation for "wine" with valuation for the different attributes.

A sequential approach, however, requires a choice to be made about the order in which attribute information is released. We chose to provide attribute information from broadest to most specific categories (i.e., wine origin, expert rating, winery name). A primary motive for choosing this order is that highly knowledgeable consumers could have immediately deduced the rest of the information for certain wines if we had instead randomized the order of release of the attribute information and they had received winery name information initially. In this case, we would have experienced a loss of control. While the subsequent information would have been meaningful to high knowledge consumers, had they already deduced the remaining attributes, they would not have changed their bid in response to the "new" information. (We discuss this general issue more below.)

Given the sequential approach to attribute release, we chose to release sensory information in the final round for two related reasons. First, published research suggests that in the absence of objective information, wine consumers on average are not able to differentiate effectively among sensory samples (Lange et al., 2002; Combris et al., 2009). Objective information is important in shaping consumers' WTP (Lange et al., 2002), and, in fact, objective information appears to influence individuals' sensory experiences with the good (Almenberg and Dreber, 2011). However, once individuals have received sensory information, subsequent objective information does not influence their experience (Lee et al., 2006)—that is, once consumers have tasted a product, they seem not to attend to subsequent objective information in their assessment of the product. Because consumers are much more likely to purchase wines based on objective information (or at least after having first received objective information) than on a blind tasting, we decided to provide objective information first. However, we mimicked a blind tasting by presenting consumers with wine samples that were identified by a random code that did not link the sample to the objective information about the wine until after the participant had recorded their rating of each wine sample.

Four wine attribute categories were provided to participants (Table 1). All wines but one—Mirassou's California appellation—had two levels of appellation of origin: a more specific sub-appellation, e.g. Oakville, and the broader appellation, Napa Valley. We also provided expert ratings from two magazines: the Wine Advocate and the Wine Spectator. Participants received the different

[1] Before data analysis, we removed 21 participants from the sample. We excluded these data because the participants submitted different WTP amounts for two or more of the four wines in the baseline round, when they had no differentiating information, and submitting varying bids violates the principles of the BDM.

Table 1
Descriptive information of the wines used in the experiment.

Winery	Appellation	Expert Rating	Shelf Price	Cases Produced
Beaulieu Vineyards	Napa Valley California	R. Parker: NA Wine Spec: 77	$20	127,000
Beringer	Knights Valley Sonoma County	R. Parker: 88 Wine Spec: 88	$25	83,500
Mirassou	California	R. Parker: NA Wine Spec: 85	$10	21,639
Robert Mondavi	Oakville Napa Valley	R. Parker: 88 Wine Spec: 93	$45	10,637

Source: Design of laboratory experiment.

Table 2
Wine Knowledge, Wine Experience and Demographic Data.

	Mean	Standard Error	Min	Max
Quiz	0.63	0.17	0.18	1.00
Bottles/Month	5.19	5.34	0	25
Price/Bottle	11.61	4.34	7.5	25
Years Buying Wine	11.10	9.72	2.5	35
Wineries Visited per Year	3.82	3.86	0	20
Wine Club Member (0, 1)	0.19	0.40	0	1
Read Wine Literature (0, 1)	0.47	0.50	0	1
Prefer Red (0, 1)	0.77	0.41	0	1
Class on Wine (0, 1)	0.27	0.44	0	1
Keep Wine Journal (0, 1)	0.14	0.35	0	1
Sensory Trained (0, 1)	0.21	0.41	0	1
Female (0, 1)	0.56	0.50	0	1
Age (years)	35.85	12.88	25	65
Household Income ($1000 s)	65.57	53.89	15	200+
Education (years)	16.57	1.45	12	18

Source: Experiment Participant Questionnaire.
Notes: 210 observations.

combinations of the appellation and expert rating information in two sets of four rounds: a baseline round; an appellation round; an expert rating round; and a winery name round. For instance, if a participant saw an 88-point Oakville in the first set of wines, they then saw a 93-point Napa Valley in the second set. After the second winery name round (Round 8), participants received a sample of each of the four wines and submitted a preference rating and then a bid for each wine. We chose not to randomize the order of information categories in the experiment because if participants were familiar with commonly available cabernet sauvignon wines, they could have deduced the specific bottle of wine offered well before all of the information was released, which would have rendered them unresponsive to further information even if that information would normally have influenced their bidding. After receiving information, the participant submitted a bid for each wine. We repeated four rounds of the objective information categories to reveal the different combinations of information. Round 9 provided 20 ml samples of the wines. After smelling and tasting each wine, participants used a 100-point scale to rate the wine according to their preferences, before bidding on each wine a final time.

For each set of wines, we included an initial round (round 1 and 5) with identical information provided for each wine (Cabernet Sauvignon produced within California) to obtain baseline WTP estimates.[2] Information from previous rounds continued to be displayed in subsequent rounds—so that in rounds 3 and 7, participants saw the region and expert rating for each wine—except when participants smelled, tasted, and submitted their own rating for the wines. Here a random number displayed onscreen and on each glass of wine connected the wine to the rating.

[2] It was stated explicitly that this did not refer to the appellation listed on the label; it only meant that the grapes used in the wine were grown in California.

Table 2 summarizes participant data. On average, participants were 36 years old, had a little over 16 years of education, and mean household income of $64,500. Participants reported purchasing an average of 4.5 bottles of wine monthly and spending $11.59 per bottle. They had been purchasing wine for 11 years on average and visited about four wineries per year. Over a quarter of participants stated they had received some type of instruction on wine; nearly half read wine literature. On average, participants received a 63 percent on the wine knowledge quiz.

4. Theoretical framework

The results discussed in the literature review highlight the role of objective knowledge in information processing and sensory categorization, both of which are relevant for consumer decision-making. In this article, we investigate these insights empirically, but first outline a conceptual model based on insights from evaluability theory (Hsee, 1996; Hsee and Zhang, 2010).

We are interested in a situation in which consumers choose among several multi-attribute goods, each of which can be described by a vector of attributes, **z**. Consumers may value these attributes in and of themselves, but we also assume they employ the information embodied in the attributes to construct an expectation of their enjoyment of the good, a notion supported by qualitative research that finds that wine consumers value both intrinsic (sensory) and extrinsic (objective, non-sensory) attributes of wines (Charters and Pettigrew, 2007; Jover et al., 2004). Some product attributes are straightforward to interpret—fuel efficiency in the automobile market or wine expert ratings, for instance—and can be evaluated by innate cognitive constructs. Other attributes, however, such as appellation of origin in the wine market or technical details of digital cameras or computers, are more complex. Consumers may require knowledge to use these complex attributes to form an expectation of their value of the good. General evaluability theory focuses on when and why individuals are sensitive to information (Hsee and Zhang, 2010). The theory proposes two conditions relevant to the examples just given that interact to determine when individuals are sensitive to information: nature and knowledge (Hsee and Zhang, 2010).

In the context of general evaluability theory, nature refers to how easily information about a product or attribute can be evaluated, while knowledge refers to extrinsic expertise or abilities accumulated by consumers. *Nature* describes whether a class of information can be evaluated by inborn psychological or physiological systems (Hsee and Zhang, 2010), or whether the information requires that an individual have acquired knowledge to be able to interpret the information. For instance, although the detailed methods and basis for the formulation of expert ratings are complex and not well known, the ratings themselves, which are expressed on a numeric scale, can be evaluated at a basic level by innate psychological systems, and are therefore more easily evaluated than appellation information, which requires knowledge.

General evaluability theory provides a foundation for hypotheses about willingness to pay for attributes, based on the nature of the attribute and the knowledge that consumers possess. In the following discussion of the valuation of wine by consumers, we index the wine attributes, **z**, according to their complexity, or *nature* (Hsee and Zhang, 2010). For this discussion we use a two-level index, low ("L") and high ("H"), to subscript attribute variables, where low refers to attribute information that can be interpreted by innate psychological or physiological systems, while high requires the possession of knowledge. "Low" attributes are hypothesized to be equally interpretable regardless of κ, while "High" attributes require more knowledge. Expert ratings, expressed on a 100-point scale, and sensory information provided via wine samples are examples of the former class of attribute, while appellations of origin, which are multi-dimensional, conveying reputational and climatic information, and winery names exemplify the latter.

Nature and knowledge interact to formulate two hypotheses we will examine through participants' bids for wines.

Hypothesis 1: Under general evaluability theory, attributes that can be evaluated by inborn psychological or physiological systems can be interpreted by consumers regardless of their level of knowledge. Therefore, we hypothesize that for expert rating or sensory attributes, changes in valuation of the wines in response to release of information about the attributes will be equivalent for low and high knowledge participants: $(\Delta WTP|\kappa = Low) = (\Delta WTP|\kappa = High)$.

Hypothesis 2: Attributes that cannot be evaluated by innate psychological or physiological systems require that consumers have knowledge of the class of attribute to be useful. We hypothesize that for this class of attribute, high knowledge consumers will change their bids more than low knowledge consumers in response to the release of information about appellations of origin or winery names: $|(\Delta WTP|\kappa = Low)| < |(\Delta WTP|\kappa = High)|$.

5. Analysis and results

Rounds 1 and 5 provided participants with information about the attributes common to all four wines to create a baseline level of expectation for participants. We use participants' bids to examine how valuation of a generic California Cabernet Sauvignon varies with knowledge, represented by participants' quiz score (K_i):

$$WTP_{ij,BL} = \beta_{0,BL} + \varphi K_i + \sum_{f=1}^{F} \gamma_c \alpha_{ci} + \varepsilon_{ij,BL}. \quad (1)$$

$WTP_{ij,BL}$ is participant i's bid on bottle j in the baseline round (BL), β_0 is the intercept, and α is a vector of consumer demographic and wine experience characteristics. There are no wine-specific variables in the BL analysis because there were no attributes available to participants that differentiated the wines. This analysis provides evidence about the relationship between knowledge and WTP, and may suggest some of the characteristics that lead consumers to sort into different market segments or capture regular differences in spending habits.

For the remaining rounds, we use the change in bid from the previous round to examine how participants with different levels of knowledge use the information provided in that round to update their bids. The estimating equation then becomes

$$\Delta WTP_{ijt,t-1} = \beta_0 + \sum_{j=1}^{J} \beta_j S_{jt,t-1} + \varphi K_i + \sum_{j=1}^{J} \rho_j \left(S_{jt,t-1} \times K_i\right) + \sum_{c=1}^{C} \gamma_c \alpha_{ci} + \varepsilon_{ijt,t-1}. \quad (2)$$

The change in bid from round t-1 to round t is a function of an intercept, the information available to participants, $S_{jt,t-1}$, participants' wine knowledge, K_i, interactions between knowledge and wine attribute information, demographic characteristics, α_{ci}, and an error term.

Table 3
Random effects regression of the relationship between demographic characteristics, participant knowledge, and baseline bids in Rounds 1 and 5 (Baseline).

Parametric Coefficients (Dependent Variable: WTP)	Parameter Estimate	Standard Error
(Intercept)	1.77	3.07
Female	−0.46	0.52
Age	0.02	0.03
Education	0.12	0.18
Income ($1000 s)	0.02**	0.01
Knowledge (Quiz Score)	1.78	1.63
Adjusted R2	0.18	
N	1728	

Source: Laboratory experiment.
*= p ≤ 0.10 with a two-tailed test.
** =p ≤ 0.05 with a two-tailed test.

5.1. Baseline (BL) round

We first analyze WTP in the baseline round to see whether there is a systematic relationship between valuation and knowledge. Table 3 presents the results from this regression. Quiz score (K) is not a significant factor in explaining BL bids. Though participants with higher K bid more for the bottles of wine than participants with lower scores, the difference was not statistically significant. In fact, only *Income* significantly affected WTP for wines in the BL round. An extra $1000 of income led to bids that were just over $0.02 higher. (We also report results from the regression of baseline bids on these variables as well as a suite of wine-related consumer characteristics in appendix A, Table 1).

We used the BL bids to examine whether there were systematic differences in the valuation of wines associated with wine knowledge and demographic characteristics. Characteristics influencing bid updating in later rounds—when differentiating information is available—could be very different from those influencing the undifferentiated BL bids. Next, we used changes in information and in WTP from one round to the next to see how participants updated their expectations of the wines, beginning with appellation.

5.2. Appellation

For many consumers, the perceived complexity of appellation information is likely to be a function of how widespread and long-lasting the appellation's presence in the market has been. Even casual wine buyers will likely recognize appellations that have long had a wide presence in the market, while only consumers more invested in exploring the wine market will know much about the newer or more obscure regions. We therefore expect that high knowledge participants will update their bids more on average than low knowledge participants given the mix of common and obscure appellations.

The first two columns of Table 4 (Appellation) present the results of the appellation updating regression. The coefficient estimates on the appellation variables were statistically significant and largely as expected. With California as the reference category, the estimated coefficient for Napa Valley was largest, at 2.19, Oakville and Sonoma County had coefficient estimates of 1.70 and 1.74, respectively, and the Knights Valley coefficient was 0.98. Of the demographic variables, only *Age* was marginally statistically significant. The estimated relationship between the change in bid and K was also marginally significant. The K estimate implies that access

Table 4
Random effects regression of the change in WTP and participants' ratings on new wine attribute information and knowledge (K) in region and expert rating rounds.

Information Round	Appellation (ΔWTP)				Expert Rating (ΔWTP)			
	1		2		3		4	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Intercept	−7.42**	1.16	5.41**	1.84	−10.37**	1.98	−8.32	7.01
Female	0.04	0.18	0.04	0.18	0.24	0.18	0.24	0.18
Age	0.02*	0.01	0.02*	0.01	0.02**	0.01	0.02**	0.01
Edu.	−0.05	0.06	−0.05	0.06	0.01	0.06	0.01	0.06
Income ($1000)	0.00	0.00	0.00	0.00	0.003*	0.002	−0.004*	0.002
Knowledge (K)	1.06*	0.57	−19.23**	2.36	−0.29	0.56	−3.05	10.87
Wine Attributes								
Knights V. (KV)	0.98**	0.12	−0.49	0.46	−0.16	0.34	1.53	1.35
Napa V. (NV)	2.19**	0.11	−0.33	0.39	−1.07**	0.25	1.62	1.02
Oakville (OAK)	1.70**	0.13	−3.78**	0.50	−0.15	0.33	2.80**	1.33
Sonoma Co (SC)	1.74**	0.15	0.10	0.56	−0.85**	0.36	1.42	1.41
Not Rated (NR)					0.90**	0.25	0.15	1.02
85 pts					2.21**	0.29	0.71	1.17
88 pts					2.61**	0.24	−0.77	0.94
93 pts					5.22**	0.25	−0.15	0.96
Interaction Terms								
KV x K			2.34**	0.70			−2.98	2.07
NV x K			4.00**	0.60			−4.30**	1.60
Oak x K			8.69**	0.77			−4.92**	2.08
SC x K			2.59**	0.89			−3.69*	2.19
NR x K							1.11	1.60
85 pts x K							2.31	1.82
88 pts x K							5.41**	1.41
93 pts x K							8.64**	1.52
Adj. R2	0.18		0.22		0.28		0.30	
N	1728		1728		1728		1728	

** =p ≤ 0.05 with a two-tailed test. Omitted category is California in appellation regression, Expert Rating 77 points in expert rating regression
* =p ≤ 0.10 with a two-tailed test. Omitted category is California in appellation regression, Expert Rating 77 points in expert rating regression.

to appellation information resulted in larger bid increases for high knowledge participants.

Participants were willing to pay most for Napa Valley, which was closely followed by Sonoma County, Oakville, Knights Valley, and finally California. Oakville, a Napa Valley sub-appellation, and Knights Valley, a Sonoma County appellation, have lower production and tend to sell at higher prices in the market place than the larger appellations (Kwon et al., 2008). On average, participants may have been less familiar with Oakville or Knights Valley. To examine the effects of wine knowledge on valuation, we next interacted K with each individual appellation. These results are presented in the second set of columns in Table 4. Appellation bid-updating results from regressions that include all consumer wine characteristics are reported in appendix A, Table 2.

With knowledge-appellation interaction terms, most of the statistical significance moves from appellation to the interactions between knowledge and appellation. In fact, all of the interaction terms are highly significant and positive. It is worthwhile to reflect on the implication of these results. We found no statistically significant difference in valuation for wine by participant knowledge in the baseline round, implying that preference and knowledge are not highly related.[3] To find, then, such a robust effect of knowledge on WTP for appellations demonstrates that high knowledge participants used the information to update their bids much more than low knowledge participants. The estimates reveal a ranking by WTP for high knowledge consumers of—from highest to lowest—Oakville, Napa Valley, Sonoma County, Knights Valley, and, finally, California. For the lowest knowledge consumers, the implied ranking is Sonoma County, California, Napa Valley, Knights Valley, and Oakville. While Gustafson, Lybbert, and Sumner (2016) found that controlling for consumer sorting on price resulted in insignificant differences in consumer WTP for appellations, given that participants in this research had no other information about the wines at this point, it is likely that appellation acted at least in part as a general reputational variable. We present a graphical depiction of the interacted knowledge-attribute terms across all objective and sensory information rounds in appendix A, Figure 2.

5.3. Expert rating

Participants next received information on the expert ratings awarded by the wine rating publications, the Wine Advocate and the Wine Spectator. Two of the wines included in the experiment were only rated by one of the publications. The expert rating score itself is easily comprehensible; therefore, we expect that knowledge will play less of a role in explaining updating behavior with the release of expert rating information than it did for appellation.

We regressed change in WTP from appellation to expert rating round on expert rating variables, appellation variables (to control for participants' expectations of expert ratings that may have been engendered by the different appellations), demographic characteristics, and knowledge. The results of this regression are presented in column III of Table 4 (Expert Rating). All expert rating parameters are interpreted relative to the reference rating, 77 points, and the omitted appellation parameter is again California. Unsurprisingly, participants increased their bids more for wines receiving higher ratings. The estimated coefficient of Not Rated, for wines that were not reviewed by a magazine, was positive and statistically significant. The point estimate, 0.90, was less than half of

[3] Knowledge is also not statistically significant at any generally accepted level in a regression using WTP from the appellation round.

the value of the estimates for the 85-point wines (2.21), implying that participants expected a rating lying between 77 points and 85 points. The remaining parameter estimates were 2.61 for 88 points and 5.22 for 93 points. Two appellation variables—Napa Valley and Sonoma County—were also significant and negative, which may be attributable to participants' expectations of the ratings that wines from these appellations would receive. If participants expected wines from Napa Valley and Sonoma County to be highly rated, the confirmation of those expectations would not lead to significant changes in WTP, while highly rated wines from an unexpected appellation, like California, would result in higher bid increases. Evidence has been found of consumer expectations of price and expert rating relationships (Hilger et al., 2011), but to our knowledge, this is the first research to document evidence that appellation information creates expectations of expert rating information among consumers. The parameter estimate for knowledge is negatively related to the change in bid after receiving expert rating information, but is not statistically significant.

The analysis with interactions between knowledge and wine attributes suggests again that knowledge plays an important role in the use of objective information to differentiate among wines. High knowledge consumers updated their bids for Napa Valley or Oakville wines significantly less when presented with expert rating information than low knowledge consumers, indicating that knowledgeable participants' appellation-based expectations of the expert ratings these wines received were relatively accurate. High knowledge participants also increased their bids relatively more for the highest rated wines, a finding that holds even when all wine-related consumer characteristics were interacted with the attributes (appendix A, Table 2).

5.4. Winery name

After Expert Rating, participants received information about the winery that produced each wine. Three of the four wineries—Beaulieu Vineyards (BV), Beringer, and Mondavi—have long histories of wine production in Napa Valley and all three produce multiple cabernet sauvignons that are sold at a range of prices, from around $10 to over $100. However, it is less clear what to expect of the relationship between bid updating, wine knowledge, and winery name than for the previous information categories.

The regression—of the change in WTP on winery name variables, demographic characteristics, and K—shows that though participants' bids change based on information provided in this round, fewer of the estimated coefficients—only two—are statistically significant than in previous rounds. Column I of Table 5 (Winery Name) presents the results of this regression. The intercept, with BV as the reference category—was statistically significant, estimated at 2.51. The estimated coefficient for Beringer was -0.69, and statistically significant at normal levels. Neither Mirassou nor Mondavi had statistically significant coefficients. Age (0.013) was the only demographic variable that was even marginally significant. Interaction terms between knowledge and winery names add some explanation. High knowledge participants reduced their bids for Beringer significantly and their bids for Mondavi marginally significantly compared to low knowledge participants.

5.5. Sensory information round

Finally, participants in the experiment had the opportunity to evaluate a 20 ml sample of each wine. The participants' sensory examination of the wines resulted in the generation of two new variables for each wine: a participant rating score (on a 100-point scale), and a monetary bid. Though participants knew that the 20 ml samples were the wines they had evaluated in previous rounds, they received all four samples in a random order, and a randomly generated number matched the glass to the rating entry form on the computer screen. Once the participants submitted their ratings, all of the information about the wines was visible on screen, including their own ratings. They then bid on the wines a final time. Here, we analyze bid updating from the winery name round to the sensory round, with and without knowledge and wine interaction variables. For both of these analyses, the omitted attribute was Beaulieu Vineyards. Results are presented in Table 5, columns 3–6.

Column 3 of Table 5 presents the results of the analysis without interaction terms and without the inclusion of the participant rating each individual gave to each of the wines. Two of the winery dummy variables, Beringer and Mondavi, were significant and negative, suggesting that their sensory-based assessment of these two wines did not meet their expected quality of the wines. Income was also statistically significant, and implied that people with more income reduced their bids after receiving the wine samples. The second analysis—column 4 in Table 5—added interaction terms. Income was still statistically significant and identical to the previous regression, but now both Mirassou and the interaction term between knowledge and Mirassou were statistically significant. The estimates indicate that high knowledge consumers decreased their bids after tasting the Mirassou relative to low knowledge consumers. This result holds with the addition of interaction terms between other wine-related consumer characteristics and attribute variables (appendix A, Table 3).

Next, we added Participant Rating to the regression. With the inclusion of the participants' wine ratings, we accounted for previously unobserved preference heterogeneity. Column 5 presents the results of the regression without interaction terms. Income continued to be significant with a very consistent point estimate (-0.01). Participant rating is highly significant and indicates that consumers increased their bids by $0.17 for each additional point they had awarded each wine. After controlling for preference heterogeneity, all of the wine dummy variables are at least marginally significant. The result implies that holding participants' own rating constant, consumers reduced their bids for all wines relative to the omitted wine, BV. The result is unsurprising since BV received the lowest expert rating score, and expert-rating scores led to significantly higher bids. Holding rating constant, bids for the other wines should decrease relative to BV.

In the final analysis, we included interaction terms between knowledge and winery dummy variables in the regression with participant rating (column 6, Table 5). Both participant rating and income variables were identical to the previous analysis. The wine and knowledge results show that none of the un-interacted or interaction terms were significant at normal levels. Only the interaction term between Mondavi and knowledge was marginally significant, again providing evidence that when we controlled sensory preference, which are typically unobservable, high knowledge consumers were more likely to have formed quality expectations based on the objective information.

Looking across rounds, the majority of significant attribute and knowledge results came with the revelation of appellation and expert rating information. Updating of consumer WTP for attributes reflected general notions of appellation and expert rating valuation, with "prestige" wine producing areas like Napa Valley and Sonoma County and higher expert rated wines attracting larger bid increases.

Interaction terms between knowledge and wine attributes were significant in response to both appellation and expert rating information, though there was no meaningful difference in average bid changes across all wines when participants received appellation or expert rating information. In the appellation round, participants with higher knowledge increased their mean bids across all of the wines more than lower knowledge participants at marginally sig-

Table 5
Random effects regression of the change in WTP and participants' ratings on new wine attribute information and knowledge (K) in winery name and sensory rounds.

	Winery Name (ΔWTP)			Sensory (ΔWTP)		
	1	2	3	4	5	6
Intercept	2.51**	−2.86	−0.25	−4.59	−11.73**	−14.48**
	(1.02)	(2.11)	(1.98)	(3.93)	(1.89)	(3.36)
Female	−0.23	−0.23	0.03	0.03	0.31	0.31
	(0.15)	(0.15)	(0.29)	(0.29)	(0.27)	(0.27)
Age	0.013*	0.013*	0.01	0.01	0.01	0.01
	(0.007)	(0.008)	(0.02)	(0.02)	(0.01)	(0.01)
Edu.	−0.05	−0.05	0.09	0.09	0.14	0.14
	(0.05)	(0.05)	(0.10)	(0.10)	(0.10)	(0.10)
Income ($1000)	0.00	0.00	−0.010**	−0.010**	−0.010**	−0.010**
	(0.00)	(0.00)	(0.003)	(0.003)	(0.003)	(0.003)
Knowledge (K)	−0.61	7.91**	1.15	8.06	0.08	4.44
	(0.48)	(2.96)	(0.92)	(5.49)	(0.86)	(4.53)
Participant Rating					0.17**	0.17**
					(0.01)	(0.01)
Wine Attributes						
Beringer (BER)	−0.69**	1.66**	−0.65**	−0.73	−1.12**	−1.22
	(0.16)	(0.62)	(0.30)	(1.15)	(0.25)	(0.94)
Mirassou (MIRA)	−0.26	0.56	−0.07	2.57**	−0.45*	0.33
	(0.16)	(0.62)	(0.30)	(1.15)	(0.25)	(0.95)
Mondavi (MOND)	−0.03	1.10*	−1.36**	−0.46	−2.08**	−0.58
	(0.16)	(0.62)	(0.30)	(1.15)	(0.25)	(0.94)
Interaction Terms						
BER × K		−3.72**		0.12		0.16
		(0.96)		(1.77)		(1.45)
MIRA × K		−1.31		−4.21**		−1.25
		(0.96)		(1.77)		(1.46)
MOND × K		−1.78*		−1.45		−2.40*
		(0.96)		(1.77)		(1.45)
Adj. R2	0.02	0.02	0.03	0.04	0.28	0.28
N	1728	1728	872	872	872	872

Source: Data from experiment.
** $=p \leq 0.05$ with a two-tailed test. Reported values are coefficients with standard errors in parentheses. Omitted category is Beaulieu Vineyards.
* $=p \leq 0.10$ with a two-tailed test. Reported values are coefficients with standard errors in parentheses. Omitted category is Beaulieu Vineyards.

nificant levels. Knowledge was not statistically significant in explaining bid updating with the release of expert rating information, and low knowledge participants actually increased their bids more in this round. The relationships between knowledge and bid updating in the appellation and expert rating rounds are consistent with our predictions about the effects of knowledge in valuation of appellation and expert rating information.

There are multiple interpretations of the finding that consumers were more responsive to appellation and expert rating information than winery name or sensory information. The information released in later rounds may be inherently less valuable to consumers regardless of knowledge level. However, it may also be that the information released in the later rounds simply aligned with the expectations that appellation and expert rating information had engendered and so only confirmed the bids rather than inducing participants to change them. A third possibility, which we explored with the introduction of the participant rating variable, is that the unobservable consumer characteristics drive the bid changes in these rounds. With participants' typically unobserved preferences included as a regressor, the fit of the model improved substantially, with adjusted R2 increasing from 0.03 to 0.28, and participants' individual ratings were important, indicating that participants increased their bids by $0.17 for a one-unit increase in rating.

6. Conclusions

For many choices that consumers face, myriad sources of objective information are available to inform their decisions. To make a fully informed decision, however, individuals must be able to interpret the information available to them, which may require sophisticated knowledge of the product. As more product variants become available, the information that consumers face increases, requiring additional knowledge. This nexus of information and consumer knowledge can also be a source of contention, as is the case with the GMO labeling debate: Those opposed to these labels worry that consumers with little knowledge about GMOs will read into the GMO label a scientific consensus that GMOs are harmful when in fact the scientific evidence suggests the opposite.

In this research, we examine the relationship between consumers' own wine knowledge, wine valuation and bid updating in a novel bid-updating framework. Results confirm some previously held notions about valuation of wine by consumers, and challenge others. Participants increased their bids for Cabernet Sauvignons from Napa Valley and Sonoma County and sub-appellations of Napa Valley and Sonoma County more than wines labeled with the California appellation. Bids for wines rated by experts such as the Wine Advocate (Robert Parker) or Wine Spectator increased as the experts' ratings increased. However, novel results derive from data that allow us to analyze how participants' knowledge interacted with the piecemeal information they received.

The analysis shows that there are systematic differences in how participants with different levels of wine knowledge update their WTP when new objective information is added. In each of the rounds in which participants received objective information, the inclusion of interaction terms between the wine attributes and participant knowledge tended to shift statistical significance from the uninteracted wine attributes to the knowledge-attribute interaction terms. When participants were given access to 20 ml samples of each wine, we observed further systematic differences in participant-generated ratings for the wines. High knowledge participants decreased bids for the lowest priced wine

significantly compared to low knowledge consumers. We also found evidence that holding participant rating constant, high knowledge consumers were more likely to reduce their bids for Mondavi, the wine awarded the two highest ratings by experts, after we controlled for heterogeneous consumer wine preferences (in the form of their ratings), which most studies are not able to observe.

The results indicate that participants who have more wine knowledge adjusted their WTP more to new information than did those participants with less knowledge. Significant interactions between knowledge and attribute information indicate that high knowledge consumers used attribute information to form expectations of the quality of the wines. For high knowledge consumers, these attributes also created expectations about the realizations of subsequent attributes. For instance, interaction terms suggest that high knowledge participants adjusted their bids for wines more upon their receipt of appellation information than low knowledge consumers. When the expert rating each wine had received was released, high knowledge participants again updated their bids much more than did low knowledge consumers, and analyses indicate that they adjusted their bids to reflect the more refined information offered by expert ratings than the general reputational information carried by appellations. Interestingly, high knowledge consumers did not bid more for wine in the baseline round, implying that there were no fundamental differences in WTP for wine by low and high knowledge participants. It appears that the knowledge variable did capture an increased ability to interpret and use information.

The nested appellation structure allows us to draw some inferences about the effect of knowledge on the ability to interpret information. For instance, Oakville is a sub-appellation of a famous wine-producing area (Napa Valley), but average WTP was higher for the broader Napa Valley appellation. However, when wine knowledge was interacted with the appellation variables, the estimated coefficient for Oakville $\times$ Knowledge was considerably larger than the estimated coefficient on the interaction between Napa Valley and knowledge.

The cumulative findings have important implications for understanding wine markets. In the part of the wine market that we studied, low knowledge consumers differentiated their bids for objective wine attributes less than high knowledge consumers, who change their bids considerably in response to attribute information. Though we only examine preference heterogeneity in the knowledge dimension in this article, the findings provide a potential rationalization of the observation that the upper price range of wine markets supports a disproportionately large diversity of products compared to the lower end of the market. In data from a Northern California supermarket chain, wines under $10 per bottle represented 38 percent of sales by volume, but less than 24 percent of the individual products, while wines over $10 represented 62 percent of sales by volume, but more than 76 percent of products offered. Moreover, wines under $5 per bottle accounted for 5.1 percent of by-volume sales, but only 2.6 percent of products offered, while wines over $30 per bottle accounted for 1.5 percent of sales by volume, but over 10 percent of individual wines in their inventory, a market structure that is consistent with the interaction between preferences and knowledge, in which high knowledge consumers differentiate their valuation based on objective attribute information to a much greater extent than low knowledge consumers.

Our research demonstrates that consumer knowledge systematically explain many differences in valuation, both for objective information such as appellation and expert rating, and for subjective sensory information. Complementing previous research showing that expertise affects ability to process wine information and—to an extent—to discriminate among wines (Lawless, 1984; Solomon, 1990, 1997), we find that these differences carry over into a valuation setting. Though high-knowledge and low knowledge consumers do not value wine differently, valuation of individual wine attributes depends on consumer knowledge.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.socec.2016.08.004.

References

Agnew, J.R., Szykman, L.R., 2005. Asset allocation and information overload: the influence of information display, asset choice, and investor experience. J. Behav. Finan. 6 (2), 57–70.

Ali, H.H., Lecocq, S., Visser, M., 2008. The impact of gurus: parker grades and en primeur wine prices. Econ. J. 118 (529), F158–F173.

Almenberg, J., Dreber, A., 2011. When does the price affect the taste? Results from a wine experiment. J. Wine Econ. 6 (1), 111–121.

Ashenfelter, O., 2008. Predicting the quality and prices of bordeaux wine. Econ. J. 118 (529), F174–F184.

Ashenfelter, O., Storchmann, K., 2010. Using hedonic models of solar radiation and weather to assess the economic effect of climate change: the case of mosel valley vineyards. Rev. Econ. Stat. 92 (2), 333–349.

Bajari, P., Hortacsu, A., 2003. The winner's curse, reserve price, and endogenous entry; empirical insights from eBay auctions. Rand. J. Econ. 34, 329–355.

Ballester, J., Patris, B., Symoneaux, R., Valentin, D., 2008. Conceptual vs. perceptual wine spaces: does expertise matter? Food Qual. Preference 19 (3), 267–276.

Becker, G., DeGroot, M., Marschak, J., 1964. Measuring utility by a single response sequential method. Behav. Sci. 9, 226–236.

Benartzi, S., Thaler, R.H., 2007. Heuristics and biases in retirement savings behavior. J. Econ. Perspect. 21 (3), 81–104.

Bende, M., Nordin, S., 1997. Perceptual learning in olfaction: professional wine tasters vs. controls. Physiol. Behav. 62 (5), 1065–1070.

California Department of Food and Agriculture, 2015. California 2014 Grape Crush Report Final accessed August 3, 2015 at http://www.nass.usda.gov/Statistics_by_State/California/Publications/Grape_Crush/Final/index.asp .

Charters, S., Pettigrew, S., 2007. The dimensions of wine quality. Food Qual. Preference 18 (7), 997–1007.

Combris, P., Bazoche, P., Giraud-Héraud, E., Issanchou, S., 2009. Food choices: what do we learn from combining sensory and economic experiments? Food Qual. Preference 20 (8), 550–557.

Conley, T.G., Udry, C.R., 2010. Learning about a new technology: pineapple in Ghana. Am. Econ. Rev. 100 (1), 35–69.

Cooke, R., Papadaki, A., 2014. Nutrition label use mediates the positive relationship between nutrition knowledge and attitudes towards healthy eating with dietary quality among university students in the UK. Appetite 83, 297–303.

Corrigan, J.R., Rousu, M.C., 2006. Posted prices and bid affiliation: evidence from experimental auctions. Am. J. Agr. Econ. 88 (4), 1078–1090.

Costanigro, M., McCluskey, J.J., Goemans, C., 2010. The economics of nested names: name specificity, reputations, and price premia. Am. J. Agr. Econ. 92 (5), 1339–1350.

Cross, R., Plantinga, A.J., Stavins, R.N., 2011. What is the value of terroir? Am. Econ. Rev. 101 (3), 152–156.

DellaVigna, S., 2009. Psychology and economics: evidence from the field. J. Econ. Lit. 47 (2), 315–372.

Dewan, S., Hsu, V., 2004. Adverse selection in electronic markets: evidence from online stamp auctions. J. Indus. Econ. 52, 497–516.

Drummond, G., Rule, G., 2005. Consumer confusion in the UK wine industry. J.Wine Res. 16 (1), 55–64.

Accessed October 15, 2012 at ERS (United States Department of Agriculture Economic Research Service). Processing and marketing: new products.

Feng, L., Seasholes, M.S., 2005. Do investor sophistication and trading experience eliminate behavioral biases in financial markets? Rev. Finan. 9 (3), 305–351.

Friberg, R., Grönqvist, E., 2012. Do expert reviews affect the demand for wine? Am. Econ. J. 4 (1), 193–211.

Frøst, M.B., Noble, A.C., 2002. Preliminary study of the effect of knowledge and sensory expertise on liking for red wines. Am. J. Enol. Viticulture 53 (4), 275–284.

Grebitus, C., Lusk, J.L., Nayga, R.M., 2013. Explaining differences in real and hypothetical experimental auctions and choice experiments with personality. J. Econ. Psychol. 36, 11–26.

Grunert, K.G., Wills, J.M., Fernández-Celemín, L., 2010. Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. Appetite 55, 177–189.

Grunert, K.G., Wills, J.M., Fernández-Celemín, L., Lähteenmäki, L., Scholderer, J., Storcksdieck genannt Bonsmann, S., 2012. Socio-demographic and attitudinal determinants of nutrition knowledge of food shoppers in six European Countries. Food Qual. Preference 26 (2), 166–177.

Gustafson, C.R., Lybbert, T.J., Sumner, D.A., 2016. Consumer sorting and hedonic valuation of wine attributes: exploiting data from a field experiment. Agr. Econ. 47 (1), 91–103.

Güth, W., Ivanova-Stenzel, R., Königstein, M., Strobel, M., 2003. Learning to bid–an experimental study of bid function adjustments in auctions and fair division games*. Econ. J. 113 (487), 477–494.

Hanoch, Y., Rice, T., Cummings, J., Wood, S., 2009. How much choice is too much? The case of the medicare prescription drug benefit. Health Serv. Res. 44 (4), 1157–1168.
Hilger, J., Rafert, G., Villas-Boas, S., 2011. Expert opinion and the demand for experience goods: an experimental approach in the retail wine market. Rev. Econ. Stat. 93 (4), 1289–1296.
Hsee, C.K., 1996. The evaluability hypothesis: an explanation for preference reversals between joint and separate evaluations of alternatives. Organ. Behav. Hum. Decis. Process. 67 (3), 247–257.
Hsee, C.K., Zhang, J., 2010. General evaluability theory. Perspect. Psychol. Sci. 5 (4), 343–355.
Hughson, A.L., Boakes, R.A., 2002. The knowing nose: the role of knowledge in wine expertise. Food Qual. Preference 13, 463–472.
Iyengar, S.S., Huberman, G., Jiang, W., 2004. How much choice is too much? Contributions to 401 (k) retirement plans. In: Mitchell, O.S., Utkus, S.P. (Eds.), Pension Design and Structure: New Lessons from Behavioral Finance. Oxford University Press, Oxford UK.
Iyengar, S.S., Kamenica, E., 2010. Choice proliferation, simplicity seeking, and asset allocation. J. Public Econ. 94 (7), 530–539.
Iyengar, S.S., Lepper, M.R., 2000. When choice is demotivating: can one desire too much of a good thing? J. Pers. Soc. Psychol. 79 (6), 995–1006.
Jin, G.Z., Leslie, P., 2003. The effect of information on product quality: evidence from restaurant hygiene grade cards. Quart. J. Econ. 118, 409–451.
Jover, A.J., Montes, F.J.L., del Mar Fuentes Fuentes, M., 2004. Measuring perceptions of quality in food products: the case of red wine. Food Qual. Preference 15 (5), 453–469.
Kagel, J.H., 1995. Cross-game learning: experimental evidence from first-price and English common value auctions. Econ. Lett. 49 (2), 163–170.
Kagel, J.H., Levin, D., 1986. The winner's curse and public information in common value auctions. Am. Econ. Rev. 76 (5), 894–920.
Kostandini, G., Mykerezi, E., Tanellari, E., Dib, N.M., 2011. Does buyer experience pay off? Evidence from eBay. Rev. Indus. Org. 39, 253–265.
Kwon, O.S., Lee, H., Sumner, D.A., 2008. Appellation, variety, and the price of California wines. ARE Update 11 (4), 15–19.
Lange, C., Martin, C., Chabanet, C., Combris, P., Issanchou, S., 2002. Impact of the information provided to consumers on their willingness to pay for Champagne: comparison with hedonic scores. Food Qual. Preference 13 (7–8), 597–608.
Lawless, H.T., 1984. Flavor description of white wine by expert and non-expert wine consumers. J. Food Sci. 49, 120–123.
Lee, L., Frederick, S., Ariely, D., 2006. Try it, you'll like it the influence of expectation, consumption, and revelation on preferences for beer. Psychol. Sci. 17 (12), 1054–1058.
List, J.A., 2003. Does market experience eliminate market anomalies? Quart. J. Econ. 118 (1), 41–71.
Lockshin, L., Jarvis, W., d'Hauteville, F., Perrouty, J.P., 2006. Using simulations from discrete choice experiments to measure consumer sensitivity to brand, region, price, and awards in wine choice. Food Qual. Preference 17 (3), 166–178.
Loureiro, M.L., 2003. Rethinking new wines: implications of local and environmentally friendly labels. Food Policy 28 (5–6), 547–560.
Melcher, J.M., Schooler, J.W., 1996. The Mis-rememberance of wines past: verbal and perceptual expertise differentially mediate verbal overshadowing of taste memory. J. Memory Lang. 35, 231–245.
Miller, L.M.S., Cassady, D.L., 2012. Making healthy food choices using nutrition facts panels. The roles of knowledge motivation, dietary modifications goals, and age. Appetite 59, 129–139.
Mueller, S., Lockshin, L., Saltman, Y., Blanford, J., 2010. Message on a bottle: the relative influence of wine back label information on wine choice. Food Qual. Preference 21 (1), 22–32.
Mueller, S., Osidacz, P., Francis, I.L., Lockshin, L., 2010. Combining discrete choice and informed sensory testing in a two-stage process: can it predict wine market share? Food Qual. Preference 21 (7), 741–754.
Mueller, S., Szolnoki, G., 2010. The relative influence of packaging, labelling, branding and sensory attributes on liking and purchase intent: consumers differ in their responsiveness. Food Qual. Preference 21 (7), 774–783.
Rangel, A., 2013. Regulation of dietary choice by the decision-making circuitry. Nat. Neurosci. 16 (12), 1717–1724.
Reinstein, D.A., Snyder, C.M., 2005. The influence of expert reviews on consumer demand for experience goods: a case study of movie critics. J. Indus. Econ. 53 (1), 27–51.
Roth, A.E., Erev, I., 1995. Learning in extensive-form games: experimental data and simple dynamic models in the intermediate term. Games Econ. Behav. 8 (1), 164–212.
Rutström, E.E., 1998. Home-grown values and incentive compatible auction design. Int. J. Game Theory 27, 427–441.
Schwartz, B., 2004. The Paradox of Choice: Why More Is Less. Ecco, New York.
Sela, A., Berger, J., Liu, W., 2009. Variety, vice, and virtue: how assortment size influences option choice. J. Consumer Res. 35 (6), 941–951.
Solomon, G.E.A., 1990. Psychology of novice and expert wine talk. Am. J. Psychol. 103 (4), 495–517.
Solomon, G.E.A., 1997. Conceptual change and wine expertise. J. Learn. Sci. 6 (1), 41–60.
TTB (Alcohol and Tobacco Tax and Trade Bureau), 2015a. Wine Appellations of Origin Accessed August 7, 2015 at http://www.ttb.gov/appellation/index.shtml .
TTB (Alcohol and Tobacco Tax and Trade Bureau), 2015b. Wine Producers and Blenders Permit List Accessed August 7, 2015 at http://www.ttb.gov/foia/frl.shtml.
Verbeke, W., 2005. Agriculture and the food industry in the information age. Eur. Rev. Agr. Econ. 32 (3), 347–368.