Drink Beer for Science: An Experiment on Consumer Preferences for Local Craft Beer

Jarrett Hart
Ph.D. Candidate
Department of Agricultural and Resource Economics
University of California, Davis
jdhart@ucdavis.edu

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Abstract

The U.S. and global beer industries include a great many smaller-scale craft breweries supplying numerous differentiated products as well as a few macro-breweries with less diverse beer portfolios. The craft and macro segments of this industry have become quite distinct, with little substitutability between the two types of beer. Furthermore, the craft segment has realized consistent growth whereas large breweries have seen a steady decline in sales since the early 2000s. Macro-breweries have responded by acquiring smaller breweries in an attempt to capture a share of the craft market. My other (ongoing) research has shown positive consumer preferences for local craft beer and mixed responses to acquisitions, but without controlling for consumer definitions of "local" or knowledge of acquisitions. This study implements an experimental approach to measure consumers' willingness-to-pay (WTP) for locally produced and independently owned beer. During the month of January 2018, customers at a local beer bar were asked to participate in an experiment in which they compare their initial beer selection with ten other beer offerings from the bar, selected at random; they were given some information about location and ownership of the breweries for these selections, details varying among participants. To conclude the experiment, participants were tested for their knowledge of acquisitions. The result is a dataset consisting of consumer demographics and their WTP that is independent of supply side effects. Hedonic analysis clearly indicates that consumers prefer locally owned and independently produced beer, and how much they are willing to pay for those attributes.

Keywords

Other, beer, consumer preferences, willingness-to-pay, choice experiment

Introduction

The craft brewing industry has grown rapidly during the 21st century, as has the number of breweries. The Brewers Association (2016) defines a craft brewery as one producing 6 million barrels of beer or less annually, not being 25% or more owned by a non-craft alcohol industry member, and brewing the majority of its total beverage alcohol volume from traditional or innovative brewing ingredients. In 2017, craft sales amounted to $26.0 billion, accounting for more than 12.7% of U.S. beer sales volume and more than 23.0% of sales value. From 2008 to 2017, the number of craft breweries increased from 1,574 to 6,266 and, between 2004 to 2017, production grew from just over 5 million barrels to more than 25 million (Brewers Association). Meanwhile, beer producers such as Anheuser-Busch and Heineken experienced a decline in sales of their flagship beers—e.g., from 2010 to 2015, sales of Budweiser decreased by 28% and Bud Light by 10% (Forbes). Larger breweries have acquired craft breweries in recent years to capture a share of the growing craft beer segment and negate their diminishing sales—e.g., in 2015 Constellation acquired Ballast Point Brewing Company for $1 billion, and Heineken acquired 50% of Petaluma-based Lagunitas for an undisclosed sum.

It is interesting to see if purchasing craft breweries is an effective approach to penetrate the craft market. If consumers have strong preferences for locally produced or independently owned beer, then the strategy may not be successful. In this study, I seek to determine how consumers' willingness-to-pay (WTP) for beer changes with their knowledge of whether or not a product is independently and locally produced. Hedonic analysis has been used widely to evaluate WTP for attributes of products. However, market data are not only subject to a great deal of unobservable variation, but they also reflect both demand- and supply-side influences on price. Therefore, such data do not truly reflect unbiased estimates of WTP. Experimental economics allows the researcher to control the environment in which individuals make product choices, thereby limiting omitted variables bias and unobservable variation. Furthermore, choice experiments can be designed such that WTP is observed free from any

supply side effects, and such that consumer self-sorting into product spaces, reflecting their preferences, is taken into account. In this setting, consumers might self-sort into a style category such as stouts or sours; WTP pay could be substantially lower for beers outside this category.

I implement a choice experiment in which each participant's initial and uninfluenced selection is compared with ten other beers chosen at random from a bar's tap list. Each participant was asked to state how much he or she would be willing to pay for each of ten randomly chosen beers in order to be indifferent between and the original selection and randomly chosen alternative. Demographic data and measures of their beer knowledge were also collected from each participant. The experiment poses non-hypothetical choices, as the compensation structure may result in participants purchasing one of the alternative beers instead of their original selection. By structuring the experiment in such a way that consumers may actually switch from their original selection, I am able to estimate consumer valuation of beer characteristics and identify self-sorting into different beer style and price segments. Using hedonic analysis and fixed effects modeling of the resulting data, I find that consumers prefer local and certified independent craft beer.

In a companion study (ongoing), using a combination of ratings data from RateBeer.com and weekly sales data from Nielsen, I also find strong evidence that consumers prefer beer that is locally produced by independently owned breweries. In particular, I find compelling evidence that consumers prefer local craft beer, and I show that "local" preferences are negated when local breweries are acquired by well-known, large brewers. However, that study does not account for differences among consumers in their definitions of "local" or their knowledge of acquisitions. "Local" can mean different things to different people, even if they agree on the relevant distance metric. It could mean locally owned or locally produced. For some it could mean that the product is only distributed locally. "Local" could refer to an individual's hometown or previous residence, not just current residence or workplace. In the present study, using experimental data, in addition to checking the findings from the companion

study using sales and ratings data, I aim to examine what constitutes "local" to individuals. The most common phrased used by participants to describe local was "locally produced." Other common phrases included "locally owned," "mile radius," and "northern California."

My companion study found evidence from ratings data of a distinct preference for independently produced beer, but the evidence from sales data was not as clear. Beyond unobservable supply-side influences in the sales data, the discrepancy is also attributable in part to differences in the populations of individuals represented in each dataset; the "beer geeks" that contribute the majority of the ratings are more likely to know and care about acquisitions than the typical consumers who are represented in the sales data. However, the analysis of sales data did demonstrate a difference in responses to acquisitions depending on whether the acquiring company was well known. Negative demand responses were observed when companies with household names such as Heineken, Anheuser-Busch, and MillerCoors acquired craft breweries, but this was not the case when Mahou San Miguel or Constellation Brands acquired breweries. To sort out the differential effect of ownership on WTP between "beer geeks" and average consumers, an acquisition quiz was administered at the end of the experiment. Furthermore, some participants were explicitly told what company owns an acquired brewery to determine if certain companies provoke a greater decrease in WTP than others. "Beer geeks" are found to not value local as highly as average consumers, but they are found to positively value certified craft beer.

Experimental Design

The experiment is designed in the same fashion as that of Gustafson et al. (2016) who estimate consumer valuation of wine varieties and appellations. The Becker-DeGroot-Marschak (BDM) (Becker et al. 1964) method is used to elicit accurate WTP from participants. Participants are told they have a chance to receive a discount of up to $2.00 on their beer purchase. They are asked to state their WTP

for each of ten alternative beers. They are told that each of those ten alternative beers will be assigned a randomly selected experimental price that is up to $2.00 below its actual price and that, at the end of the experiment, one of those ten beers will be selected at random and the participant's WTP will be compared to the experimental price for that beer. If their WTP for that selected beer is higher than the experimental price, the participant is issued a coupon to purchase that beer at the experimental price. This approach incentivizes honesty for two reasons. If individuals overstate their WTP, they may be issued a coupon for a beer that they would not wish to purchase at the experimental price. If they understate their WTP, they may miss the opportunity to receive a discount for a beer they were actually willing to purchase.

The mechanism and incentives were explained to participants before the experiment.[1] To encourage participation, each participant was given a beer tasting glass emblazoned with the slogan: "I drink beer for Science." The gift of the glass was used as a lower cost extrinsic motivation tool, not as a monetary reward, and its message provides intrinsic and image motivation. Individuals get the feeling they are assisting scientific research, and they receive a token to show their peers they have done so. Research has shown that intrinsic motivation can be sufficient for incentivizing research participants (Smith and Walker 1993), that the context in which a participant is selected to participate can be as important as the incentive (Levitt and List 2007), and that the visibility of an individual's contribution can be motivational (Ariely et al. 2009). Additionally, Heymann and Ariely (2004) found that gifts can be more effective than monetary incentives to motivate participants.

[1] Although participants were told they would have a chance to receive a discount of up to $2.00 and that the experimental price would be drawn at random, in every case the experimental price was in fact set $2.00 below the actual price for every beer. Furthermore, if participants stayed with their initial selection, and did not select one of the other ten beers with a $2.00 discount, they were awarded a $2.00 coupon for their initial selection. The minor deception was necessary to comply with the constraint from the Institutional Review Board at the University of California, Davis, which requires that all participants receive identical compensation. Individuals are informed of these truths at the end of the experiment and asked not to divulge the details to other potential participants.

The experiment was held at the "University of Beer" in Davis, California, a bar that exclusively sells beer and cider, boasting a selection of 60 products on tap. Individuals were approached at random, typically before or after they ordered their first drink, told of the experiment, and invited to participate. Participants were instructed to decide which beer they fully intended to purchase next, but to await further instructions before ordering the drink. The following details the systematic procedure for the experiment once an individual agreed to participate.

1. The participant is brought to a computer in the back of the bar to avoid influence or scrutiny from other patrons, since the presence of others can influence a participant's stated preferences (List et al. 2004).
2. Participants begin by providing basic demographic data and information about their beer drinking habits, and any history of rating beers, brewing, or beer-related education.
3. The researcher provides and reads instructions for the experiment. The participant then practices one or more rounds of the experiment, until she is comfortable with proceeding.
4. At this point the choice experiment begins. The participants are divided into three groups, at random, to be given different information about the beers they will be assessing. Twenty-five percent of participants are selected at random, to be given complete information about the beer's alcohol content, rating, brewery location, and ownership; a further twenty-five percent are selected at random to be provided no additional information; the remaining fifty percent are provided some pieces of information, with some randomization of the details.
5. Each participant is asked to assess ten alternative beers, one beer at a time. These ten beers include three beers produced under ownership of a large company, three craft beers from California, and four other craft or imported beers. As much as possible the ten alternative beers are selected to have characteristics in common with the initial choice; and in a similar price range. The price of the beer chosen initially, as well as any information provided on the bar's tap

list are provided on the screen at all times for comparison. The alternative beer has no price listed, instead there is a scroll bar for the participant's willingness to pay. Participants move the bar to the price at which they are indifferent between the original and alternative; the scroll bar is in increments of $0.25, and the starting position is set to that of the originally selected beer. When participants have determined their willingness to pay, they press a confirmation button to move on to the next beer.

6. After all ten beers have been assigned a willingness to pay, the participant completes a quiz and exit survey. The quiz asks the participant to identify the home state (or indicate that it is an import) of each of the beers they assessed, and to go through a list of 20 breweries and identify each of them as craft or non-craft to the best of their knowledge. The survey then prompts the participant to define "local" and to identify which of the beers from the experiment was local by that definition.
7. The computer then shows the discounted experimental price for one of the ten alternative beers, selected at random, and the participant's stated WTP. If the WTP is higher than the experimental price, the participant is issued a coupon to buy the beer at the experimental price. Otherwise, the participant receives a $2.00 coupon for their original selection. In either case, the beer to purchased and its discounted price are written on the coupon, and the participant may return to the bar buy their beer. At this point, to conclude the interview, the participant is given the complimentary tasting glass.

Data

I collected data from 301 unique participants, combining for 3,311 total observations of WTP (i.e., 11 observations per participant; 3,299 observations were useable for analysis). Table 1 provides a few descriptive statistics for the initial beer choice participants made during the experiment. The University

of Beer categorizes available beer into six primary groups: Belgian, Cider, IPA, Light & Other, Sour, and Stout. IPAs constituted the largest share of initial picks, totaling 104 instances, that is 34.6 percent of the initial choices. This share corresponds with the finding from The Brewers Association (2018) that IPA constituted 3.1 percent of the total beer market volume, but 33 percent of craft beer volume. Style choices provide some evidence that the preferences of the sample may be representative of the average craft beer consumer. The initial choices are primarily from California (188 or 62.5%), and those from out of state are typically from other western states or are imported from Belgium or Germany.

Table 2 summarizes a few key demographic characteristics of the participants in the experiment. The median income falls in the range of $20,000−$34,999, and the median age is 26. Julia Herz (2016) from The Brewers Association states that Millennials comprise 57 percent of weekly craft beer drinkers, thus the age and income of the sample appear to be representative of craft beer drinkers in general. Herz (2016) also states in the same article that only 25 percent of weekly craft beer drinkers are women, whereas the sample used in the present study is comprised of more than 40 percent women, which suggests that women might be overrepresented in the sample. However, other market research has reported significant growth in the share of women among craft beer drinkers, and a larger share; a 2016 report from Craft Brewing Business cites women as composing 32 percent of the craft beer market according to a Nielsen Report, and suggests that this share may be growing. Small Business Development Center Network (2018) cites women as accounting for 40.0% of craft beer consumers. The sample used in this study therefore may over-represent women compared with the market as a whole, but it is also possible that the sample reflects the trend of women consuming more craft beer. Furthermore, reflecting the racial composition of the Davis population, the sample is skewed towards Caucasians and Asians, leaving African Americans (1.3 percent of the sample) and Hispanics (12.0 percent of the sample) underrepresented. Herz (2016) states that African Americans and Hispanics encompass 10 percent and 21 percent of weekly craft beer drinkers, respectively.

Craft beer consumption habits of the participants are summarized in Table 3. Participants typically consume craft beer regularly; the median individual spends $20.00 per week on beer on average. The participants are also primarily craft beer consumers; 35.2 percent claim that the majority of beer they consume is craft beer, and 29.6 percent state that the only beer they consume is craft beer. To identify individuals who may be more knowledgeable about craft beer, participants were asked: "do you post beer ratings?" "are you a certified Cicerone?" and "are you a brewer?" The answers reveal that 13.3 percent post beer ratings, 3.0 percent are certified Cicerones, and 11.0 percent brew beer either at home or professionally.

Before delving into the econometric models employed, it is informative to consider some graphical representations of the data on WTP. Figure 1 shows the distribution of WTP for beers considered to be local versus nonlocal as well as participants' original selections. The distribution of the WTP for the initial choice is clearly offset to the right of the other distributions, whereas the distributions of WTP for local and nonlocal beers are quite similar. The distribution of WTP for local beer appears to be slightly to the right of that for nonlocal beer, but econometric analysis is necessary to determine if the difference is economically and statistically significant. As mentioned, the figure reflects what consumers identify as local, not what is geographically local to the place where the experiment took place. Figure 2 breaks down the origin of "local" beers, illustrating the flaw of assuming a universal definition. Participants identified beers from across the country and even internationally as being local. Some of the categorization can be attributed to individuals having moved to the area from other locations, but it is likely that some individuals were simply incorrect as to the home of some breweries. Regardless of whether or not the consumer correctly identifies a beer as being local, the belief that it is local may influence WTP.

Model

An econometric approach is used to determine the effects on WTP of the characteristics of both the participating consumers and the beers they assessed. Fixed effects are included to control for participant-specific variation, such as self-sorting into price segments, price anchoring, and other unobserved characteristics. First, hedonic analysis is used to estimate the marginal prices of attributes for each of the beers assessed in the experiment:

$$price_i = \sum_{s=1}^{S} \beta_s sty_i + \sum_{z=1}^{Z} \beta_z size_i + \sum_{l=1}^{L} \beta_l location_i + \beta_v ABV_i + \beta_r rate_i + \epsilon_i. \quad (1a)$$

$$price_i = \sum_{s=1}^{S} \beta_s sty_i + \sum_{z=1}^{Z} \beta_z size_i + \sum_{b=1}^{B} \beta_b brew_i + \beta_v ABV_i + \beta_r rate_i + \epsilon_i. \quad (1b)$$

Here the tap price of the beer i, $price_i$ is the dependent variable, and the measures of beer-specific attributes include the alcohol content (ABV_i) in % alcohol by volume and several categorical variables: style (sty_i), drink size ($size_i$), location ($location_i$), beer rating ($rate_i$), and brewery ($brew_i$). The purpose of hedonic analysis is to determine if the market values local versus nonlocal beer differently. It is interesting to check if the market capitalizes on consumer preferences for local craft beer, or if prices are determined by other factors such as alcohol content and transportation costs. Equation 1a includes a location variable, whereas equation 1b utilizes brewery-specific fixed effects. Using brewery-specific effects is preferable to including a location categorical variable, as the fixed effects control for any unobservable variations in the beers. However, both models are tried in case there is not enough statistical power, given the fairly small sample size, to obtain statistically significant results when incorporating fixed effects.

Next, the relationship between WTP for beer i by consumer j and their respective attributes is examined. As before, WTP is regressed on either style, size, ABV, and rating (equation 2a), or ABV, rating, and beer-specific effects (equation 2b). Summaries of these variables are provided in Table 4.

Additionally, a vector of consumer characteristics c_j and indicator variables are included that denote whether beer *I* was the initial selection ($init_i$), if it was considered local by participant *j* ($local_{ij}$), and if information was provided to the participant on the acquiring company or type of ownership (own_{ij}). The vector of characteristics includes gender, age, education, income, and a few beer knowledge variables:

$$WTP_{ij} = \sum_{s=1}^{S} \beta_s sty_i + \sum_{z=1}^{Z} \beta_z size_i + \sum_{l=1}^{L} \beta_l local_{ij} + \sum_{q=1}^{Q} \beta_q own_{ij} + \beta_v ABV_{ij} + \beta_r rate_{ij} + \beta_o init_{ij} + \sum_{l=1}^{L} \beta_c v_j + \epsilon_{ij}. \quad (2a)$$

$$WTP_{ij} = \sum_{l=1}^{L} \beta_l local_{ij} + \sum_{q=1}^{Q} \beta_q own_{ij} + \sum_{b=1}^{B} \beta_b beer_i + \beta_v ABV_{ij} + \beta_r rate_{ij} + \beta_o init_{ij} + \sum_{l=1}^{L} \beta_c v_j + \epsilon_{ij}. \quad (2b)$$

In equations 3a and 3b, to control for participant sorting into price segments and any other unobservable consumer characteristics, individual-specific fixed effects I_j are utilized in lieu of the vector of characteristics:

$$WTP_{ij} = \sum_{s=1}^{S} \beta_s sty_i + \sum_{z=1}^{Z} \beta_z size_i + \sum_{l=1}^{L} \beta_l local_{ij} + \sum_{q=1}^{Q} \beta_q own_{ij} + \beta_v ABV_{ij} + \beta_r rate_{ij} + \beta_o init_{ij} + \beta_n I_j + \epsilon_{ij}. \quad (3a)$$

$$WTP_{ij} = \sum_{l=1}^{L} \beta_l local_{ij} + \sum_{q=1}^{Q} \beta_q own_{ij} + \sum_{b=1}^{B} \beta_b beer_i + \beta_v ABV_{ij} + \beta_r rate_{ij} + \beta_o init_{ij} + \beta_n I_j + \epsilon_{ij}. \quad (3b)$$

Some consumers may have prior knowledge of a brewery's location or ownership. Furthermore, those with prior knowledge may value craft beer and local beer more highly on average. The intuition behind this theory is that consumers who take time to learn about their beers and where they come from likely do so because these characteristics contain value. Regardless, the initial estimates are

unbiased estimates of the treatment effects. In equation 4, to discern if there is heterogeneity in the valuation of characteristics, the analysis is replicated with the addition of a beer knowledge variable interacted with the ownership treatment variable:

$$WTP_{ij} = \beta_o init_{ij} + \beta_l local_{ij} + \sum_{q=1}^{Q} \beta_q own_{ij} + \beta_k know_j + \sum_{q=1}^{Q} \beta_{qk} own_{ij} * know_j + \sum_{b=1}^{B} \beta_b beer_i + \beta_v ABV_{ij} + \beta_r rate_{ij} + \epsilon_{ij}. \quad (4)$$

Consumers may sort not only into price segments, but also into style segments. For example, a participant who chose an IPA originally may not be willing to consume sour beers; if cases like this exist, WTP for alternative beers would be biased downward since some participants are asked to provide their WTP for beers in style categories outside their original selection's category. To account for potential style sorting, an indicator variable signifying if a beer is the same style as the original choice is introduced in equation 3 and interacted with the local indicator and ownership treatment variables (equation 5a), and is introduced in equation 4 and interacted with the same variables (equation 5b). A categorical variable for each style could be used in lieu of the same style indicator, but interacting this with the individual fixed effects would likely remove too much variation to allow significant results to be obtained.

$$WTP_{ij} = \sum_{l=1}^{L} \beta_l local_{ij} + \sum_{q=1}^{Q} \beta_q own_{ij} + \sum_{b=1}^{B} \beta_b beer_i + \beta_v ABV_{ij} + \beta_r rate_{ij} + \beta_o init_{ij} + \beta_n I_j + \beta_m sort_{ij} + \sum_{l=1}^{L} \beta_{lm} local_{ij} * sort_{ij} + \sum_{q=1}^{Q} \beta_{qm} own_{ij} * sort_{ij} + \epsilon_{ij}. \quad (5a)$$

$$WTP_{ij} = \sum_{l=1}^{L} \beta_l local_{ij} + \sum_{q=1}^{Q} \beta_q own_{ij} + \sum_{b=1}^{B} \beta_b beer_i + \beta_v ABV_{ij} + \beta_r rate_{ij} + \beta_o orig_{ij} + \beta_k know_j$$
$$+ \sum_{q=1}^{Q} \beta_{kq} own_{ij} * know_j + \beta_m sort_{ij} + \sum_{l=1}^{L} \beta_{lm} local_{ij} * sort_{ij}$$
$$+ \sum_{q=1}^{Q} \beta_{qm} own_{ij} * sort_{ij} + \epsilon_{ij}. \quad (5b)$$

If results indicate heterogeneity exists in WTP based on knowledge, it may be fruitful to determine the average WTP for ownership. By combining the treatment group with those who claim to know if a brewery has been acquired, a pooled acquisition effect can be derived. Equation 6 describes this model; although the average effect of an acquisition on WTP provides valuable insight, the effect is not to be misinterpreted as a treatment effect of being provided with information about ownership.

$$WTP_{ij} = \sum_{l=1}^{L} \beta_l local_{ij} + \beta_q acq_{ij} + \beta_c craft_{ij} + \sum_{b=1}^{B} \beta_b beer_i + \beta_v ABV_{ij} + \beta_r rate_{ij} + \beta_o init_{ij} + \beta_n I_j$$
$$+ \epsilon_{ij}. \quad (6)$$

Results

Hedonic analysis is useful for determining the implicit price of attributes of a product; specifically I check if the market assigns a premium to local beer. Table 4 contains the results from regressing the bar prices of beers on the product attribute space, with and without brewery fixed effects as in models 1a and 1b. Fixed effects control for unobservable price differences at the brewery level, but they disallow the examination of location-specific implicit values. For this reason, discussion here focuses on the model with fixed effects, except when referring to the location variables.

If basic trade theory holds true, and markets are reasonably competitive, spatial patterns in the price of beer should reflect the associated transportation costs, and other sources of differences in

costs. That is, the farther a beer is shipped, the more expensive we would expect it to be. However, at the University of Beer, only beers from Belgium and the U.S. Northeast have significantly higher prices compared to California beers, as seen in Table 5(a). Beers from Germany, the Midwest, Northwest, and West are not statistically significantly more expensive than California beer, and beers from Colorado are actually cheaper. Unobservable quality differences between beers from these different locations, or greater demand for California beer (i.e., local beer) might be driving these price patterns. Table 5(b) presents results from model 1b, which incorporates brewery-specific fixed effects to control for more unobservable variation. In comparison to Belgian style beers, prices for sour beers are significantly higher whereas prices for IPAs and Light and Other beers are significantly lower. As the serving size of the beer increases, so does the price on average. Interestingly, there is no statistically significant price premium for a beer with a high rating, but the price of beer with a low- or medium rating is significantly lower than a beer with no rating.

Initial analysis of the experiment is based on evaluating WTP for local versus nonlocal and certified craft versus non-craft beer. But what constitutes "local"? Participants were asked to define the concept, and a wide range of responses were provided. The most common definitions used the phrases "locally produced" and "locally owned," and many others stated a specific mile radius or region such as "northern California" or "Bay area." Some definitions claimed the beer is only distributed locally, or that the beer is from their hometown. The main takeaway is that consumers have highly variable definitions of the term "local." It might not be possible to incorporate each individual's definition into analysis, so instead beers are considered to be local in estimations if participants specifically identified the beers as such. Table 6 first presents results from regressing WTP on product attributes with no controls (column 1), then with consumer demographic variables incorporated (column 2). Next fixed effects for beer attributes are introduced (column 3); lastly, beer-specific fixed effects are introduced, as in models 2a and 2b (column 4).

Across all four models, the marginal attribute price of being the customer's original beer selection is positive and statistically significant, ranging from $1.24 to $1.48, compared with a mean price of $7.31. The same is true for beers identified as being local; the marginal attribute price ranges from $0.19 to $0.32. The treatment effect of a customer being told a product is Brewer's Association Certified Independent Craft Beer is positive and significant in three of four models, ranging from $0.21 to $0.24. However, when beer-specific fixed effects are utilized, the coefficient on "Certified Craft" becomes much smaller and loses significance. This suggests that the treatment effect is capturing unobservable quality variation in the beers, and that beer-specific fixed effects are necessary to control for omitted variables bias.

The treatment effect of a customer being told a beer is owned by Constellation Brands ranges from –$0.21 to $0.07 and is not statistically significant. The treatment effect of a customer being told a beer is owned by Heineken is negative and statistically significant, devaluing the product by $0.51 in the third model, but the effect is not significant in the other models. The treatment effect of a customer being told that Mahou San Miguel owns the product contradicts expectations for the first model: a surprising positive and statistically significant marginal attribute price of $0.59. The other models do not produce statistically significant results. The treatment effect of a customer being told a product is owned by MillerCoors is negative and statistically significant in three of four models, with the discount ranging from $0.63 to $1.34. When beer-specific fixed effects are utilized, the coefficient loses significance.. The treatment effect of a customer being told a product is produced by a nonbrewery was not statistically significant in any of the models. The treatment effect of a customer being told the ABV of a beer was to increase the WTP between $0.068 and $0.085 on average per percent ABV, across a range of 0.072 to 0.130 ABV.

Next, to control for individual customers sorting themselves into price categories, individual fixed effects are utilized in lieu of demographic variables. The model is tested using beer attribute

variables as well as beer-specific fixed effects, as in models 3a and 3b. To test for heterogeneity across participants in the valuation of product attributes, a beer knowledge variable is introduced as in model 4. Results are provided in Table 7.

Once again, the marginal attribute price of being the customer's original selection is positive and statistically significant in all models, ranging from $1.30 to $1.50. Results are also consistent for beer identified as being local; the marginal attribute price ranges from $0.21 to $0.31. The treatment effect of being told a product is Brewer's Association Certified Independent Craft Beer increases WTP significantly in three of four models, ranging from $0.11 to $0.37. When beer-specific fixed effects are utilized and beer knowledge is introduced, the effect is not statistically significantly different from zero. However, the interaction between the knowledge and treatment variables is positive and statistically significant, increasing WTP by $0.10 to $0.11 per point on the quiz; the base knowledge variable decreases WTP by approximately the same amount.

The treatment effect of a customer being told a beer is imported or owned by Constellation Brands, Mahou San Miguel, or a nonbrewery is not statistically significant. The treatment effect of a customer being told a beer is owned by Heineken is negative and statistically significant, devaluing the product by $0.50 in the first model; the estimate ranges from –0.27 to –0.49 in the other models, but is statistically insignificant. The treatment effect of a customer being told a product is owned by MillerCoors is negative and statistically significant in two of the four models, reducing WTP by $0.56 and $1.44, but when beer-specific fixed effects are utilized, the coefficient loses significance. The treatment effect of a customer being told the ABV of a beer is to increase the WTP by between $0.060 and $0.079 on average per percent ABV.

It is difficult to discern net marginal attribute prices for treatment and local variables based on the level of knowledge. Table 8 helps clarify these results, listing marginal attribute prices for the effects when participant knowledge score is equal to −1, 1, 3, and 5. Knowledge scores are determined by the

twenty-question acquisition quiz: participants receive 1 point for each correct answer, −1 point for each incorrect answer, and 0 points for each omitted answer. In general, as knowledge increases, the marginal attribute prices of the treatment effects become smaller or more negative. Exceptions occur for Heineken and Mahou San Miguel; in both cases WTP increases with knowledge. With exceptions for non-breweries when knowledge is −1 and imports for each level of knowledge, the premiums and discounts for all ownership variables are statistically insignificant.

Consumers probably sort into style segments as well as price segments. To address this issue, treatment and local effects are interacted with a sorting variable that indicates whether each beer is the same style as the original selection as in model 6a. Then to allow for consumer knowledge to be considered, individual fixed effects are dropped and the knowledge variable is interacted with the ownership variable as in model 6b. The results are presented in Table 9.

Results for initial selections and local beers remain consistent with the other models. Customers' WTP for the original selection is positive and statistically significant in each model, ranging from $0.96 to $0.99. Likewise, the marginal attribute price for local beer ranges from $0.20 to $0.54. The estimated treatment effect of a customer being told a product is Brewer's Association Certified Independent Craft Beer is to increase WTP by from $0.26 to $0.57. The knowledge variable decreases WTP by $0.12 per point, and the interaction between knowledge and the Certified Craft variable increases WTP by $0.09 per point.

Treatment effects for a customer being told a beer is imported or owned by Constellation Brands, Heineken, or a nonbrewery are not statistically significant. The treatment effect of a customer being told a beer is owned by Mahou San Miguel is positive and significant in the second and third models, ranging from $0.91 to $1.01. The treatment effect of a customer being told a product is owned by MillerCoors is statistically significant only in the second model, increasing WTP by $0.44.

The effect of a beer being the same style as the original choice is not immediately apparent. In order to illustrate the influence of style sorting on WTP, Table 10 provides the net marginal attribute prices for the treatment and local effects for beers within and outside the original selection's style. Calculations are based on coefficients from the second model which utilized individual fixed effects to control for price segment sorting and anchoring. Except when the beer is an import or owned by Heineken, consumers' WTP is higher for beers within the same style category as their initial choice.

Finally, to test if consumers being knowledgeable mitigated the treatment effects, individuals in the treatment group are combined with those who claimed to have prior knowledge of acquisitions (and appeared not to be guessing). Results are provided in Table 11; coefficients are generally consistent with results in Tables 6−10. There is a statistically significant premium associated with the beer initially chosen, ranging from $1.32 to $1.42; the premium for local beer is also statistically significant, ranging from $0.21 to $0.29. ABV increases WTP by $0.082–$0.098 per percentage point increase in alcohol. When incorporating individual fixed effects to account for style-sorting, there is no significant effect from acquisitions, but there a statistically significant premium for certified craft beer of $0.29. This result suggests that the craft treatment variable was biased downwards in other models due to individuals in the control group having prior knowledge of breweries' classification as craft.

Conclusion

Choice experiments using the BDM method elicit accurate estimations of willingness-to-pay without confounding supply and demand side effects by proposing non-hypothetical choices and incentivizing truthful responses. In this study, such an approach was used to determine willingness-to-pay for local versus nonlocal beer as well as certified independent craft beer versus beer produced by non-craft breweries.

No universal definition of local was adopted for the analysis. Instead, participants identified which beers were local at the end of the experiment. Local could refer to an individual's current location or hometown; furthermore, an individual's definition could refer to a small region or encompass multiple states. Regardless, consumers exhibited preferences for local beer across all models in the study. The marginal attribute price for local ranged from $0.19 to $0.54, but the premium diminished with knowledge of craft beer, eventually becoming a discount. The result suggests that a premium may be assigned to local beers by default, but the better-informed consumers base their WTP on other attributes of the product.

Several breweries have been purchased by large companies over the past few years, sparking outrage amongst the craft beer community. Ratings for acquired beers drop after acquisitions, and numerous angry threads can be found throughout popular online beer forums. However, results suggest that this discontent comes from a vocal minority. When controlling for consumer sorting into price and style categories, the marginal attribute price for certified craft beer was not significantly higher than that for beers produced by some of the larger companies. Additionally, there was no discount associated with any of the beers acquired by non-craft breweries (when controlling for sorting). However, when combining individuals in the treatment group with those who claimed to have prior knowledge of acquisitions , the marginal attribute price for craft beer was indeed positive and statistically significant. This results indicates that those with knowledge of craft beer—i.e. beer geeks—are willing-to-pay more for certified craft beer, but informing consumers that a beer is certified craft does not increase WTP on average.

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Table 1. Initial Beer Choice Summary

Style (Count)		Location (Count)		Ownership (Count)		ABV		Price ($)	
IPA	104	California	188	Craft	215	Mean	0.072	Mean	7.31
Light & Other	72	Oregon	38	Import	34	Min.	0.025	Min.	4.00
Stout	38	Belgium	26	Nonbrewery	25	Max.	0.130	Max.	12.00
Cider	33	Colorado	14	Constellation	15				
Sour	28	Germany	8	MillerCoors	7				
Belgian	26	Other	27	Heineken	5				
Total	301		301		301				

Notes: Style categories are defined by the University of Beer; any beer that does not classify as IPA, Stout, Cider, Sour, or Belgian, is in the "Light and Other" category. There are 301 participants.
Source: Author created using experiment data.

Table 2. Demographics Summary

Income (%)		Age		Sex (%)		Ethnicity (%)	
< $20,000	31.9	Mean	30	Male	56.5	Caucasian	73.2
$20,000–$34,999	21.3	Median	26	Female	41.9	African American	1.3
$35,000–$49,999	10.1	Min.	21	Nonbinary	1.7	Hispanic	12.0
$50,000–$74,999	12.6	Max.	75			Asian/Other	14.0
$75,000–$99,999	7.0					Multiracial	6.0
$100,000–$124,999	5.3						
$125,000–$149,999	5.3						
>=$150,000	5.6						

Notes: Compared to the average craft beer drinker, the experiment sample has a slightly lower income and age on average, and is comprised of more females, Caucasians, and Asians. Income, age, and gender differences fit with trend of changing composition of craft beer drinkers; racial differences conform with the Davis population.
Source: Author created using experiment data.

Table 3. Beer Habits and Experience

Expenditure/Week		Craft vs Macro (%)		Posts Ratings (%)		Cicerone (%)		Brewer (%)	
Mean	$ 29.23	None	2.7	Yes	13.3	Yes	3.0	Professional	1.0
Median	20.00	Not Much	11.3	No	86.7	No	97.0	Home	10.0
Min.	0.00	About Half	21.3					No	89.0
Max.	500.00	Most	35.2						
		All	29.6						

Notes: Majority of sample drinks mostly or entirely craft beer as opposed to import or macro beer. A Cicerone has certified knowledge of beer and beer service as well as competence in identifying beer by taste.
Source: Author created using experiment data.

Table 4. Summary of drawn and initial beers

Style (Count)		Size (Count)		Local (Count)		Ownership (Count)	
IPA	1226	Pint	2439	Not Local	2323	Unknown	1582
Light & Other	1019	10 oz.	728	Local	675	Craft	1086
Stout	389	6 oz.	94	First Beer	301	MillerCoors	223
Cider	287	8 oz.	38			Import	109
Sour	195					Constellation	105
Belgian	183					Heineken	88
						Mahou San Miguel	61
						Nonbrewery	45
Total	3299		3299		3299		3299

Rating (Count)		ABV		WTP ($)	
High	727	Mean	0.070	Mean	6.03
Medium	226	Min.	0.025	Min.	0.00
Local	319	Max.	0.130	Max.	12.00
None	2027				
Total	3299				

Notes: Style categories are defined by the University of Beer; any beer that does not classify as IPA, Stout, Cider, Sour, or Belgian, is in the “Light and Other” category. There are 301 participants and 3311, but only 3299 observations were used in the analysis.
Source: Author created using experiment data.

Table 5(a). Implicit price of beer attributes using hedonic regression, location variables

Intercept	6.752***	Colorado	−0.539***
	(0.617)		(0.117)
Cider	−1.104**	Germany	0.179
	(0.435)		(0.207)
IPA	−0.255	Midwest	0.995
	(0.355)		(0.820)
Light & Other	−0.679*	Northeast	0.503*
	(0.369)		(0.267)
Sour	0.827**	Northwest	−0.030
	(0.380)		(0.184)
Stout	−0.377	West	0.153
	(0.360)		(0.289)
6 oz.	−0.133	ABV	11.161**
	(0.445)		(5.255)
8 oz.	−0.411	High Rating	−0.313*
	(0.292)		(0.160)
16 oz.	0.492**	Medium Rating	−0.827***
	(0.227)		(0.194)
Belgium	1.821***	Low Rating	−0.596***
	(0.347)		(0.179)
R-Sq., F: 0.4645, 14.70			

Notes: *** denotes significance at 1%, ** at 5%, * at 10%. Numbers in parentheses denote standard errors.

Source: Author created using experiment data.

Table 5(b). Implicit price of beer attributes using hedonic regression, brewery fixed effects

Cider	NA
	NA
IPA	−2.004***
	(0.253)
Light & Other	−1.701***
	(0.274)
Sour	4.526***
	(0.409)
Stout	0.197
	(0.348)
6 oz.	−2.231***
	(0.602)
8 oz.	NA
	NA
16 oz.	0.919***
	(0.194)
ABV	21.593***
	(3.792)
High Rating	−0.289
	(0.215)
Medium Rating	−0.593***
	(0.088)
Low Rating	−0.749***
	(0.278)
R-Sq., F: 0.8606, 24.44	

Notes: *** denotes significance at 1%. Numbers in parentheses denote standard errors.
Source: Author created using experiment data.

Table 6. WTP for Local and Acquired Beer

	Model 1	Model 2	Model 3	Model 4
Intercept	5.827***			
	(0.066)			
First	1.485***	1.458***	1.389***	1.242***
	(0.094)	(0.098)	(0.094)	(0.108)
Local	0.317***	0.275***	0.227***	0.186**
	(0.085)	(0.084)	(0.084)	(0.090)
Certified Craft	0.242***	0.224***	0.214**	0.076
	(0.088)	(0.086)	(0.105)	(0.109)
Constellation	0.070	0.030	−0.214	−0.084
	(0.203)	(0.194)	(0.214)	(0.274)
Heineken	−0.370	−0.398	−0.509*	−0.132
	(0.263)	(0.256)	(0.271)	(0.360)
Import	0.245	0.251	0.057	−0.540*
	(0.230)	(0.227)	(0.248)	(0.280)
Mahou	0.594**	0.445	0.022	0.303
	(0.263)	(0.288)	(0.304)	(0.463)
MillerCoors	−1.312***	−1.339***	−0.625***	−0.081
	(0.155)	(0.153)	(0.164)	(0.201)
Nonbrewery	0.028	−0.180	1.737	0.202
	(0.335)	(0.362)	(3.036)	(0.453)
ABV			6.754*	8.526**
			(3.793)	(3.950)
Fixed Effects		Demo.	Demo., Size, Style, Rating	Demo., Beer, Rating
R-Sq., F	0.0692, 28.25	0.1345, 17.57	0.1769, 16.62	0.1988, 5.84

Notes: *** denotes significance at 1%, ** at 5%, * at 10%. Numbers in parentheses denote standard errors.

Source: Author created using experiment data.

Table 7. WTP for Local and Acquired Beer Controlling for Price Sorting and Knowledge

	Model 1	Model 2	Model 3	Model 4
Intercept			5.951***	
			(0.070)	
First	1.502***	1.306***	1.502***	1.295***
	(0.117)	(0.128)	(0.096)	(0.105)
Local	0.265***	0.208**	0.309***	0.254***
	(0.075)	(0.086)	(0.084)	(0.091)
Certified	0.365***	0.247**	0.111***	−0.020
Craft	(0.097)	(0.101)	(0.102)	(0.128)
Constellation	0.024	0.062	−0.018	−0.164
	(0.180)	(0.238)	(0.249)	(0.323)
Heineken	−0.504**	−0.285	−0.493	−0.268
	(0.243)	(0.309)	(0.325)	(0.422)
Import	0.088	−0.285	0.145	−0.707**
	(0.237)	(0.309)	(0.260)	(0.307)
Mahou	0.063	0.486	0.430	0.278
	(0.251)	(0.379)	(0.334)	(0.500)
MillerCoors	−0.556***	0.141	−1.443***	−0.294
	(0.151)	(0.182)	(0.173)	(0.224)
Nonbrewery	0.473	−0.037	0.023	0.465
	(0.331)	(0.412)	(0.377)	(0.458)
ABV	5.994*	7.854**		7.688*
	(3.265)	(3.363)		(3.976)
Knowledge			−0.107***	−0.116***
			(0.026)	(0.026)
Certified			0.107***	0.100***
Craft*Know.			(0.036)	(0.036)
Constellation			0.087	0.096
*Knowledge			(0.073)	(0.074)

Heineken			0.108	0.145
*Knowledge			(0.107)	(0.110)
Import			0.089	0.079
*Knowledge			(0.059)	(0.062)
Mahou			0.128	0.132
*Knowledge			(0.096)	(0.970)
MillerCoors			0.113*	0.108*
*Knowledge			(0.058)	(0.057)
Nonbrewery			−0.055	−0.017
*Knowledge			(0.155)	(0.180)
Fixed Effects	Size, Style, Rating, Individual	Beer, Rating, Individual		Beer, Rating
R-Sq., F	0.3944, 7.65	0.4167, 6.32	0.0752, 26.26	0.1353, 4.42

Notes: *** denotes significance at 1%, ** at 5%, * at 10%. Numbers in parentheses denote standard errors.

Source: Author created using experiment data.

Table 8. Marginal Attribute Prices for Treatment and Local Beer, by Knowledge Level

	Knowledge = −1		Knowledge = 1		Knowledge = 3		Knowledge = 5	
	Not Local	Local	Not Local	Local	Not Local	Local	Not Local	Local
Base	0.116***	0.370***	−0.116***	0.138	−0.348***	−0.094	−0.580***	−0.326*
	(0.026)	(0.095)	(0.026)	(0.095)	(0.026)	(0.095)	(0.026)	(0.095)
Original	1.411***		1.179***		0.947***		0.715***	
	(0.108)		(0.108)		(0.108)		(0.108)	
Craft	−0.004	0.250	−0.035	0.218	−0.067	0.187	−0.099	0.155
	(0.134)	(0.163)	(0.135)	(0.163)	(0.135)	(0.163)	(0.135)	(0.163)
Constellation	−0.143	0.111	−0.184	0.070	−0.224	0.029	−0.265	−0.011
	(0.332)	(0.344)	(0.332)	(0.344)	(0.332)	(0.344)	(0.332)	(0.344)
Heineken	−0.297	−0.043	−0.239	0.015	−0.181	0.073	−0.122	0.131
	(0.447)	(0.456)	(0.447)	(0.456)	(0.4467)	(0.456)	(0.447)	(0.456)
Import	−0.670**	−0.416	−0.744**	−0.490	−0.818***	−0.564*	−0.892***	−0.638*
	(0.314)	(0.327)	(0.314)	(0.327)	(0.314)	(0.327)	(0.314)	(0.327)
Mahou	0.261	0.515	0.294	0.548	0.327	0.581	0.360	0.614
	(1.091)	(1.094)	(1.091)	(1.094)	(1.091)	(1.094)	(1.091)	(1.094)
MillerCoors	−0.286	−0.032	−0.302	−0.048	−0.318	−0.065	−0.335	−0.081
	(0.232)	(0.240)	(0.232)	(0.245)	(0.232)	(0.250)	(0.232)	(0.250)
Nonbrewery	0.598	0.852*	0.331	0.585	0.065	0.318	−0.202	0.052
	(0.493)	(0.501)	(0.493)	(0.501)	(0.493)	(0.501)	(0.493)	(0.501)

Notes: *** denotes significance at 1%, ** at 5%, * at 10%. Numbers in parentheses denote standard errors.
Source: Author created using experiment data.

Table 9. WTP for Local and Acquired Beer Controlling for Category Sorting

	Model 1	Model 2	Model 3
First	0.987***	0.958***	0.967***
	(0.147)	(0.128)	(0.105)
Local	0.196	0.451***	0.543***
	(0.188)	(0.148)	(0.173)
Certified Craft	0.261	0.573***	0.280
	(0.235)	(0.181)	(0.215)
Constellation	0.181	0.449	0.237
	(0.346)	(0.312)	(0.390)
Heineken	−0.304	0.314	0.541
	(0.468)	(0.424)	(0.501)
Import	−0.729	0.202	−0.321
	(0.454)	(0.431)	(0.467)
Mahou	0.443	0.908**	1.006*
	(0.620)	(0.458)	(0.553)
MillerCoors	0.109	0.439**	0.146
	(0.315)	(0.214)	(0.244)
Nonbrewery	0.557	−0.627	−0.916
	(0.490)	(0.569)	(0.705)
ABV	6.230	8.064**	7.933**
	(4.020)	(3.329)	(3.953)
Knowledge			−0.115***
			(0.025)
Certified Craft *Knowledge			0.093***
			(0.036)
Constellation *Knowledge			0.068
			(0.072)
Heineken *Knowledge			0.148
			(0.107)
Import			0.081

*Knowledge			(0.064)
Mahou			0.142
*Knowledge			(0.104)
MillerCoors			0.105*
*Knowledge			(0.056)
Nonbrewery			0.214
*Knowledge			(0.160)
Sort		1.273***	1.161***
		(0.135)	(0.155)
Local*Sort	−0.086	−0.373**	−0.450**
	(0.208)	(0.166)	(0.199)
Certified Craft	−0.100	−0.442**	−0.355
*Sort	(0.260)	(0.187)	(0.218)
Constellation	−0.389	−0.715**	−0.539
*Sort	(0.379)	(0.334)	(0.410)
Heineken	−0.322	−1.037**	−1.422***
*Sort	(0.555)	(0.463)	(0.536)
Import*Sort	0.211	−0.667	−0.435
	(0.486)	(0.485)	(0.515)
Mahou*Sort	0.097	−0.777	−1.286**
	(0.640)	(0.478)	(0.578)
MillerCoors	−0.445	−0.859***	−1.129***
*Sort	(0.372)	(0.279)	(0.329)
Nonbrewery	0.371	1.228**	1.894***
*Sort	(0.491)	(0.579)	(0.710)
Fixed Effects	Beer, Rating, Ind.*Style	Beer, Rating, Individual	Beer, Rating
R-Sq., F	0.5292, 3.80	0.4486, 6.94	0.1648, 5.07

Notes: *** denotes significance at 1%, ** at 5%, * at 10%. Numbers in parentheses denote standard errors.

Source: Author created using experiment data.

Table 10. Marginal Attribute Prices for Treatment and Local Beer, Controlling for Category Sorting

	Different Category		Same Category	
	Not Local	Local	Not Local	Local
Base		0.451***	1.273***	1.351***
		(0.148)	(0.135)	(0.260)
Original	0.958***			
	(0.128)			
Craft	0.573***	1.024***	1.404***	1.482***
	(0.181)	(0.233)	(0.293)	(0.365)
Constellation	0.449	0.900***	1.007**	1.085**
	(0.312)	(0.345)	(0.476)	(0.525)
Heineken	0.314	0.764*	0.550	0.628
	(0.424)	(0.449)	(0.642)	(0.680)
Import	0.202	0.653	0.808	0.886
	(0.431)	(0.455)	(0.662)	(0.698)
Mahou	0.908**	1.359***	1.404**	1.482**
	(0.458)	(0.481)	(0.676)	(0.711)
MillerCoors	0.439**	0.890***	0.854**	0.932**
	(0.214)	(0.260)	(0.376)	(0.437)
Nonbrewery	−0.627	−0.176	1.873**	1.951**
	(0.569)	(0.586)	(0.822)	(0.851)

Notes: *** denotes significance at 1%, ** at 5%, * at 10%. Numbers in parentheses denote standard errors.

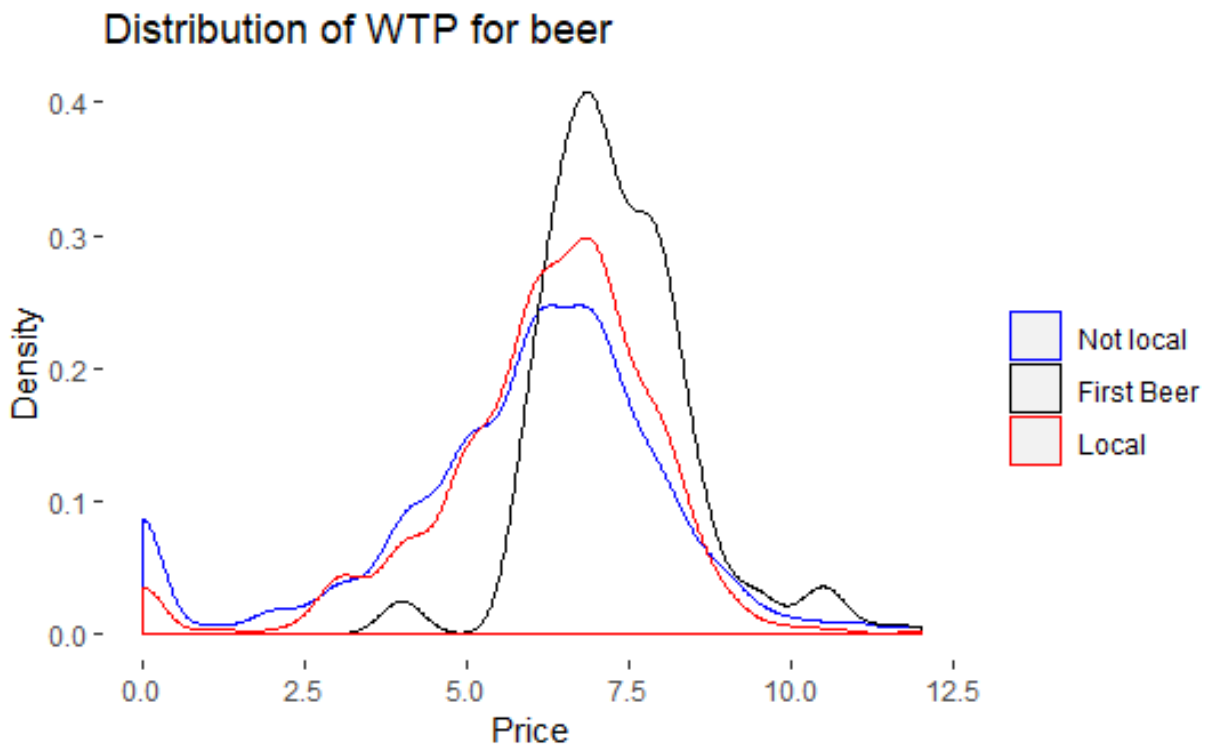
Source: Author created using experiment data.

Table 11. WTP for Local and Acquired Beer, with Treatment on Untreated

	Model 1	Model 2	Model 3
First	1.419***	1.321***	1.353***
	(0.091)	(0.104)	(0.127)
Local	0.293***	0.269***	0.211***
	(0.085)	(0.091)	(0.081)
Know Acq.	−0.482***	−0.041	0.187
	(0.121)	(0.156)	(0.133)
Know Craft	0.154	0.107	0.286***
	(0.102)	(0.112)	(0.097)
ABV	8.182**	9.790**	8.459**
	(3.733)	(3.839)	(3.318)
Fixed Effects	Size, Style, Rating	Beer, Rating	Beer, Rating, Individual
R-Sq., F	0.1074, 23.04	0.1274, 4.49	0.4167, 6.38

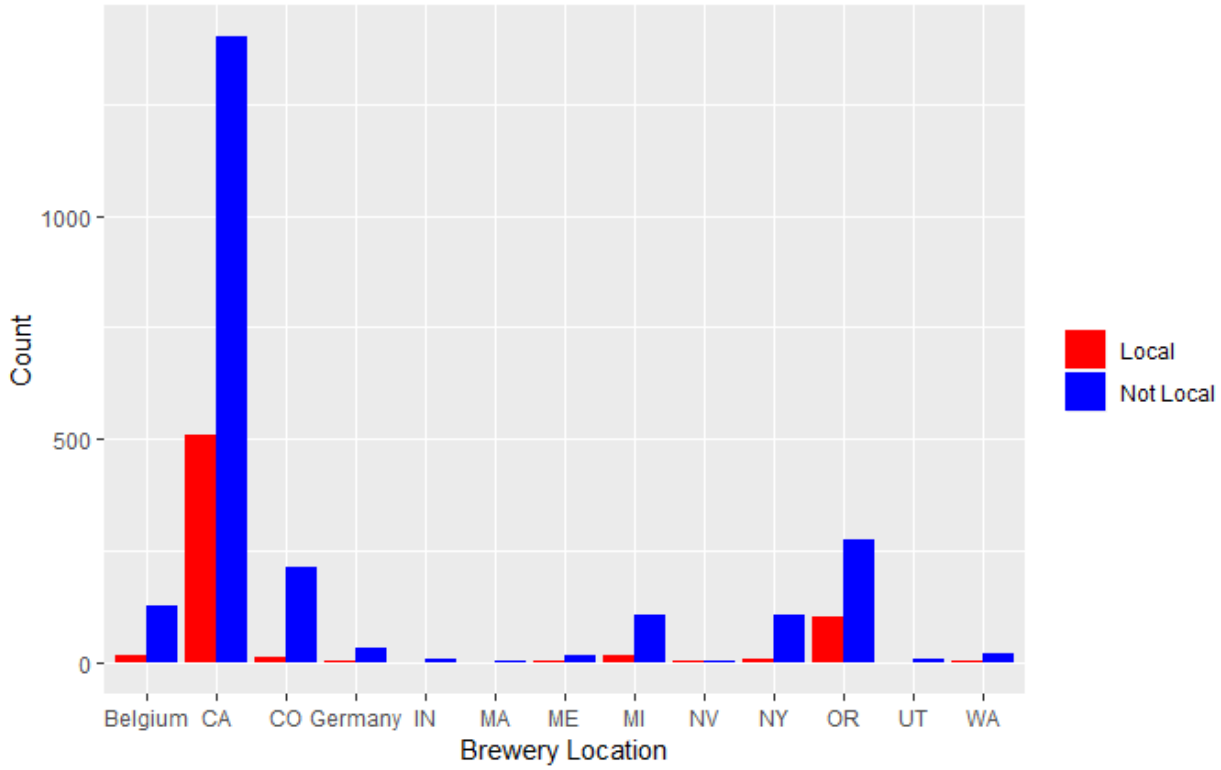
Notes: *** denotes significance at 1%, ** at 5%, * at 10%. Numbers in parentheses denote standard errors.

Source: Author created using experiment data.



Notes: Beers are considered to be local if identified as so by the participant.
Source: Author created using experiment data.

Figure 1. Distribution of WTP for local, nonlocal, and original selections



Notes: Beers are considered to be local if identified as so by the participant.
Source: Author created using experiment data.

Figure 2. Count of local and nonlocal beers, by state and country