Scraping the Bottom of the Beer Barrel:
Consumer Preferences for Localness and Responses to Brewery Acquisitions

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ABSTRACT. The U.S. beer industry has shifted dramatically over the past two decades from a highly concentrated and homogeneous industry to one composed of thousands of small, heterogeneous producers, primarily focused on local markets. This shift evokes the question: how much do consumers prefer locally produced craft beer? I use large, newly developed datasets, based on beer reviews and observations of weekly sales, to explore the market for craft beer in America and address this question. Analysis of ratings data provides clear evidence of preferences for local and independently owned craft beer among avid craft beer drinkers. Examination of sales data extends these results to the general U.S. population, also showing that consumer demand is less price elastic for local beer than nonlocal beer. In econometric analysis, "natural experiments" created by mergers and acquisitions act as exogenous shifts in localness, and they are found to cause reductions in ratings but mixed changes in demand. Finally, ratings and sales are combined to infer an implicit value for local preferences.

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Researcher(s) own analyses calculated (or derived) based in part on data from The Nielsen Company (US), LLC and marketing databases provided through the Nielsen Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the Nielsen data are those of the researcher(s) and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.

1 Introduction

The U.S. beer industry comprises many breweries supplying numerous differentiated products, as well as a few macro-breweries with less diverse beer portfolios. 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 (flavored malt beverages are not included). The craft and macro segments of this industry have become quite distinct and segmented, with little substitutability between the two, and divergent market trajectories. Specifically, the craft segment has realized consistent growth during the 21st century whereas large breweries have seen a steady decline in sales.

In 2016, craft beer sales rose by 10% to $23.5 billion, accounting for 12.3% of U.S. beer sales volume and 21.8% of sales value. From 2008 to 2016, the number of craft breweries increased from 1,574 to 5,234 (Brewers Association). Brewers Association depicts this growth in Figure 1, which shows production of craft beer by brewery type from 2004 to 2017; production grew from just over 5 million to over 25 million barrels in that time. In recent years, microbreweries (craft breweries that produce under 15,000 barrels annually) have been the primary driver of this growth. In the past few years, production from regional breweries (craft breweries that produce more than 15,000 barrels annually) declined, partially because craft breweries in this category were acquired by macro-breweries. Beer producers such as Anheuser-Busch and Heineken experienced a decline in sales of their flagship beers in recent years. For example, from 2010 to 2015, Budweiser sales volume decreased by 28% and Bud Light decreased by 10% (Forbes). Larger breweries have acquired regional craft breweries in recent years in an attempt to capture a share of the growing craft segment and negate their diminishing sales—e.g., Constellation Brands acquired Ballast Point Brewing Company for $1 billion in 2015. Table 1 lists all craft brewery acquisitions by large breweries since 2008.

[Figure 1. Craft Beer Production]

[Table 1. Brewery acquisitions]

In this paper, I focus on one primary research question: "do consumers prefer locally produced beer?" I explore multiple avenues to shed light on this question. First, do consumers rate local beers higher on average, all else equal? Consumer ratings of beers are used to estimate preferences for localness. The ratings come from RateBeer.com and consist of approximately 3.4 million ratings from more than twenty-three thousand users. Fixed effects regressions of ratings on varying definitions of "local" controlling for user, temporal, and brand level effects are used for this analysis. The results clearly indicate that individuals prefer locally produced beer.

Second, is demand for local beer less price elastic? Responses to price changes are evaluated using time-series, store-level data. Sales data allow me to check if preferences seen in ratings materialize in the market. The data are from Nielsen and are composed of more than one billion store-level weekly observations of UPC-specific sales. Once again fixed effects regressions are used, with spatial, temporal, store- and brand-specific demand shifters to estimate demand response to price and other characteristics. The results indicate heterogeneous shifts in demand depending on the acquiring company, and that the own-price elasticity of consumer demand is smaller for local craft beer brands.

Third, if a preference for localness reflects not just the proximity of production, but also the fact that the brewery is locally owned and operated, then observations of demand response to acquisitions present an additional avenue for testing local preferences. That is, does the acquisition of a craft brewery by a macro-brewery cause a decline in the preference for beer from that brewery, negating localness? Ratings data provide observations of quality separate from other attributes, and they allow for a check of the degree to which perceptions change following acquisitions. Sales data allow for a check if acquisitions result in demand shifts. Using a difference-in-differences approach with the above estimation strategies, I find that post-acquisition ratings fall to a greater extent locally than nonlocally.

That is, acquisitions negate any localness effect on perceived quality that previously existed. However, analysis of sales provides mixed evidence of a reduction in demand in response to acquisitions.

Finally, can an implicit value be assigned to a preference for localness? An implicit value is the difference in equilibrium price in the local market relative to all other markets, and is determined by combining ratings and sales data and performing an hedonic analysis. Results show that a positive implicit value exists in some states, but there is a great deal of heterogeneity across the United States.

This paper contributes findings from exploiting two large, newly developed datasets to study craft beer. Results are specific to craft beer, but they are also applicable in a much broader sense. The general context is consumer demand for highly differentiated and local products, a topic that hitherto has typically been limited to studies using small survey samples in the economics literature. Results specific to craft beer are pertinent to consumer preferences for other goods such as locally produced wine or even locally grown produce. This study also contributes to the literature on market power in food and beverage markets. Craft beer appears to be an instance of monopolistic competition in which market power is being exercised in local markets; consumers rate local beers higher, and we can observe that consumers pay and breweries charge a significant local premium. Without measuring consumer preferences using ratings, I would not be able to identify a local premium indicating potential market power.

2 Review of Literature

Studying preferences for local products is not new, but the existing economic literature on consumer preferences for localness relies on small survey samples. This study makes use of large datasets to build upon the literature. Economic literature on consumer responses to acquisitions is virtually nonexistent. However, some limited marketing and management literature on the subject does exist. This study bridges that literature to an economic context. A brief economics literature has developed on craft beer

preferences and demand, as well as the use of beer ratings data. A second contribution of the present study is to expand the literature on analysis of demand for beer by deriving brand level own-price elasticities of demand for craft beer, specific to local and nonlocal products. Most of the previous work focuses on elasticities of demand for entire beer segments, and none of the studies provides brand level elasticities of demand for craft beer; nor do they distinguish the effect of localness on these measurements.

Yue and Tong (2009) and Meas (2014) both study consumer willingness-to-pay (WTP) for local produce (tomatoes and blackberry jam). Both studies are able to find the WTP for local products, but they rely on small survey samples. The current study extends the literature on WTP for local products by examining large datasets on ratings and sales, deriving elasticities of demand for local versus nonlocal products, and calculating an implicit value for localness.

Štrach and Everett (2006) and Bradley (2013) examine consumer responses to acquisitions and mergers in the case of luxury automobiles. Both studies find that while firms making acquisitions may benefit from advantages of economies of scale and scope, they may suffer from “brand corrosion.” Bradley defines this phenomenon as "evaporation of distinctive features, attempts to appeal to new customer segments while not building on brand heritage, and boosting production figures through less expensive models or reduced attention to quality” (2). Consumer perceptions of luxury brands become influenced by commonality with the acquirer’s mass-market brand, causing the product to be less appealing. Similarly, an acquired craft beer might lose its appeal of localness and uniqueness, leading to it becoming perceived as yet another mass-produced beer in the acquirer’s portfolio. The present study tests the theory of brand corrosion using ratings data and treating acquisitions as “natural experiments.”

Aquilani, et al. (2015) conduct an experiment that investigates consumer preferences for craft versus macro-beer in Italy. They use a probit model to determine the probability of an individual becoming a craft beer consumer, taking into account several socio-demographic characteristics of the

consumers and qualitative attributes of the beer and. Survey respondents rate the importance of quality and other characteristics of beer to their purchasing decisions on 6 a point scale. They find that craft beer is perceived to be of higher quality than macro-beer, and that higher price is associated with higher quality. However, their sample is limited to only 444 individuals, their style classifications are quite broad, and they do not consider any "localness" effect. The current study estimates a price premium or discount associated with ratings to determine if higher prices are associated with higher quality, and the study is not limited by sample size.

Clemons, Gao, and Hitt (2006) use RateBeer reviews and Brewers Association sales data to determine the relationship between ratings and sales growth using a fixed effects ordinary least squares (FE-OLS) approach. The study is limited in comparison to the present one by having only 281,868 observations of ratings and 484 observations of annual sales; the current study links ratings to more detailed sales data, and takes localness into account as a determinant of ratings or sales.

Numerous studies have been published reporting estimates of elasticities of demand for macro-beer, but very few studies have reported elasticities of demand for craft beer. Rojas and Peterson (2008) use a linear approximation of the Almost Ideal Demand System (AIDS) model that incorporates the Distance Metric method to obtain estimates of own- and cross-price elasticities of demand for macro-beer brands conditional on total beer expenditure. The median own-price elasticity is −3.53 and the median cross-price elasticity is 0.05. Although the median is quite elastic, the own-price elasticity ranges from −1.165 to −16.13 in a sample of 17 of their 64 studied brands, with demands for more popular brands typically less elastic.[1] Toro-González, et al. (2014) analyze demand for beer as a differentiated product and estimate unconditional own- and cross-price and income elasticities of demand for beer by

[1] In terms of the Slutzky equation, this own-price elasticity is decomposed into the substitution and income effects—income is total expenditure on beer in this case. Although the authors do not provide all estimates, it appears the own-price elasticity is dominated by the substitution effect for more popular brands, but for other brands it is dominated by the income effect. This result is probably an artifact of the functional form of the model.

type (craft, mass, and imported) using discrete choice multinomial logit and nested logit models. They also cite own-price and income elasticities from other studies, as summarized by Tremblay and Tremblay (2005). Own-price elasticities vary from −0.142 and −0.889 in the literature, and Toro-González, et al. report an estimate of −0.177 for overall own-price elasticity of demand for beer. Specifically, the own-price elasticity is −0.126 for mass, −0.212 for craft, and −0.225 for imported beer. Cross-price elasticities are close to zero. None of these studies provides brand level estimates of own-price elasticities of demand for craft beer, but Kleban and Nickerson (2011) claim that, compared with other beers, demands for craft beer should be less elastic because they have additional valued product features. In this study, I estimate the average brand-level, own-price elasticity of demand for local and nonlocal craft beer.

3 Ratings

Using ratings from consumer reviews, I am able to estimate consumer preferences for locally produced beers. I find that this preference exists and identify the magnitude of the preference. Using acquisitions as an exogenous shock to localness, I find additional evidence of a preference for localness. I am able to determine if and to what extent the acquisition of a craft brewery by a macro-brewery causes a change in consumer perceptions of the quality of beer brands from the acquired craft brewery. Acquisitions result in a decrease in the average rating for beers, and this decrease is more pronounced for local reviewers. These findings are clear evidence that part of the appeal of craft beer is its small-scale production and localness to consumers, attributes that are lost when a macro-brewery gains ownership of a craft brewery. The preference for localness is not strictly based on proximity of production, but rather attributable to a beer being locally produced and independently owned. I conjecture that negative reactions following an acquisition reflect a change in the perception of quality; sales data are

used later in this paper to bolster the finding that acquisitions induce a change in consumer perceptions of craft beer brands.

3.1 Data

My analysis is based on consumer reviews of beers from RateBeer.com. RateBeer is a website in which individuals can post reviews of beers they consume. By scraping this data, I obtained access to over three million reviews recorded by more than twenty-three thousand distinct users between 2000 and 2016. Each observation consists of the name, style, and alcohol content of the beer, the name and location of the brewery, the user ID and location of the reviewer, date of the rating, and the score (on a scale of 0.5–5.0). The score is a composite rating based on the aroma, appearance, taste, and palate of the beer. The detail of the data allows us to determine the preference for localness and the effect of an acquisition on preferences while controlling for individual user, temporal, and beer-specific effects. Ratings are available from 2000 until the present. I am able to examine the consequences of 14 acquisitions of craft breweries by large companies and breweries during this time. Figure 2 depicts a specific review from RateBeer. The mean rating in the sample of three million reviews is 3.46 and the median is 3.50 compared with a maximum of 5.00.

[Figure 2. Sample]

Comparing average values over time for local versus nonlocal ratings provides some, albeit limited information. Figure 3 depicts the monthly average of all city-level local (i.e. brewery and rater from the same city) and nonlocal ratings. In the early part of the sample, these data seem to reveal a preference for localness. However, in recent years the two series become entwined. If a local preference persists throughout, then appropriate fixed effects need to be taken into consideration to identify the difference in ratings. By examining the distributions and frequencies of ratings for acquired breweries before and after the acquisition, I can gain some insight into induced changes in consumer perceptions of the products as reflected in ratings. To illustrate these ideas, Figure 4 depicts in panel (a), the

distribution of ratings for beer produced in California, and in panel (b), the distribution of ratings for the San Diego brewery Ballast Point. Constellation Brands acquired Ballast Point in November 2015. Panel (a) depicts the slight difference between the mean and distribution of ratings coming from reviewers that are local to a brewery at the city level versus nonlocal. Panel (b) shows the distribution and mean of ratings of Ballast Point posted by reviewers from San Diego before and after the acquisition. Ratings before the acquisition are blue, and after are red. Differences can be seen in the means, indicated by dashed lines, as well as the shape of the distribution before and after the acquisition. This result is not unique to Ballast Point, similar results are observed for other acquired breweries. The statistical and economic significance of the differences cannot be discerned from the figure; for this, econometric techniques are necessary. It is apparent that without controlling for variation across reviewers and brands, there is little or no apparent preference for localness or response to acquisitions.

[Figure 3. Average Ratings of Local versus Nonlocal Beers]

[Figure 4(a). Ballast Point Ratings, Local versus Nonlocal]

Figure 5 allows for a preliminary check of potential negative responses to acquisitions. This graph depicts monthly average ratings up to twenty months before and after acquisitions. The dots represent the average ratings, the lines are smoothed polynomials, and gray shaded areas are 95% confidence intervals for the polynomials. The blue line represents average ratings from users local to acquired breweries, and the red line nonlocal. In this case, a user is defined as being local if he/she is in the same city as the brewery. Prior to the acquisition, there does not appear to be a significant preference for localness; this demonstrates the importance of including user- and beer-specific effects in the regression model. Following the acquisition, there is a distinct separation between the local and nonlocal ratings. The local ratings decline at a much steeper rate than the nonlocal ratings, suggesting that users local to the acquired brewery responded more negatively. Any local preference that may have

existed previously appears to have been entirely negated. Regression analysis, discussed next, supports these preliminary findings and demonstrates the importance of user- and beer-specific fixed effects.

[Figure 5. Average Ratings Before and After Acquisitions, 1 to 20 Month Windows]

3.2 Model

An econometric approach is used to determine the effect of brewery acquisitions on consumer ratings (or probability of preference). I test whether ratings are higher for local beers, and whether an acquisition has a differential effect on ratings from local versus nonlocal raters. The model uses ratings (or a transformation of ratings) as the dependent variable and a "local" indicator as the primary independent variable. If the user is from the same location as the brewery, then the "local" variable takes a value of one and otherwise it is zero; locality may be defined at the city or state level or within a certain proximity from the brewery. An indicator for whether the beer is produced by a brewery that has been acquired is introduced, as well as an interaction between the indicators for "local" and "acquired." If a brewery has been acquired in time period *t*, then the "acq" variable takes the value of one; otherwise it is zero. Taking a difference-in-differences approach allows for an interpretation of how local users respond to a brewery acquisition. Fixed effects are implemented to control for user-, temporal-, and beer-specific variation. Although users adhere to the same 5.0 scale, they vary in their range of ratings used; user-specific fixed effects are necessary to control for differences in the average ratings across users. Time-specific fixed effects may be either monthly or annual; they are used to control for seasonality or changes in average ratings over time. Ratings vary greatly across styles and brands, thus brand-specific fixed effects are incorporated to control for the difference in average ratings across beers. Errors are clustered at the reviewer level. User tastes may develop over time causing ratings to be autocorrelated, and their ratings may be correlated within styles. Fixed effects alone cannot account for these correlations. To account for potential seasonality of users' reviews, user-month clustered errors

can be incorporated instead; unfortunately, this approach eliminated all significance in the estimates when used in practice. The econometric model can be defined as,

$$rating_{i,b,t,c} = \boldsymbol{y}_c = \boldsymbol{X}_c\boldsymbol{\beta} + \boldsymbol{\epsilon}_c$$
$$= \alpha_i + \gamma_b + \theta_t + \beta_1 local + \beta_2 acq + \beta_3 local * acq + \epsilon_{i,b,t,c}, \quad (1)$$

where $rating_{i,b,t,c}$ refers to ratings by reviewer *i* (in cluster *c*) of beer brand *b* in time *t*, α_i are individual user fixed effects, γ_b are individual beer brand fixed effects, and θ_t are time (month or year) fixed effects. The coefficients of interest are β_1, β_2, and β_3. β_1 is interpreted as the average difference in rating or probability of preference for a local beer versus the same beer in nonlocal markets, β_2 is the average difference in rating or probability of preference for a nonlocal beer following after compared to before an acquisition, and $\beta_2 + \beta_3$ is the average difference in rating or probability of preference for a local beer following after compared to before an acquisition.

To check robustness of findings with respect to specification choices, the model is modified in various ways. Modifications include changing the definition of what qualifies as local, using monthly versus annual fixed effects, testing various cluster specifications, and subsetting the data by states, beer styles, breweries, or time periods. Additionally, windows of various lengths around the acquisition event are studied. In order to obtain estimates of brewery-specific local biases for use in the second part of the study, the model is also run using brewery-specific indicators as opposed to brand-specific fixed effects, and these indicators are interacted with the local variable to obtain brewery-specific local preferences. The brewery-specific estimates are used in part 4 of the paper to determine implicit values of ratings.

Later estimations normalize ratings according to the Decoupling Normalization Method as described by Jin & Si (2004). This method corrects for the differences in distributions of ratings used across users. The halfway accumulative distribution formula is used to convert a rating of a beer to a probability that a specific reviewer prefers the beer. The formula for the probability of preference for a

given beer, *B,* is calculated as the user-specific cumulative probability of the rating, *r,* of *B* minus one half of the point probability of the rating of *B.*

$$P(B\ preferred) = P(Rating \leq r) - \frac{P(Rating = r)}{2}. \quad (2)$$

3.3 Results

Table 2—Table 5 provide results from several regressions analyzing the effect of localness and acquisitions on ratings. General findings are that localness has a positive and statistically significant effect on ratings, and acquisitions have a negative and statistically significant effect on ratings, with a more negative effect at the local level. Before interpreting results, I portray the importance of correctly specifying the model and defining localness.

Table 2 provides results for the effect of acquisitions and localness on ratings for all U.S. beers. The models demonstrate the benefits from including fixed effects by first including none, then iteratively adding beer, user, year, month, and beer/month interacted fixed effects. When user fixed effects are included, standard errors are clustered at the user level. In each model except the first, ratings are regressed on local and acquisition indicator variables and a difference-in-differences approach is used. Reviewers are defined as being local at the city level; changes to the definition of local are discussed later. The local effect is positive and statistically significant across all of the models, but omitting the acquisition indicator biases the estimated localness effect downward. Switching from no fixed effects to beer fixed effects, the sign of the "Acquisition" variable changes from positive to negative and the magnitudes of the "Local" and "Acquisition*Local" effects change substantially. These changes suggest that there may be differences in the offerings of beers between the local and nonlocal markets as well as before and after an acquisition. When user-specific fixed effects are introduced, the magnitudes of coefficients once again change substantially. These shifts demonstrate the need to control for variation across users. There is no change in the model when switching from annual to monthly fixed effects. In general, the estimated coefficient for "Local" is slightly biased upwards when

omitting temporal fixed effects. When the beer*year interacted fixed effect is included it is not possible to obtain significant estimates for the acquisition variables.

[Table 2. Effect of acquisitions and localness on ratings, various fixed effects]

The estimation is next conducted for a subset of data, comprising ratings for all beers originating from California, to check robustness across different specifications of the fixed effects; results are shown in Table 3. Reviewers are defined as being local at the city level; given the large concentration of craft breweries in California, this is appropriate. The results are generally similar to those from the full sample, and the few differences are discussed. Examining the different models used to control for temporal variation, the model clearly loses too much variation in ratings when monthly fixed effects are used. Including beer*year interacted effects controls for any possible changes to a given beer over time, and doing so results in a significantly greater estimate of the effect of acquisitions.

[Table 3. Effect of acquisitions and localness on ratings in California, various fixed effects]

Among states, California has the most craft breweries in the United States, thus the breweries considered to be local for users are likely to be found within the same city or an even more narrowly defined space. However, for states with fewer breweries, it may be necessary to define locality at the state level (i.e. brewery and rater from the same state). Table 4 expands the analysis to include different qualifiers for the “Local” indicator variable. First, the city variables are redefined to include all towns and cities in the greater metropolitan area for San Diego, San Francisco, Los Angeles, and Chicago. Reclassification of cities is implemented because many users list as their home smaller towns that are considered to be part of larger metropolitan areas. Each of the cities chosen is a large city with a greater metropolitan area that is home to an acquired craft brewery. This practice could be extended to other cities throughout the United States, but these four are the most relevant for acquisitions in the study. As

was seen in Table 2, too much variation is lost when using the entire sample and including beer*year interacted fixed effects, thus the fixed effects are excluded from these regressions.

[Table 4. Effect of acquisitions and localness on ratings in California & United States, variant definition of local]

Within the state of California, the additional preference for city-local beer is statistically significantly greater at 0.024 ratings points than the additional preference for expanded city area-local beer at 0.007 points on the five-point scale, highlighting the narrow spatial scope for localness within California. Furthermore, the "Acquisition*Local" term is negative but not statistically significant in California, implying either that there is no greater response to the acquisition at the local level, that too much variation is lost owing to fixed effects, or that localness is not defined narrowly enough. Using data for the entire United States, the definition of local makes little difference for the magnitude of the local and acquisition coefficients. However, the effect of the acquisition at the city-local level is significantly greater than at the state-local level. Results show that on average in the United States, beers that are local at the city level are rated 0.035 rating points higher than the same beers in other cities, and acquisitions result in a decrease of ratings by −0.022 for nonlocal users and by −0.049 rating points for local users. That is to say, an acquisition completely negates any preference for localness that previously existed for a beer from the acquired brewery.

Table 5 displays the results from normalizing ratings to a probability of preference. As a reminder, ratings are normalized at the individual user level using equation (2) such that each reviewer's mean probability of preference is 0.5. Findings regarding the definition of localness and signs of coefficients are consistent with results discussed previously in this section. For brevity, results are discussed for the model including all beers in the United States and defining localness at the city level. The probability of preference is higher by 10.2% on average for ratings of local beers and the difference is statistically significant. An acquisition results in a decrease in the probability of preference by 4.1% on

average for nonlocal beers and by 17.2% for local beers, and once again, results are statistically significant. Examining results in this fashion helps interpret the meaning of ratings. Although the estimated changes in attributable to localness and acquisitions appeared to be small using raw ratings data, normalization reveals these seemingly small effects can be substantially large in determining whether an individual prefers a given beer.

[Table 5. Effect of acquisitions and localness on probability of preference in California & United States]

To determine the robustness of the estimated acquisition effect and to see whether the effect dissipates over time, I perform regressions on subsets of data from different time windows. Figure 6 depicts the effect of an acquisition on subsequent ratings for windows ranging from 1 to 24 months at the nonlocal and city-local level. All U.S. breweries are included in the estimation, beer, year, and reviewer fixed effects are incorporated, and standard errors are clustered at the reviewer level. The average effects (solid lines) and plus or minus two standard deviations (dashed lines) are shown on each graph. The acquisition effect at the nonlocal level is in blue, and the effect at the local level is in red. In each series, the effects are not statistically significantly different from 0 for the first three months following an acquisition. The acquisition effect is negative and statistically significant for windows of length 4 to 24 months, and the magnitude of the effect is gradually increasing, ranging from −0.019 points to −0.026 points. The effect of the acquisition at the city-local level is negative and significant for windows of length 4 to 24 months, it ranges from −0.060 points to −0.095 points, and it eventually stabilizes at approximately −0.075 points. Results from using windows are consistent with the previous results in this section, but the average magnitude of the effect of an acquisition at the local level of −0.075 points using windows is notably greater than the −0.049 points estimated using the entire sample. The key takeaway is that there is a significant amount of noise in ratings during the early period following an acquisition, but after the first few months, responses to acquisitions are consistently negative and statistically significant.

[Figure 6. Change in Ratings Following an Acquisition, 1 to 24 Month Windows]

3.4 Summary

In this section I asked whether consumers prefer local craft beer, and I tested this hypothesis using ratings data. The tests used indicator variables for localness and acquisitions in a series of different specifications. From these results, it can be seen that a preference for locally produced and locally owned beer exists. Acquisitions completely negated any preference for localness that previously existed for a brewery's brands. For properly controlled models, the preference for localness generally ranged from 0.24 to 0.74 rating points on a 5.0 point scale, the acquisition effect at the nonlocal level from −0.013 to −0.041, and the acquisition effect at the local level from −0.039 points to −0.146. However, these results are limited to consumers who post beer reviews. This subset is likely non-representative of the general population. To examine a more representative sample in the next section, I use data based on grocery store sales in the contiguous United States. I test if consumer demand for local beer is less elastic than demand for nonlocal beer and if acquisitions result in a downward shift in demand. Affirmative evidence in the next section would suggest that preferences for locally produced and owned craft beer extend to the general U.S. population.

4 Sales

Whereas consumer preferences are directly stated in beer ratings, they are revealed through purchases. The next stage of the study aims to determine if the findings from ratings are borne out in actual purchase data. This, the second main part of the analysis for the paper, utilizes Nielsen scanner data, which contain weekly prices and quantities for more than half of U.S. grocery and drug stores by sales volume during the years 2006–2015. Ten acquisitions of craft breweries occurred during this time, and they are listed in Table 1. The acquisition of Goose Island by Anheuser-Busch is the only case with data

available for multiple years following the purchase, so that brewery is used as an example in the preliminary analysis of the effect of acquisitions on demand.

4.1 Data

The data include more than one billion observations of individual sales transactions, covering 2,800 brands of beer and 270 metropolitan areas. The composition of the dataset by store-type is 76% grocery, 14% drug, 4% mass merchandiser, 4% convenience, and 2% liquor stores. The sheer number of brands renders estimating a demand system model, such as the AIDS model, practically impossible. An alternative approach would be to implement a model of demand for brand characteristics, rather than brands. One potential way of building such a model would be to construct a random-coefficients multinomial-logit demand model, similar to that of Nevo (2001). Nevo studies the effect of mergers on market power in the ready-to-eat breakfast cereal industry. Similar to the beer industry, a key characteristic of the cereal industry is that it consists of a large number of brands. Unfortunately, whereas Nevo has information on characteristics of each product, our data contain no such information. Therefore, for now at least, I am forced to rely solely on prices and brand fixed effects, which, despite great effort, has rendered a Nevo-type model infeasible. Instead, I turn to a simplistic econometric method akin to that I am using to analyze ratings data.

Before diving into formal analysis, insight can be gleaned from exploring samples of the sales data. Figure 7 is included to demonstrate brewery level price variation across time and cities. The graph shows weekly average New Belgium beer prices per ounce in Denver, San Francisco, and St. Louis. New Belgium is a regional craft brewery based in Fort Collins, Colorado, which is in the same Nielsen designated market area (DMA) as Denver. In a perfectly competitive market, price differences represent a difference costs—such as transportation and taxes. Assuming all consumers have the same preferences for beer, no local preferences, and allowing for transportation costs, prices for New Belgium beer should be lower in Denver than in other DMAs, but this does not hold true. In fact, prices for New

Belgium beer are on average higher in Denver than all other cities in some of the later periods in my dataset.[2] Higher prices could be a result of price discrimination against the local market, differences in product selection (a different mix of New Belgium beers) among markets, or both, but the cause cannot be determined from this graph.

[Figure 7. Weekly Average Prices of New Belgium Beer in Selected U.S. Cities, 2006–2015]

Turning to Figure 8, it is apparent that product selection is not the explanation. This graph depicts the average price of Fat Tire, New Belgium's flagship beer, in the same DMAs. The same phenomenon as before is observed, Fat Tire prices are higher on average in Denver than in the other DMAs in the last few years of data. Consumers have noticed the price discrimination, and New Belgium has acknowledged it (indirectly). A forum on Beer Advocate, started in October 2013, discusses prices of New Belgium in Colorado compared with other areas. Consumers quoted typical prices for New Belgium Lips of Faith, a series of 22 oz. barrel aged beers, in Denver for $17–18, California and Minnesota for $12–13, and Iowa for $9. Andrew Emerton, Specialty Brand Manager at New Belgium, responded on a separate Beer Advocate forum in February 2013, to an individual inquiring about the higher prices of New Belgium in Colorado than in other states. Emerton did not provide a direct answer, but suggested that the differences were attributable to varying margins for distributors and retailers in different markets. State taxes could play a role in markups as well, but according to Tax Foundation (2016), Colorado had the sixth-lowest tax rate per gallon of beer for off-premise sales as of January 2016.

[Figure 8. Weekly Average Prices of New Belgium's Fat Tire Beer in Selected U.S. Cities, 2006–2015]

Figure 9 shows sales of Goose Island versus all other craft beer in Chicago. Vertical lines indicate the acquisition and distribution takeover dates. The acquisition on March 11, 2011, refers to the date at which Anheuser-Busch purchased the brewery, whereas the distribution takeover one year later marks

[2] The figure depicts one representative West Coast city and one representative Midwest city for comparison. Data for many other cities were examined with identical findings, but for the sake of clarity of the image, data for only two other cities are included alongside Denver

the approximate date at which Anheuser-Busch began controlling the production and distribution of Goose Island products. It is important to control for both events because at the point of the distribution takeover, Anheuser-Busch began producing Goose Island products at a mass scale in new facilities using different recipes, and distribution then expanded to more DMAs. Despite the expansion in production of Goose Island beer and its greater availability within Chicago following the Anheuser-Busch takeover, Goose Island sales growth stagnates while other craft beer sales continue to climb.

This figure shows a possible negative shift in demand in local markets in response to acquisitions, as was evident from the analysis of ratings data. It is possible that the figure is misleading because the composition of stores in the dataset changed over time, but the next two graphs contradict this possibility. Figure 10 depicts the number of stores with Goose Island sales versus other craft beer sales in Chicago. Although availability of Goose Island does not increase much following the acquisition and takeover, there is a slight increase in the number of stores with Goose Island sales; it certainly does not appear to be the case that stores carrying other craft beer are replacing stores formerly carrying Goose Island. Figure 11 is more enlightening, plotting average sales per store of Goose Island versus other craft beers in Chicago. The timing of the acquisition coincides with a rapid growth in other craft sales per store, but Goose Island sales per store remain relatively flat. Unfortunately, we are not able to observe changes in shelf space within stores, which may partially explain the trends in these figures.

[Figure 9. Weekly Sales of Goose Island Beer, 2006–2015]

[Figure 10. Stores with Goose Island Sales, Chicago, 2006–2015]

[Figure 11. Average Goose Island Sales per Store, Chicago, Dollars per Week, 2006–2015]

The slight increase in sales and sales per store might not be due to increased demand; it could be because of lower prices, as seen in Figure 12 and Figure 13. In Figure 12, weekly prices are deflated by a beer price index (BPI), defined as the weighted average price of the basket of craft beer consumed in Chicago at the start of 2006. Prices are measured in dollars per ounce and deflated using two different

approaches. In one approach, prices are deflated by a BPI. The BPI in equation (3) is defined as the average beer prices per ounce weighted by quantity sold in state z, week t, ($\boldsymbol{Q}_{t,z}$) relative to an arbitrarily chosen base week $\bar{t}$,

$$BPI_{z,t} = \frac{P_{z,t}}{P_{z,\bar{t}}}, where\ P_{t,z} = \frac{\sum_{b=1}^{B}\sum_{s=1}^{S} p_{b,s,t,z} * Q_{b,s,t,z}}{\boldsymbol{Q}_{t,z}}, \quad (3)$$

where $\boldsymbol{Q}_{t,z}$ is the total ounces sold in state z, week t. Although this indexing method is easy to implement, it does not account for the varying product mixes from week to week. Many new craft brands are introduce during the sample period. Often these new brands are local to the DMA and are more expensive than the pre-existing regional craft options. Failing to account for the change in product mix may therefore incorrectly deflate prices and increase the price spread between the new and old brands, thereby inflating results. The Chained Fisher Price Index (CFPI) is the geometric mean of a Laspeyres and Paasche index, and it controls for changing product mixes by constructing an index for a given week t that utilizes only prices and quantities of brands available in week $t-1$, as seen in equation (4).

$$CFPI_{z,t} = CFPI_{z,t-1} * \sqrt{\frac{\sum_{b=1}^{B} \bar{p}_{b,z,t} * \bar{Q}_{b,z,t-1}}{\sum_{b=1}^{B} \bar{p}_{b,z,t-1} * \bar{Q}_{b,z,t-1}} * \frac{\sum_{b=1}^{B} \bar{p}_{b,z,t} * \bar{Q}_{b,z,t}}{\sum_{b=1}^{B} \bar{p}_{b,z,t-1} * \bar{Q}_{b,z,t}}}, and\ CFPI_{z,1} = 1. \quad (4)$$

By design, any products unavailable in a week are given a weight of zero in the calculation. $\bar{p}_{b,z,t}$ is the quantity-weighted average price across all stores of brand b for week t in state z. $\bar{Q}_{b,z,t}$ is the total quantity sold in ounces across all stores of brand b for week t in state z. One shortcoming of this method is there must be at least one shared product between two weeks to calculate the index; in the rare case in which there are no shared products in consecutive time periods, the index takes the same value as in the preceding period. Figure 14 demonstrates the average difference in price spreads between indexing methods for a sample of ten DMAs: Denver, Bend, San Francisco, San Diego, Los Angeles, Phoenix, Grand Rapids, Chicago, New York, and Seattle. The difference in average deflated prices for local and nonlocal craft beer are shown in blue for the BPI method and in red for the CFPI

method; typically, the price indices are quite similar, but the BPI method understates this difference in recent years, which could cause results using the index to be biased.

Returning to Figure 12, the deflated average prices of Goose Island dropped in 2013; one year following the 2012 takeover of production and distribution, whereas other craft beer prices did not exhibit structural change. However, this fixed weight index does not take into account the changing product mix of craft beers in Chicago. Using the CFPI, it can be seen in Figure 13 that the BPI understates the price increase of craft beer. In fact, the deflated price of Goose Island increases following the acquisition in 2011 along with other craft prices. From 2013 forward, craft beer prices increase at a faster rate than Goose Island. The differences in BPI and CFPI are likely due to the introduction of new, more expensive craft beer brands. Furthermore, the shares of new brands increase over time relative to Goose Island, and the simple weighted average index does not account for this change.

[Figure 12. Weekly Average BPI-deflated Price of Goose Island Beer, Chicago, 2006–2015]

[Figure 13. Weekly Average CFPI-deflated Price of Goose Island Beer, Chicago, 2006–2015]

[Figure 14. Difference in Average Prices of Local and Nonlocal Beer for BPI and CFPI Deflators, 2006–2015]

4.2 Model

The analysis has two parts: first, I examine the impact of acquisitions and localness on demand, and second I examine the impact of local preferences on prices. Once again, fixed effects, difference-in-differences, and event study techniques are utilized. Fixed effects are incorporated to control for store-, temporal-, and the interaction of brand/market city-specific variation. Brand and market city fixed effects are interacted to control for the different product offerings in each city. Breweries are more likely to experiment with more products in or near their home city, and to distribute the successful brands to other markets. Neglecting this control could result an in upward bias on the estimated own-price elasticity of demand for local beer since there are likely to be more less-favored products in the

home market. The richness of the data is such that weekly time fixed effects can be used to control for any possible holidays or season variation. Indicator variables are included in the analysis for acquisition, local, and distribution take-over (assumed to occur one year after the initial acquisition, as was the case with Goose Island). In some initial regressions, I controlled for promotional prices, but given the enormity of the dataset, I realized this control could be dropped from the analysis without consequence. Therefore, there is no indicator in the data for promotional pricing, instead any sales that are one cent or less per ounce are considered promotional and removed. Indicator variables are defined as previously discussed, and the distribution takeover variable takes a value of one if, in the location of the observation, it has been at least one year since Anheuser-Busch acquired Goose Island.

The econometric model used to determine the effect of acquisitions on quantity demanded is defined as,

$$ln(Q)_{i,b,j,k,t,c} = s_i + B_{b,j} + \theta_t + \beta_1 acq + \beta_2 local * acq + \beta_3 distr + \beta_4 local * distr + \beta_5\, ln(price) + \beta_6\, ln(price) * local + \epsilon_{i,b,j,t,c}, \quad (5)$$

where $Q_{i,b,j,k,t,c}$ refers to the quantity (in ounces) of beer brand *b* sold in city *j* and produced in city *k* during week *t* at a given store *i* (in cluster *c*); s_i are store fixed effects, $\mathrm{B}_{b,j}$ are brand/market city interacted fixed effects, and θ_t are time fixed effects. The coefficient for the local variable is completely captured by the interaction between brand and market city fixed effects, thus it takes on no value in estimation and does not need to be included in the model.

The specification of clusters is critical for accurate standard errors. Neglecting to use cluster-robust standard errors results in grossly understated standard errors. Clustering at the brewery-month level inflates standard errors in a way that seems appropriate on *a priori* grounds, and the estimates remain statistically significant. This level of clustering is appropriate since it allows errors to be correlated within a brewery across brands and cities but only for a limited window of time. Clustering at the brewery level results in standard errors that are exceptionally large. This level of clustering is

probably not appropriate; for example, it allows errors to be correlated for brand X of a brewery in 2006 in San Diego with brand Y of the same brewery in 2014 in New York, an unlikely scenario. Clustering at the brewery-city level is unreasonable for the same temporal reasoning.

The fixed effects act as store-, weekly-, and city-specific demand shifters for a given beer. The price variable identifies the remaining store-level idiosyncratic variation in prices of each beer resulting from unobserved supply-side factors. The price observations represent the equilibrium prices, and assuming all demand-side variation is controlled for by the fixed effects, the observations chart out a series of demand curves. That is, I can interpret the coefficients from equation (5) as demand-side elasticities. Therefore, the coefficient on $\ln(price)$ in equation (5) identifies an own-price demand elasticity, and the coefficient on the interaction between the local indicator variable and $\ln(price)$ is the change in the elasticity for consumers of local beer.

Next, I define the model used to determine the implicit value of local preferences:

$$price_{i,b,r,j,k,t,c,s} = s_i + B_b + \theta_t + \zeta_{j,k} + \alpha\widehat{F_{r,k}} * \phi_s + \epsilon_{i,b,r,j,k,t,c}, \quad (6)$$

where price is once again deflated as before and measured in dollars per ounce, "$\widehat{\mathrm{F_{r,k}}}$" is the average increase in ratings for a brewery r in its local market *k* as determined by the brewery-specific fixed effects described in the section 3 (the value is set to zero in all other markets), and ϕ_s is a vector of state-specific fixed effects. The model is tested with and without the vector of state-specific fixed effects interacted with the preference variable. Including these effects allows for heterogeneity in the implicit price of ratings for different states; there may be states in which higher prices are paid for higher-rated beers, and conversely, states where ratings are higher owing in part to their lower price for the beer. Brewery- and market-city pair fixed effects allow for a nonlinear control for the effects of transportation costs.

Once again, robustness is checked by modifying the model in numerous ways. Modifications include changing the definition of what qualifies as local, subsetting the data by states or breweries,

using random samples of the entire dataset, and testing various cluster specifications. Cluster-robust standard errors are implemented along various time and spatial groupings. Brewery-month clusters are considered most appropriate, as they allow within-brewery errors to be correlated across brands and cities, but not across lengthy windows of time.

4.3 Results

Table 6 provides results from estimation of equation (5). The first set of results is derived using a subset of more than 17.6 million observations that contains all sales from 130 breweries during the ten years, 2006–2015 for ten metropolitan areas: Denver, Bend, San Francisco, San Diego, Los Angeles, Phoenix, Grand Rapids, Chicago, New York, and Seattle. Each of the DMAs was chosen because it was home to a craft brewery that had been acquired by a large company. To account for demand differences by store classification—i.e. convenience, drug, grocery, liquor, or mass merchandiser store—a store-type indicator variable is included in some regressions. To check for the possibility that results are biased because of the introduction or exit of stores in the data set, the analysis is repeated for the sample consisting of only stores present before and after the acquisition. To accommodate the massive number of parameters and observations, the estimation was performed across five random samples (without replacement), comprising the entire dataset. Averages across the samples are reported.

[Table 6. Effect of acquisition on demand]

The percentage change in demand implied from the coefficient β of an indicator variable is calculated as $exp(\beta) - 1$; the other coefficients are elasticities.[3] Results in the first four columns of Table 6 use CFPI deflated prices. When including all stores and not controlling for store type ("All Stores" column), these results indicate that an acquisition resulted in a 13.1% increase in demand, and that the

[3] It is a common mistake to interpret the coefficient of an indicator variable in a log-transformed model as an elasticity. However, a continuous regressor variable cannot be differentiated with respect to a discrete variable. Instead, the percent change in *Q* in response to a change from 0 to 1 in an indicator variable *x* is obtained by taking the exponential of both sides, then evaluating the difference between *Q* when *x* = 0 and *x* = 1. Thus $\frac{\%\Delta Q}{\Delta x} = \exp(\beta * 1) - \exp(\beta * 0) = \exp(\beta) - 1.$

takeover of craft production and distribution (estimated to occur one year after the initial acquisition) further increased demand by 11.3%. The acquisition had no significantly different effect in local versus nonlocal markets. The takeover of distribution and production decreased demand in local markets by 18.2%, implying a net increase in demand for acquired craft beer in local markets of 6.6% one year following an acquisition. This change might be attributable to greater shelf space or visibility at stores and availability in a greater number of stores within a DMA; these benefits are likely gained owing to the distribution network and power of Anheuser-Busch and other large companies compared to craft breweries. The possibility of benefits owing to availability in more stores is refuted by the data, but the possibility of benefits attributable to increased shelf space cannot be determined with these data. When stores not present both before and after the acquisition are excluded from the analysis ("Pre-acquisition Stores" column), the changes in the magnitudes of the coefficients are marginal and not economically meaningful. The (own-price) elasticity of demand for craft beer is –1.936, and for local consumers demand is more elastic by 0.073, suggesting consumers are slightly more sensitive to changes in price of locally produced beers. However, these estimates of elasticities may be heavily influenced by the large regional breweries which were acquired in the cities considered. To obtain more reliable elasticity estimates, all DMAs will be considered in estimations following Table 6.

Results in in the final column of Table 6 use BPI deflated prices, and they paint a similar picture. Here, the acquisition resulted in a 15.5% increase in demand, and the takeover of craft production and distribution further increased demand by 16.0%. The effect of an acquisition was not significantly different between local versus nonlocal markets. The takeover decreased demand in local markets by 29.5%, implying a net decrease in demand for acquired craft beer in local markets of 1.1%. These results demonstrate the importance of taking into account the changing product mix of craft beers in a given DMA. Coefficients are larger by 17–74 percent for all demand responses to acquisitions and distribution takeovers. The unexpected finding of increased demand for acquired craft beer in local markets could

reflect increased visibility within stores because of enhanced distribution and marketing. Any decrease in demand from craft enthusiasts could easily be outweighed by the increased exposure of the brands to average consumers. Unfortunately, there is no mechanism available in the data to control for shelf space or product visibility. The findings thus far could also reflect heterogeneity in consumer responses to acquisitions owing to differing acquiring companies.

To check for heterogeneous demand responses to acquisitions depending on the acquiring company, the acquisition indicator variable was broken into fixed effects for each acquiring company. To reduce the effects possible changes in distribution or marketing, sales of acquired brands were only considered for three months before and after the date of the acquisition. Results are presented in Table 7 and reveal differing effects by company. An acquisition by Heineken reduced demand in nonlocal markets by 19.9% and in local markets by 32.0%, and the acquisition decreased the own-price elasticity of demand by 0.114 in nonlocal markets in local market by 0.184. An acquisition by Constellation Brands or Mahou San Miguel caused no statistically significant changes in demand or the own-price elasticity of demand. An acquisition by ABInBev reduced demand by 56.5% and the own-price elasticity of demand by 0.467 in nonlocal markets, but the acquisition had no statistically significant effect in local markets. An acquisition by MillerCoors reduced demand in nonlocal markets by 54.4% and in local markets by 89.6%, and the acquisition decreased the own-price elasticity of demand by 0.472 in nonlocal markets and by 1.190 in local markets. This variability suggests that consumers may have strong negative perceptions of some acquiring companies, but positive perceptions or no opinion of others. Extremely large negative shifts in demand, as seen with ABInBev and MillerCoors, could also reflect immediate changes in distribution. Questionably substantial demand shifts associated with these two companies suggests a high likelihood of unobservable supply-side variation. Although this finding effect means that the effect of acquisitions cannot be properly identified for some acquiring companies, the difference in elasticity of demand for local versus nonlocal beer still can be estimated across markets.

[Table 7. Effect of acquisition on demand, by acquiring company]

The results in Table 8 are based on a subset that contains data for beers from 130 breweries and random samples of 5% of the stores throughout the entire country. The random samples are selected without replacement, and thereby comprise the entire dataset. Using samples that contain so few observations of sales of acquired beer brands, I am unable to test for the effects of an acquisition, thus the corresponding variables are omitted. However, by including all DMAs, I obtain more representative elasticities for local and nonlocal craft beer; the presence of large regional craft breweries that were acquired in each city of the last subset may have undue influence on the elasticities. Results are obtained using CFPI deflated prices. The average own-price elasticity of demand for craft beer based on twenty 5% random samples is −2.231, and for local consumers demand is less elastic by 0.099. As expected, consumers are less sensitive to price changes of local beers, providing further evidence of a preference for localness. Although the demand for local beer is less elastic on average, there is some variation in the results, suggesting that there could be heterogeneous preferences for local craft beer across markets.

[Table 8. Own-price elasticity of demand for individual craft beer]

Table 9 provides the results from estimation of equation (6) to determine the implicit value of local preferences. Results are based on the 5% samples used previously, but only approximately 90 of the 130 breweries are used because many of them had too few ratings to be included. The coefficient for local bias is multiplied by 72 to translate the average change in dollars per ounce for a unit change in ratings to the average change in dollars per six-pack per unit change in ratings. The result is then divided by 20 to compute the average change in dollars per six-pack for a 0.05 rating point change in ratings. This value, given in the last column of Table 9, implies that a typical preference of just 0.05 rating points results on average in no change in the price of a six-pack when using CFPI deflated prices to allow for product mix changes. Results using these prices indicate there is no significant implicit value for ratings,

but there is a great deal of heterogeneity across samples. The implicit price of a 0.05 increase in ratings varies from −$1.18 to $0.72 across samples.

[Table 9. Implicit value of local preference]

Each state likely has different weights in these samples, and it is likely that there is heterogeneity in preferences across states. To determine if this is the case, a fixed effect interacting the local indicator and state is introduced. Results from this estimation approach averaged across the same 20 samples are provided in Table 10. The implicit price of preference can only be estimated for states that are home to breweries with sales both within and outside the state. A great deal of heterogeneity exists, with the average implicit price for a 0.05 rating point change ranging from −$7.99 in Maine to $15.64 in Oregon.[4] Lower and upper quartiles are included in the table to demonstrate the range of the values for each state, but the sign of the implicit price is consistent for the majority of states. Colorado, New York, Pennsylvania, Texas, and Wisconsin consistently have positive implicit prices for local preferences, whereas Illinois, Massachusetts, Maine, Minnesota, Missouri, and Ohio consistently have negative implicit prices for local preferences (although they are not necessarily significant on average).

Figure 15 depicts the range in implicit prices for each state using box-and-whiskers plots. The results are recent and need to be explored further as ongoing work is performed for this study. Preliminary investigation suggests that the extreme values found in Maine and Oregon are driven by only a couple of local brands being sold at much higher and lower real prices respectively in other states. There may be identifiable factors, such as demographic variables or brewery characteristics, that could help explain what determines whether a state has a positive or negative implicit price for local preferences.

[Table 10. State-specific implicit value of local preference]

[4] Implicit price for preference is converted to dollars per bomber (22 ounce bottle of beer). Many of the beers sold across states are in this format, and they often exceed $20 per bottle, making the conversion to price per 6-pack illogical. I plan to separate the estimation by packaging type in the future.

[Figure 15. State-specific implicit value of ratings]

5 Summary

The data used in this study are extremely powerful owing to the large number of observations and degree of detail. Combining these powerful datasets for purchases and ratings puts us in a unique position to study the effects of acquisitions or other factors on preferences for beers. Thus far, I have been able to find clear evidence that (1) consumers have a preference for local beers, (2) acquisitions induce a decline in ratings, an effect which is more pronounced for local reviewers and completely negates any preference for localness, and (3) this preference is reflected in the market as negative demand shifts for craft beer acquired by certain large companies, differences in the own-price elasticity of demand for local and acquired beer, and a price premium in some parts of the United States.

The findings that acquisitions cause a change in ratings and that consumers have a preference for local beer were derived using nearly 3.5 million reviews from RateBeer.com. The average measured effects ranged from 0.01 to 0.05 points on a 5.0 point scale. Despite small low magnitude of the effect, preference for local beer was consistently positive and statistically significant, and the effects of an acquisition on ratings at the city-local and nonlocal level were consistently negative and statistically significant. These results were combined to show conclusively that consumers prefer local craft beer, but when a brewery is acquired, it is no longer considered local.

In the second part of the analysis, Nielsen scanner data were analyzed to see if these effects were also evident in sales data and if local preferences could be monetized. The Nielsen scanner data comprise more than one billion observations of weekly store level sales of beer by brand and container size. Average prices of craft beer are suggestive of price discrimination against local beer consumers. Results from regression analysis support this possibility and earlier conclusions of local preferences, finding that consumer demand is less elastic for local versus nonlocal craft beer, with average elasticities

of −2.231 and −2.132, respectively. Plots of sales data in Chicago illustrate a potential negative reaction to the acquisition of Goose Island in its home market. Regression analysis could not confirm this, probably because of changes in confounding factors such as shelf space and product changes following acquisitions. The data do show that the acquisition of Goose Island occurred at a point in time when overall sales of craft beer in Chicago were growing exponentially, but Goose Island growth remained stagnant, suggesting it was no longer considered a local craft beer. When separating the acquisition effect into several company-specific indicator variables, there was evidence of potential negative demand responses to acquisitions by ABInBev, MillerCoors, and Heineken. However, the ABInBev and MillerCoors demand responses were substantially large enough to raise concerns of unobservable supply-side changes.

Merging brewery level preferences for localness estimated from the ratings data with sales data provided mixed results regarding local preferences. On average, a 0.05 rating point preference for a local brewery had no effect on the price per 6-pack of craft beer using CFPI deflated prices. However, the effect varied greatly across samples, suggesting heterogeneity in the relationship between prices and ratings. Initial results support the theory that, in some states, higher ratings are associated with higher prices, but in other states higher ratings are associated with lower prices; this analysis is ongoing.

The next step in ongoing research is to examine preferences for local craft beer without strictly defining local, to study the effects of acquisitions on preferences without confounding supply side effects, and to explore the heterogeneity in the implicit price of ratings across states. These objectives are currently being approached using a choice experiment and standard demand modeling. The experiment tests for preferences for local and craft beer while controlling for consumers' definition of local and knowledge of acquisitions; the design of the experiment avoids the issues encountered here due to unobservable supply side variation. The other study uses a Rotterdam demand system to link demographic variables with the heterogeneous preferences for local craft beer observed here.

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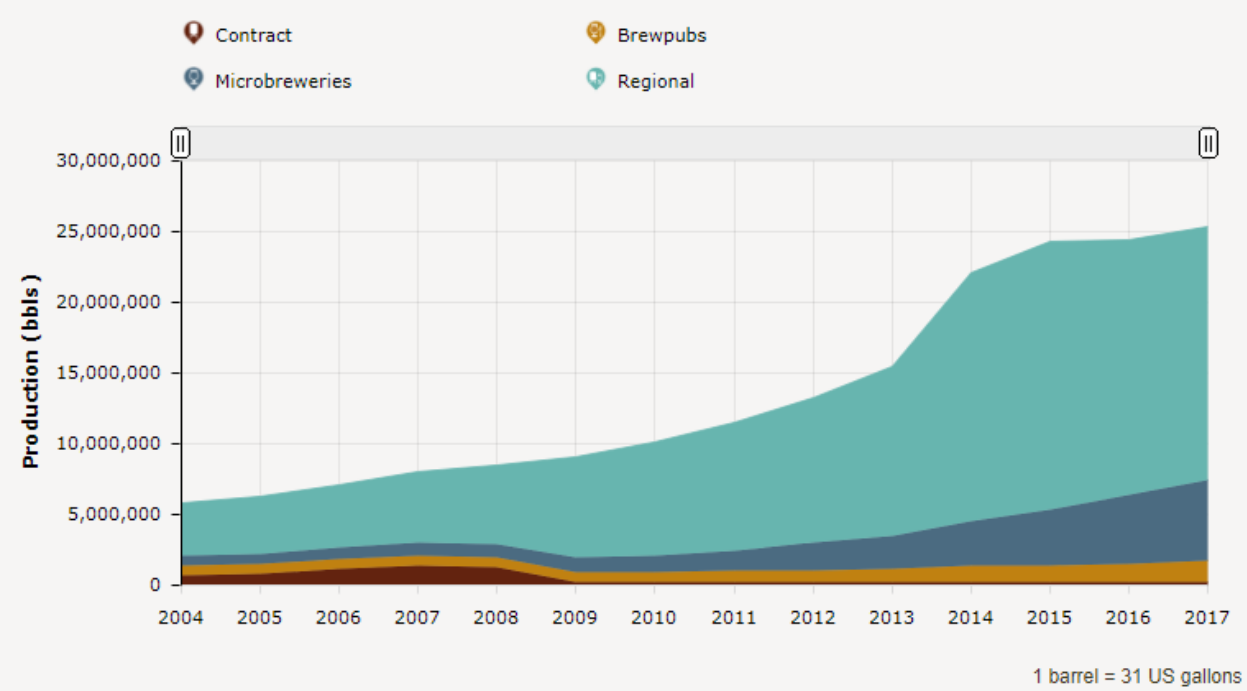
7 Data Description

Consumer ratings were collected from RateBeer.com. RateBeer is a website in which individuals can post reviews of beers they consume. I have scraped the website for data, obtaining access to roughly 3.4 million ratings from thousands of distinct users between 2000 and 2016. Each observation consists of the name, style, and alcohol content of the beer, the name and location of the brewery, the user ID and location of the reviewer, date of the rating, and the score (on a scale of 0.5–5.0). Since I acquired these data, ABInBev has acquired a minority stake of RateBeer, introduced an API to the website, and severely limited the extent to which ratings can be scraped. For this reason, the dataset cannot be expanded to include more recent ratings.

The sales data are proprietary and sourced from Nielsen. Access was granted thanks to a one-year contract between Nielsen and the University of California, Davis. They include more than one billion observations of store-specific weekly sales transactions, covering 2,800 brands of beer, and 270 metropolitan areas. The composition of the dataset by store-type is 76% grocery, 14% drug, 4% mass merchandiser, 4% convenience, and 2% liquor stores. Data are available for the entirety of 2006 through 2015. Data for 2016 will soon become available, and I plan to submit a request for access. The study will eventually be expanded to include the additional data. Each observation gives the total quantity sold for a specific brand and container size in units for a given week, the unit of measurement, description of unit (quantity of ounces or millimeters), the price per unit, the store code identifier, and the DMA location of the store. I deflated prices using two different method: an index defined as the average beer prices per ounce weighted by quantity sold for a given state relative to an arbitrarily chosen base week, and a Chained Fisher Price Index.

8 Figures & Tables



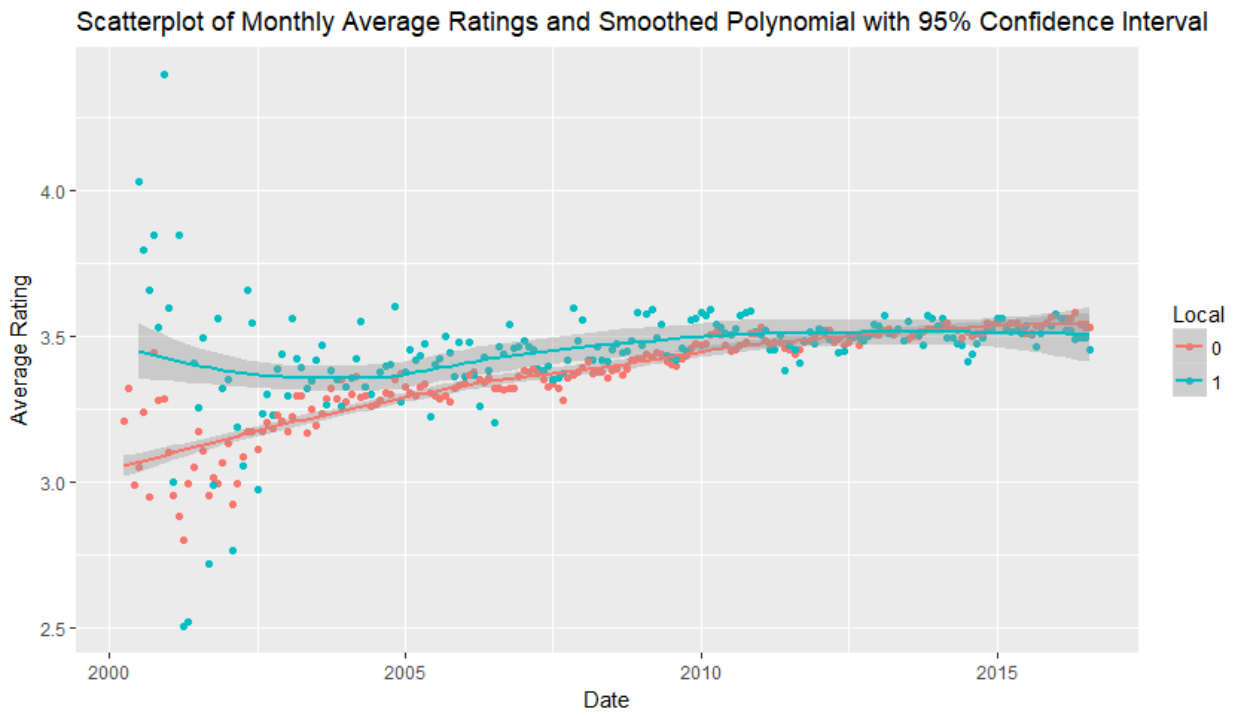
Source: Brewers Association

Notes: Annual production is denoted as volume of beer, in barrels by type of craft brewery.

Figure 1. Craft Beer Production

Source: RateBeer
Note: The bolded number in the top left of the figure is the composite rating used in analysis.

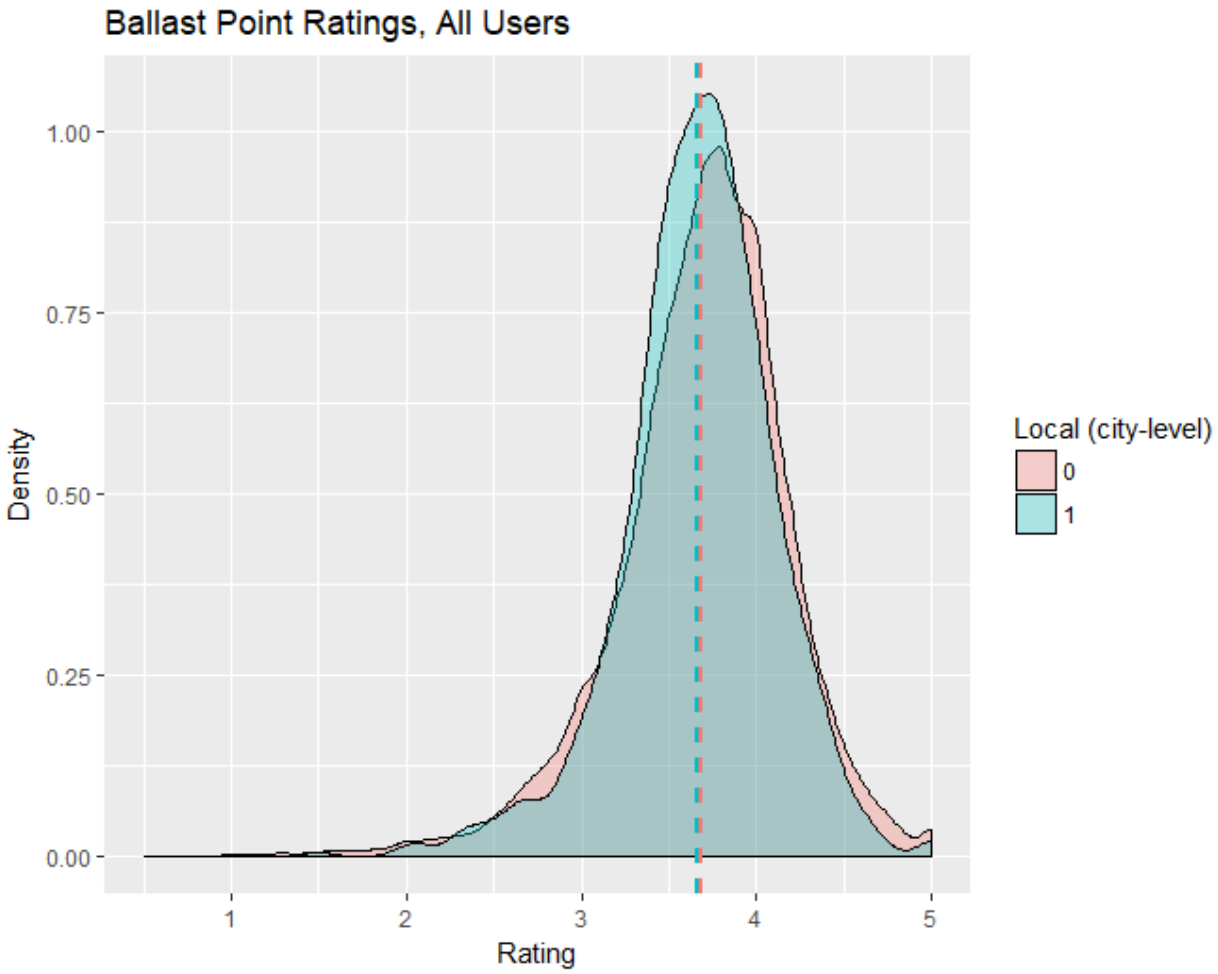
Figure 2. Sample Review of a Beer from RateBeer.com



Source: Author generated from RateBeer data, 392 observations

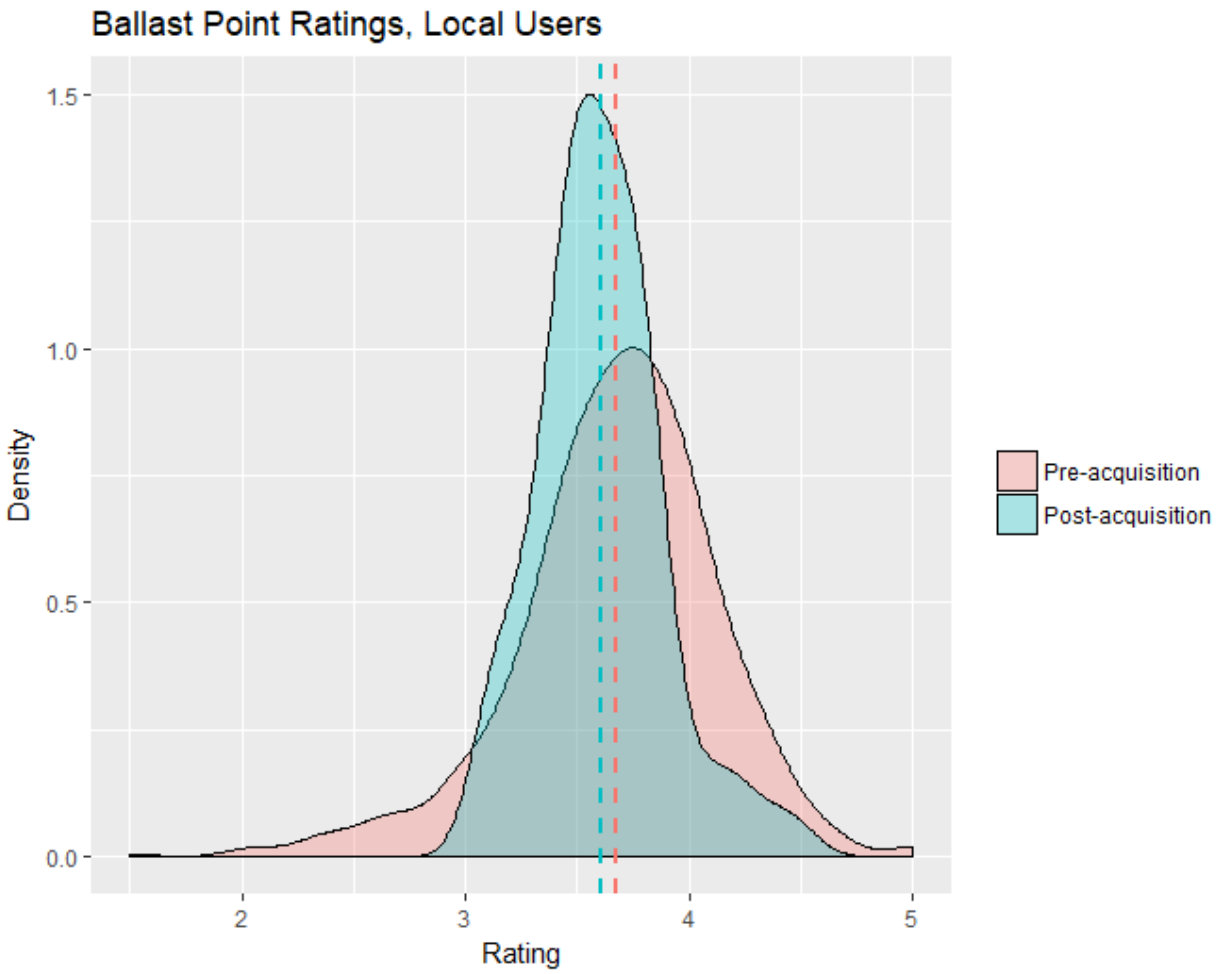
Notes: There is a distinct difference between local and nonlocal reviews until 2010.

Figure 3. Average Ratings of Local versus Nonlocal Beers



Source: Author generated from RateBeer data, 20,889 observations
Notes: No significant difference between local and nonlocal ratings can be readily observed.

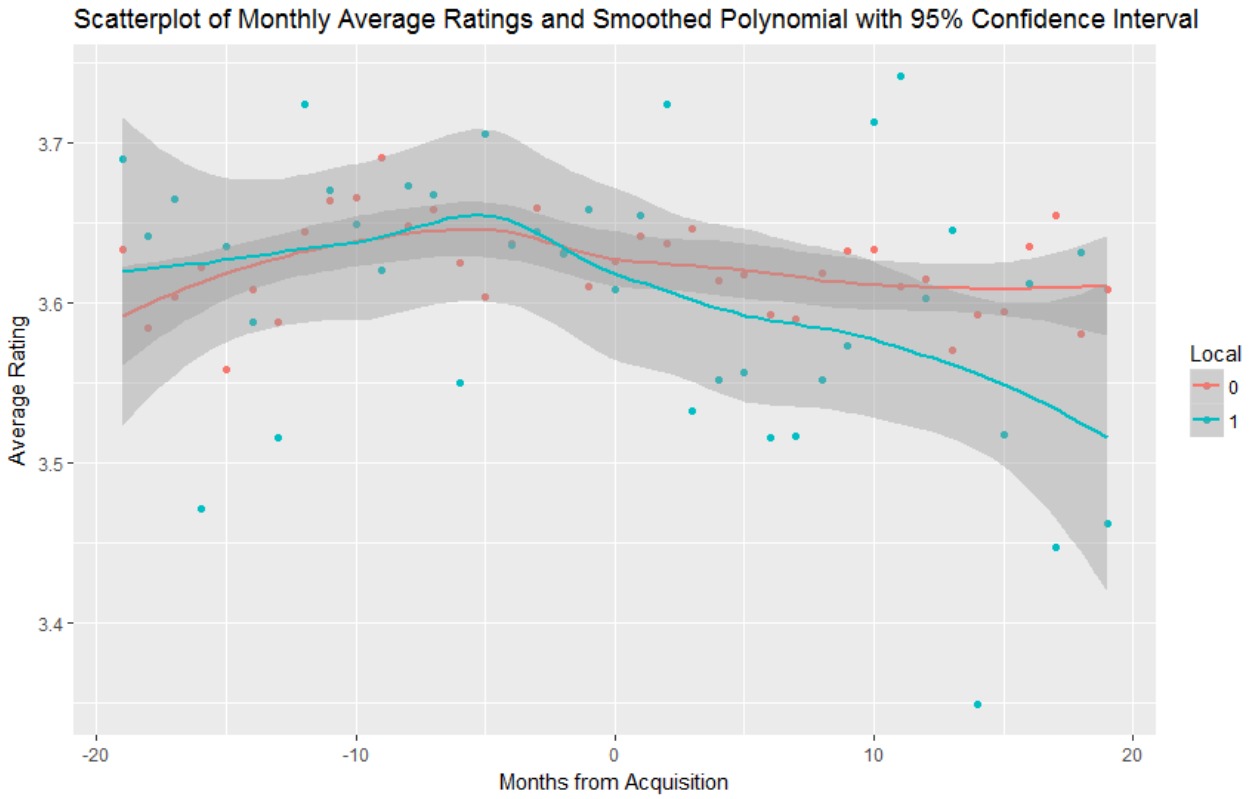
Figure 4(a). Ballast Point Ratings, Local versus Nonlocal



Source: Author generated from RateBeer data, 882 observations

Notes: There is a distinct leftward shift in the mean and distribution of ratings following the acquisition.

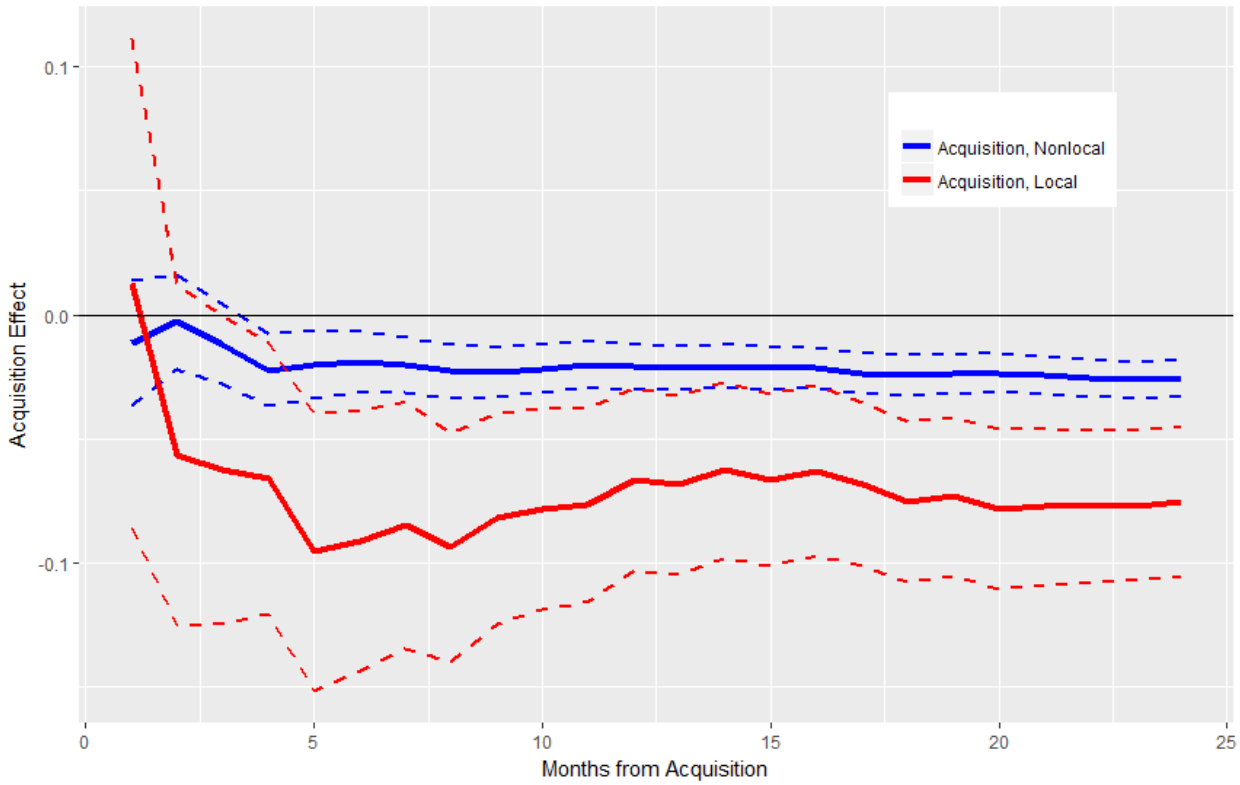
Figure 4(b). Ballast Point Ratings Pre- and Post-acquisition



Source: Author generated from RateBeer data, 78 observations

Notes: Local ratings appear to decline following an acquisition.

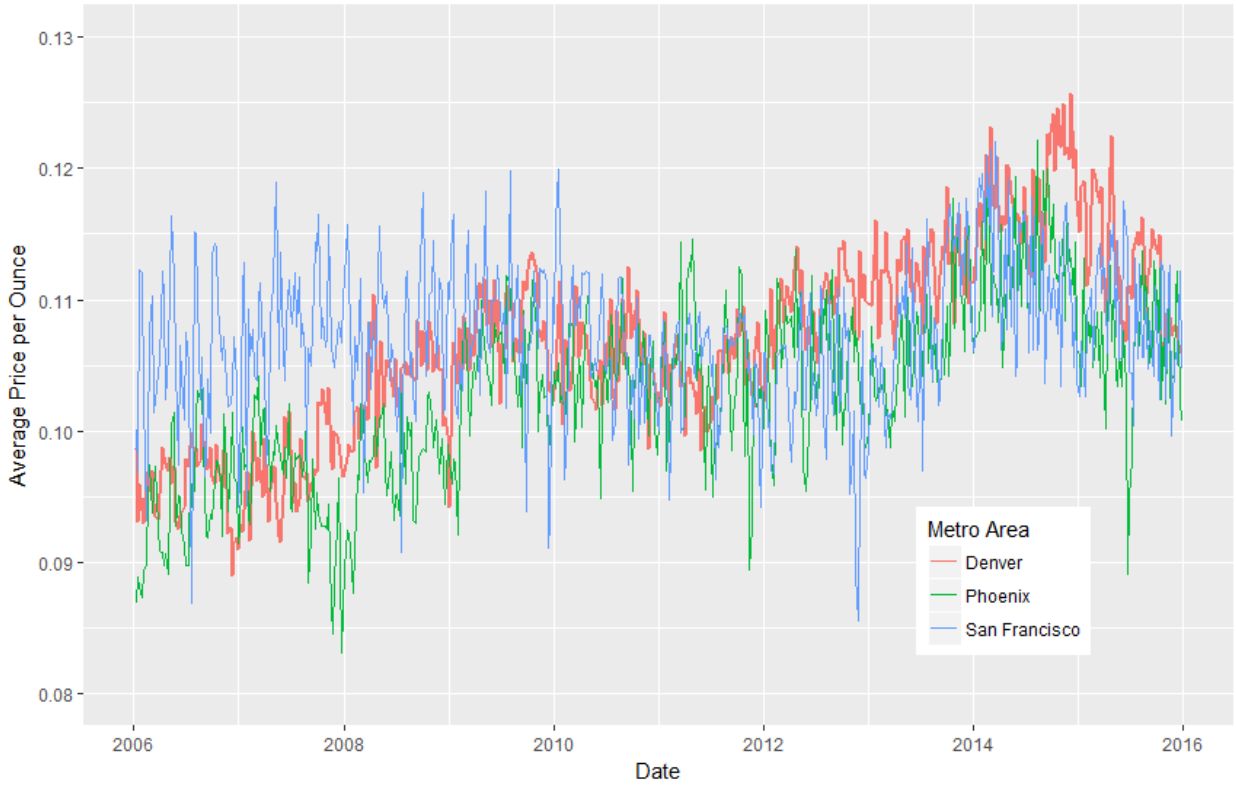
Figure 5. Average Ratings Before and After Acquisitions, 1 to 20 Month Windows



Source: Author generated from RateBeer data, 3,308,676 observations

Notes: The acquisition effect is noisy for the fist few months, but otherwise it remains negative and statistically significant, and the local response is significantly more negative than the nonlocal.

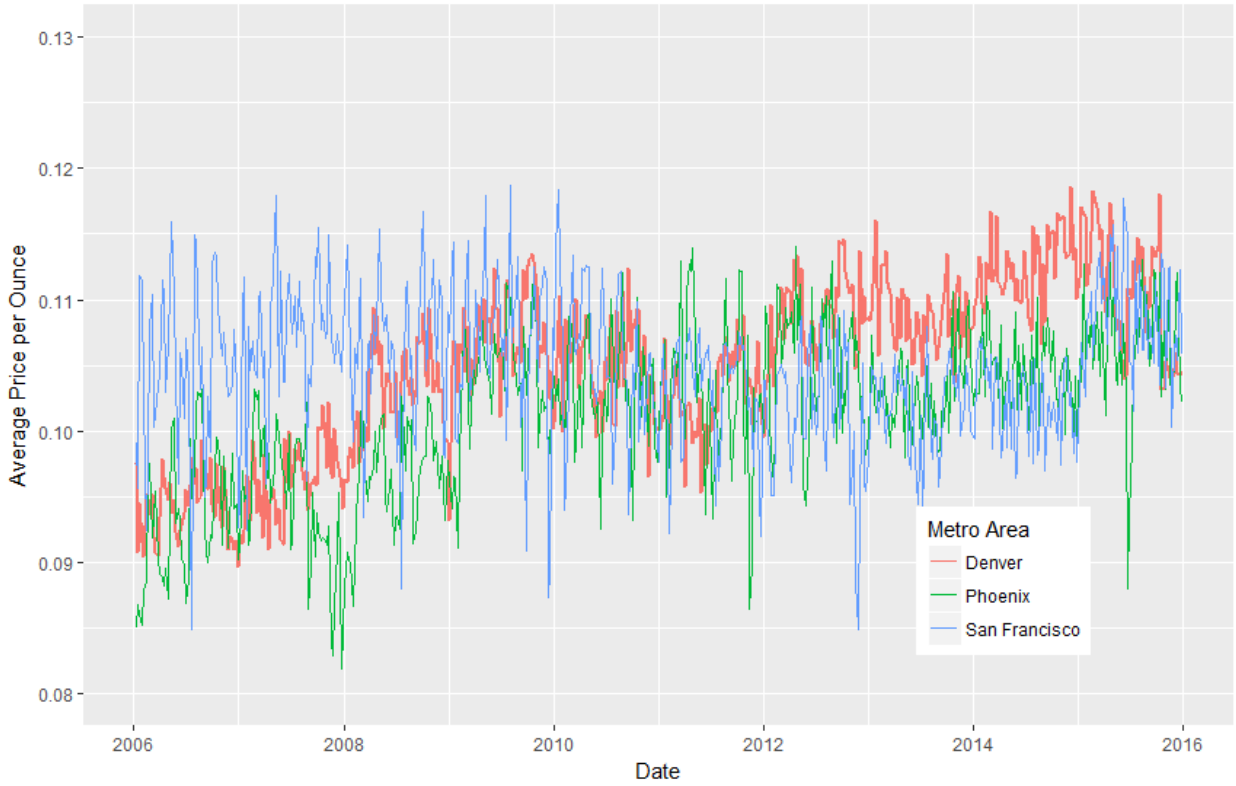
Figure 6. Change in Ratings Following an Acquisition, 1 to 24 Month Windows



Source: Author generated from Nielsen Scanner data, ? observations

Notes: New Belgium prices are higher in the brewery's home market of Denver than in other markets from 2012 forward.

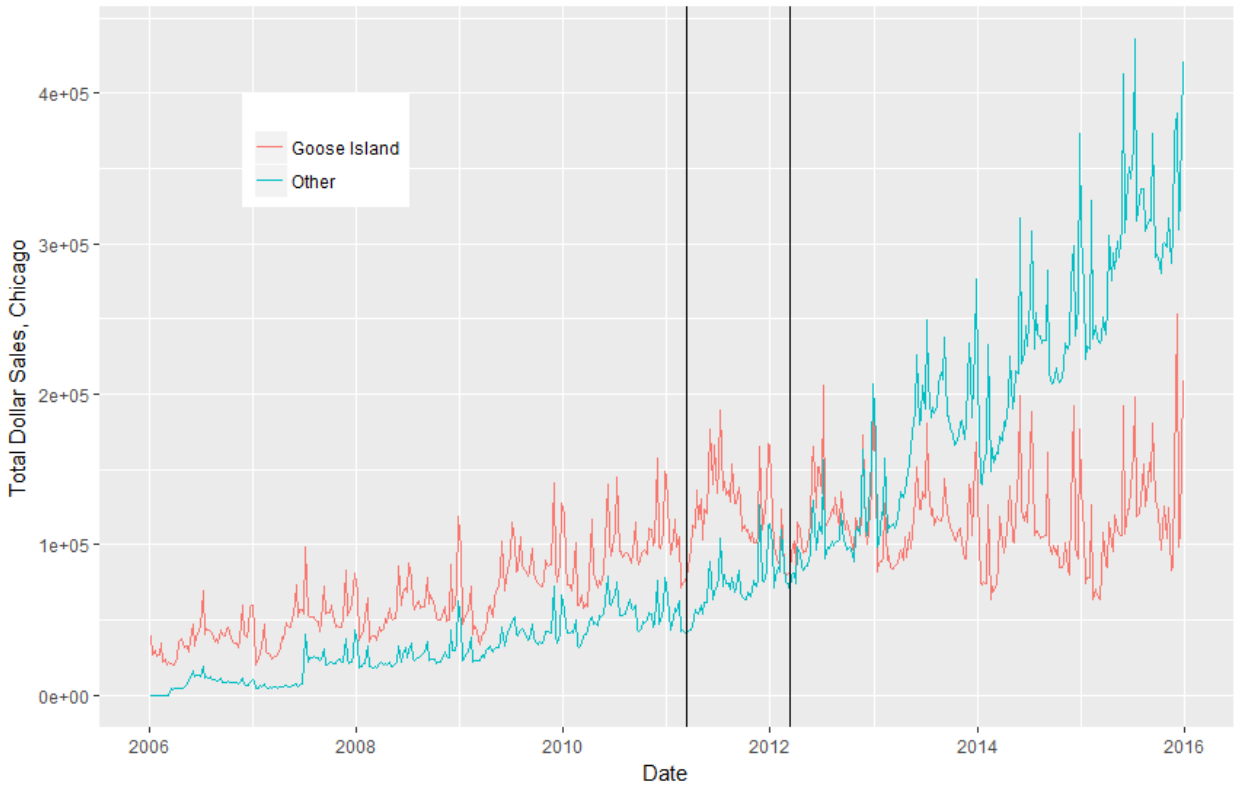
Figure 7. Weekly Average Prices of New Belgium Beer in Selected U.S. Cities, 2006–2015



Source: Author generated from Nielsen Scanner data, ? observations

Notes: New Belgium prices for the Fat Tire brand are higher in the brewery's home market of Denver than in other markets from 2012 forward.

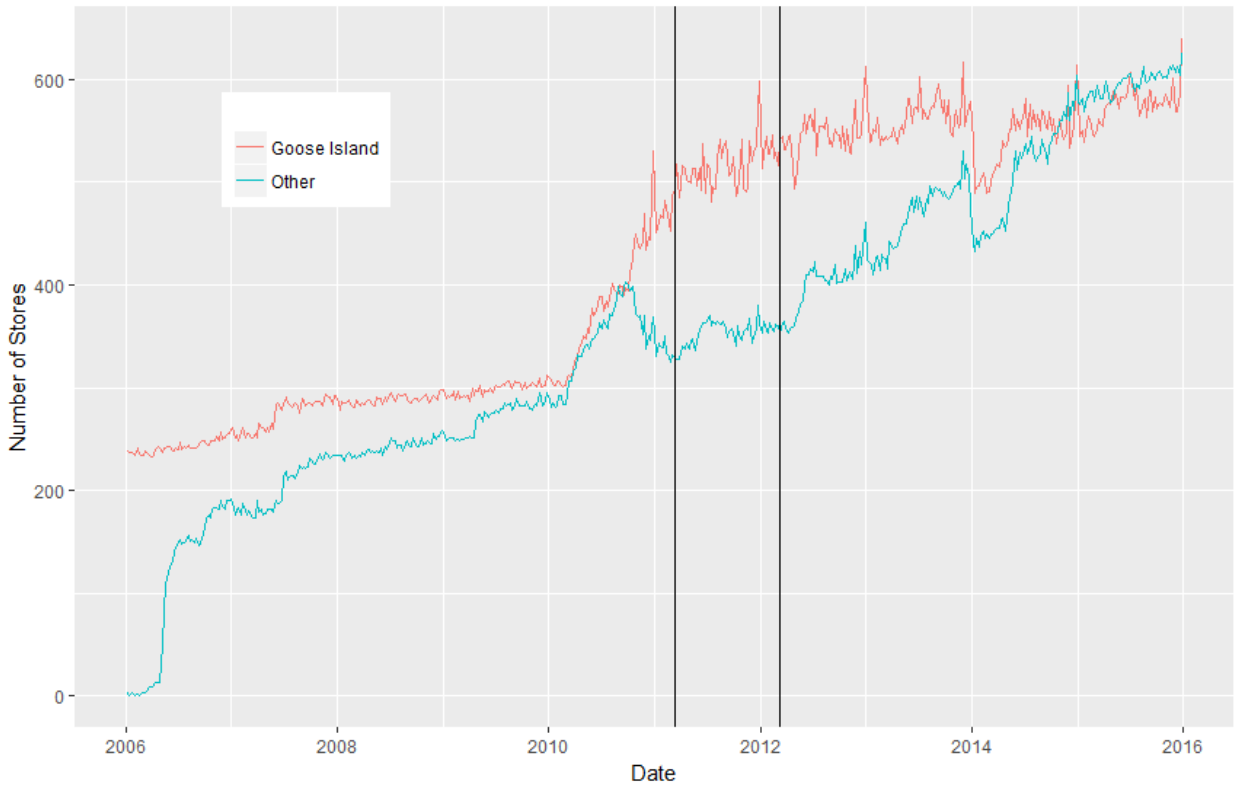
Figure 8. Weekly Average Prices of New Belgium's Fat Tire Beer in Selected U.S. Cities, 2006–2015



Source: Author generated from Nielsen Scanner data, ? observations

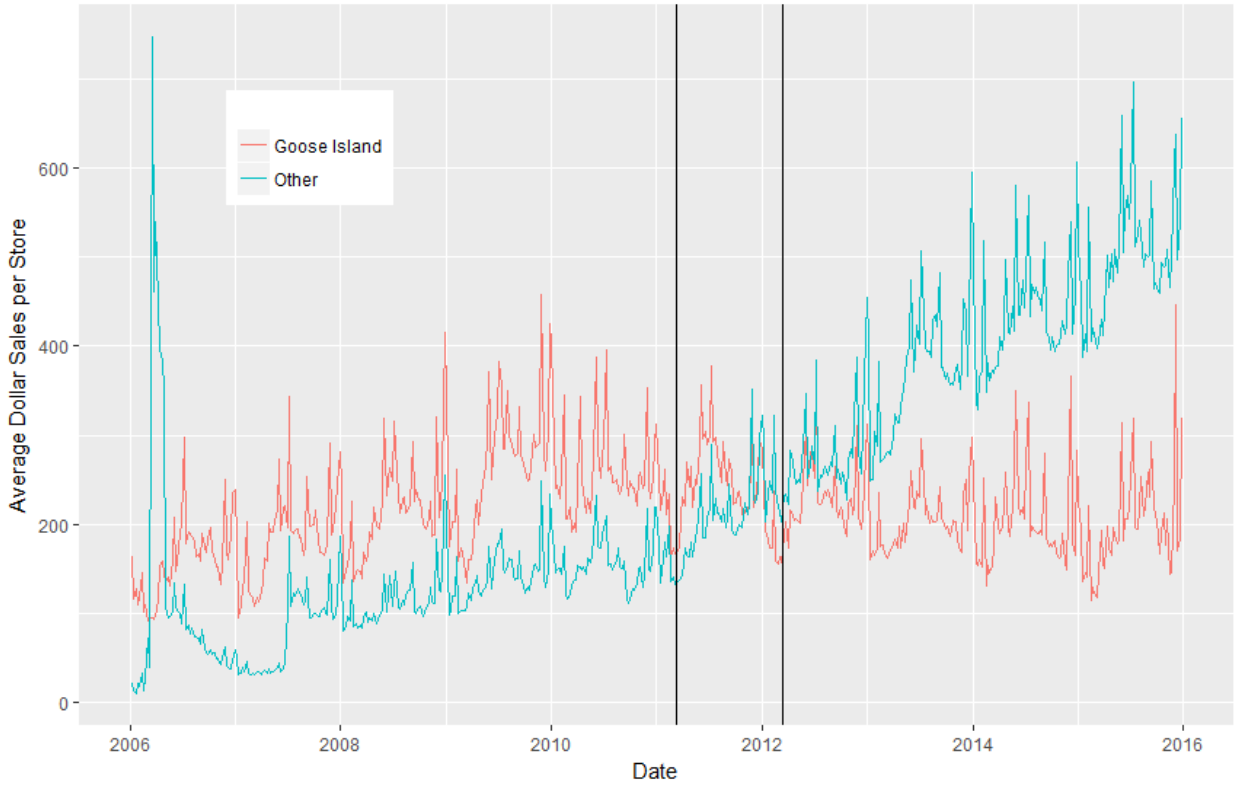
Notes: The first vertical line denotes the 2011 acquisition of Goose Island by ABInBev, and the second denotes when ABInBev took over distribution and production in 2012. Sales of Goose Island exhibit no structural change, whereas other craft beer sales rapidly increase from 2012–2015.

Figure 9. Weekly Sales of Goose Island Beer, 2006–2015



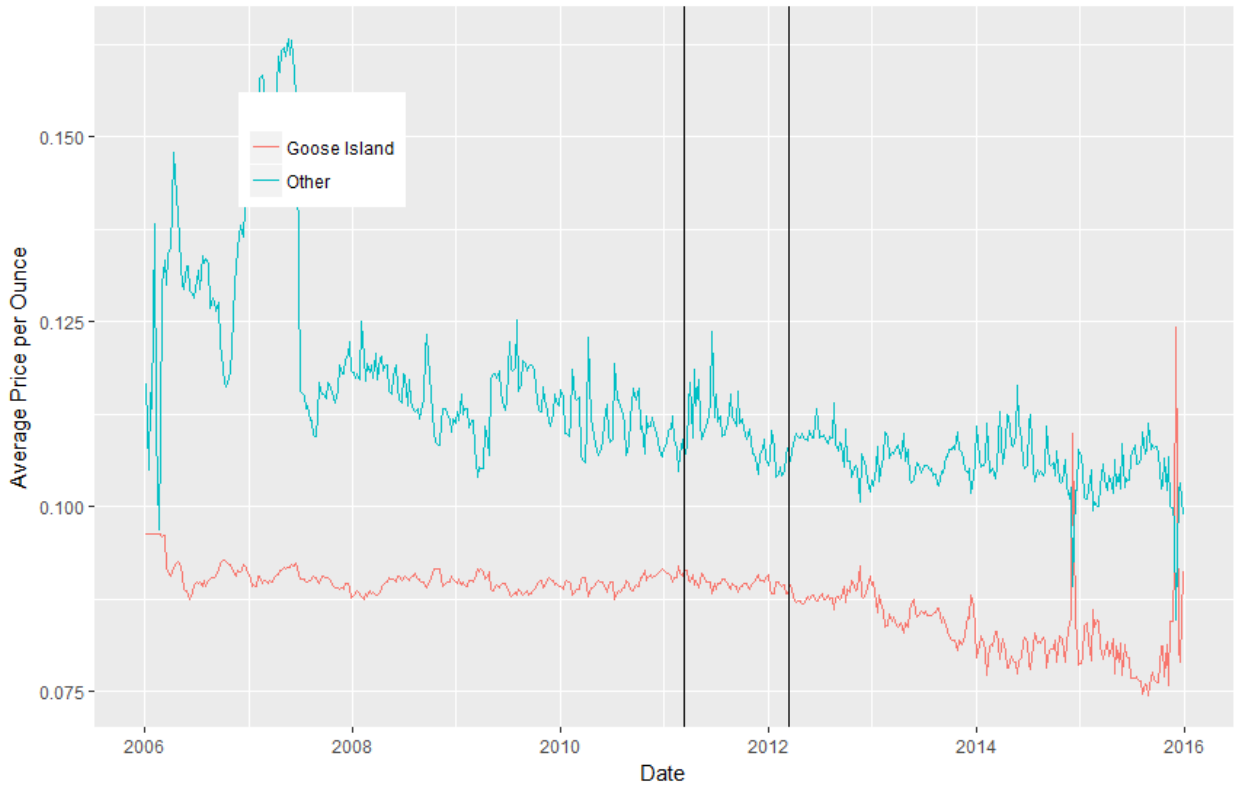
Source: Author generated from Nielsen Scanner data, ? observations
Notes: The first vertical line denotes the 2011 acquisition of Goose Island by ABInBev, and the second denotes when ABInBev took over distribution and production in 2012. The number of stores carrying Goose Island increases slightly, whereas the number of stores carrying other craft beer sales increases substantially from 2012–2015.

Figure 10. Stores with Goose Island Sales, Chicago, 2006–2015



Source: Author generated from Nielsen Scanner data, ? observations
Notes: The first vertical line denotes the 2011 acquisition of Goose Island by ABInBev, and the second denotes when ABInBev took over distribution and production in 2012. The number of stores carrying Sales of Goose Island per store decrease slightly, whereas other craft beer sales per store increase dramatically from 2012–2015.

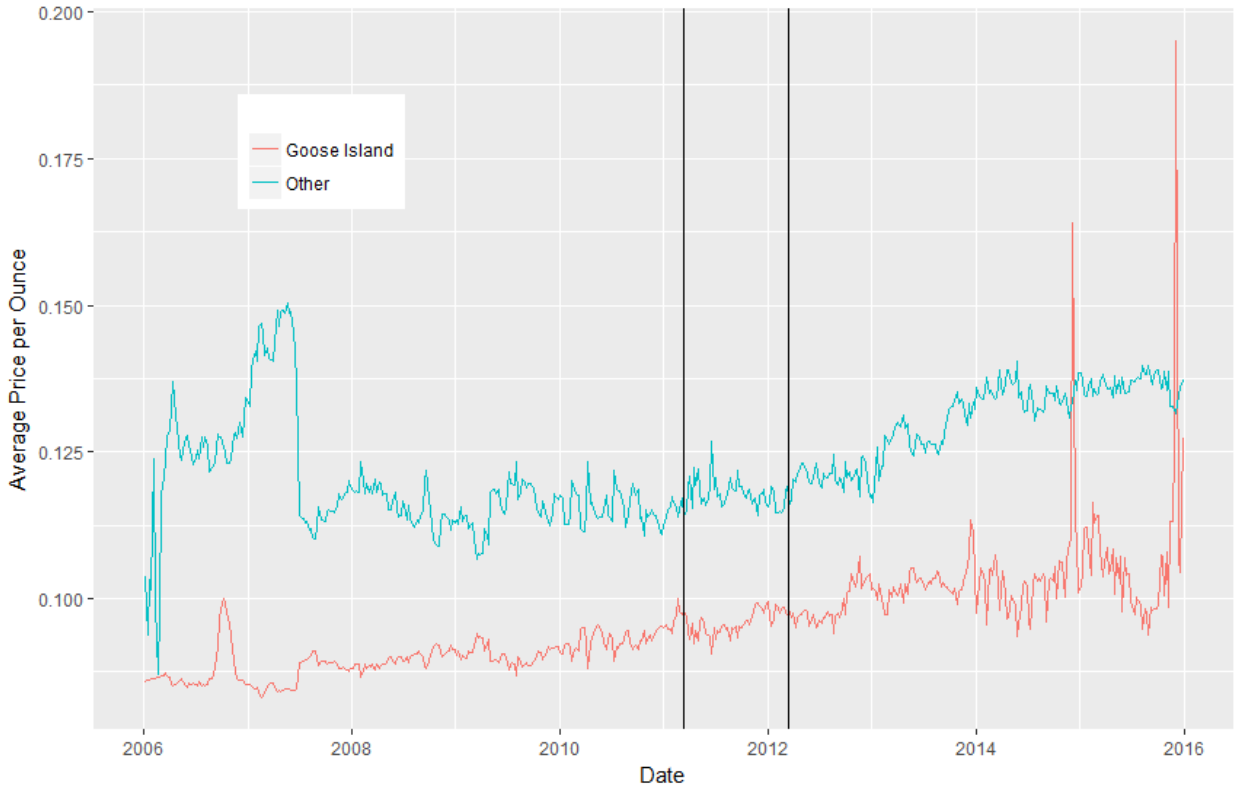
Figure 11. Average Goose Island Sales per Store, Chicago, Dollars per Week, 2006–2015



Source: Author generated from Nielsen Scanner data, ? observations

Notes: The first vertical line denotes the 2011 acquisition of Goose Island by ABInBev, and the second denotes when ABInBev took over distribution and production in 2012. The average price of Goose Island decreases slightly, whereas there is no structural change for the price of other craft beer from 2012–2015.

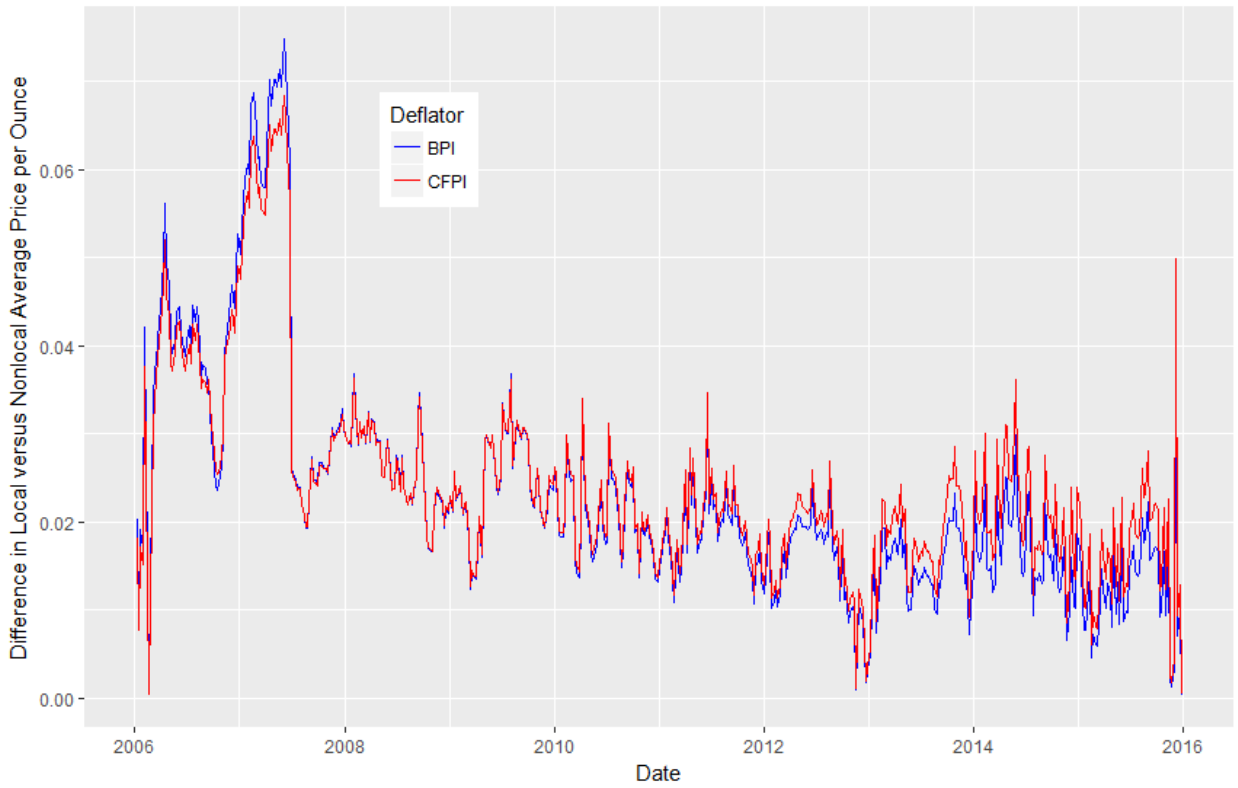
Figure 12. Weekly Average BPI-deflated Price of Goose Island Beer, Chicago, 2006–2015



Source: Author generated from Nielsen Scanner data, ? observations

Notes: The first vertical line denotes the 2011 acquisition of Goose Island by ABInBev, and the second denotes when ABInBev took over distribution and production in 2012. The average price of Goose Island increases slightly, whereas the price of other craft beer increases more substantially from 2012–2015.

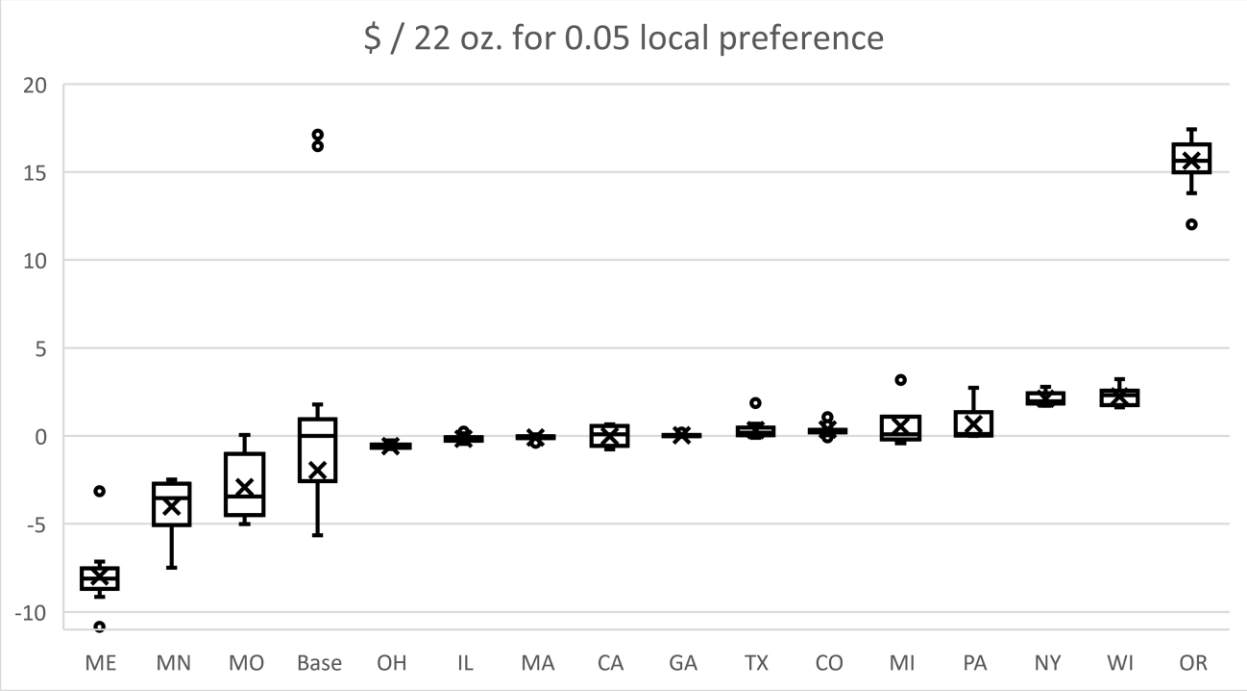
Figure 13. Weekly Average CFPI-deflated Price of Goose Island Beer, Chicago, 2006–2015



Source: Author generated from Nielsen Scanner data, ? observations

Notes: The BPI deflator tends to slightly understate price differences of local and nonlocal beers owing to a fixed initial bundle of goods that does not account for a changing product mix.

Figure 14. Difference in Average Prices of Local and Nonlocal Beer for BPI and CFPI Deflators, 2006–2015



Source: Author generated by combing RateBeer and Nielsen Scanner data, ? observations
Notes: Dots represent outliers and x's represent mean values. Tails depict 95% confidence intervals, and boxes depict upper and lower quartiles.

Figure 15. State-specific implicit Value of Ratings

Table 1. Brewery acquisitions

Brewery	Acquiring Firm	Date	Location
Magic Hat	North American Breweries	2008	Burlington, VT
Pyramid	North American Breweries	2008	Seattle, WA
Lagunitas	Heineken	09/08/2015	Petaluma, CA
Ballast Point	Constellation Brands	11/15/2015	San Diego, CA
Founders	Mahou San Miguel	12/17/2014	Grand Rapids, MI
Goose Island	Anheuser-Busch	03/28/2011	Chicago, IL
Blue Point	Anheuser-Busch	02/05/2014	Patchogue, NY
10 Barrel	Anheuser-Busch	11/05/2014	Bend, OR
Elysian	Anheuser-Busch	01/23/2015	Seattle, WA
Golden Road	Anheuser-Busch	09/23/2015	Los Angeles, CA
Four Peaks	Anheuser-Busch	12/18/2015	Tempe, AZ
Breckenridge	Anheuser-Busch	12/22/2015	Littleton, CO
Devils Backbone	Anheuser-Busch	04/12/2016	Lexington, VA
Karbach	Anheuser-Busch	11/03/2016	Houston, TX
Wicked Weed	Anheuser-Busch	05/03/2017	Asheville, NC
Saint Archer	MillerCoors	09/10/2015	San Diego, CA
Terrapin	MillerCoors	07/20/2016	Athens, GA
Hop Valley	MillerCoors	07/29/2016	Springfield, OR

Source: Author generated.
Notes: Each craft brewery acquisition by a large company that ratings are available for before and after the event are included in the table.

Table 2. Effect of acquisitions and localness on ratings, various fixed effects

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Local	0.029***	0.036***	0.052***	0.037***	0.035***	0.035***	0.029***
	(0.004)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
Acquisition		0.101***	−0.030***	−0.039***	−0.022***	−0.021***	−0.015
		(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.010)
Acquisition* Local		−0.056***	−0.084***	−0.028*	−0.027*	−0.027*	−0.021
		(0.015)	(0.012)	(0.016)	(0.016)	(0.016)	(0.017)
Intercept		3.459***					
		(0.000)					
Fixed Effects	None	None	Beer	Beer, User	Beer, User, Year	Beer, User, Month	Beer, User, Year, Beer*Year

Source: Author generated from RateBeer data, 3,431,149 observations.
Notes: *** denotes significance at 1%, * at 10%. Numbers in parentheses denote standard errors.

Table 3. Effect of acquisitions and localness on ratings in California, various fixed effects

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Local	0.024***	0.045***	0.074***	0.031***	0.029***	0.029***	0.024***
	(0.008)	(0.007)	(0.006)	(0.008)	(0.008)	(0.008)	(0.008)
Acquisition		0.049***	−0.024***	−0.039***	−0.016**	−0.013	−0.039***
		(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.014)
Acquisition* Local		−0.082**	−0.122**	−0.046	−0.050	−0.049	−0.044
		(0.055)	(0.052)	(0.048)	(0.048)	(0.048)	(0.048)
Intercept		3.597***					
		(0.001)					
Fixed Effects	None	None	Beer	Beer, User	Beer, User, Year	Beer, User, Month	Beer, User, Year, Beer*Year

Source: Author generated from RateBeer data, 682,957 observations.
Notes: *** denotes significance at 1%, ** at 5%. Numbers in parentheses denote standard errors.

Table 4. Effect of acquisitions and localness on ratings in California & United States, variant definition of local

	California			United States		
Variable	City	City Area	State	City	State	CA City, Other State
Local	0.024***	0.007*	0.046	0.035***	0.035***	0.039***
	(0.008)	(0.004)	(0.052)	(0.004)	(0.004)	(0.002)
Acquisition	−0.039***	−0.040***	−0.041***	−0.022***	−0.021***	−0.021***
	(0.014)	(0.014)	(0.014)	(0.004)	(0.004)	(0.004)
Acquisition* Local	−0.044	0.006	0.008	−0.027*	−0.018*	−0.022**
	(0.048)	(0.037)	(0.023)	(0.016)	(0.009)	(0.010)
Fixed Effects	Beer, User, Year, Beer*Year	Beer, User, Year, Beer*Year	Beer, User, Year, Beer*Year	Beer, User, Year	Beer, User, Year	Beer, User,

Source: Author generated from RateBeer data, 682,957 observations for California and 3,431,149 observations for the United States.
Note: *** denotes significance at 1%, ** at 5%, * at 10%. Numbers in parentheses denote standard errors.

Table 5. Effect of acquisitions and localness on probability of preference in California & United States

	California			United States		
Variable	City	City Area	State	City	State	CA City, Other State
Local	0.098***	0.031***	0.110	0.102***	0.103***	0.115***
	(0.022)	(0.011)	(0.175)	(0.011)	(0.006)	(0.006)
Acq.	−0.140***	−0.144***	−0.145***	−0.041***	−0.038***	−0.038***
	(0.039)	(0.039)	(0.039)	(0.009)	(0.009)	(0.009)
Acq*Local	−0.169	0.018	0.029	−0.131***	−0.096***	−0.114***
	(0.158)	(0.126)	(0.069)	(0.042)	(0.023)	(0.025)
Fixed Effects	Beer, User, Year, Beer*Year	Beer, User, Year, Beer*Year	Beer, User, Year, Beer*Year	Beer, User, Year	Beer, User, Year	Beer, User, Year

Source: Author generated from RateBeer data, 682,957 observations for California and 3,431,149 observations for the United States.
Note: *** denotes significance at 1%. Numbers in parentheses denote standard errors.

Table 6. Effect of acquisition on demand

Variable	All Stores	All Stores & Store Type	Pre-acquisition Stores	BPI
ln(Price)	−1.936***	−1.936***	−1.947***	−1.822***
	(0.036)	(0.036)	(0.039)	(0.032)
Acquisition	0.123***	0.123***	0.118***	0.144***
	(0.019)	(0.019)	(0.019)	(0.019)
Distribution	0.107***	0.107***	0.101***	0.148***
	(0.040)	(0.040)	(0.038)	(0.040)
ln(Price) *Local	−0.073**	−0.073**	−0.063*	−0.351**
	(0.035)	(0.035)	(0.036)	(0.033)
Acquisition *Local	0.004	0.004	0.010	−0.031
	(0.024)	(0.024)	(0.025)	(0.023)
Distribution *Local	−0.201***	−0.201***	−0.182***	−0.350***
	(0.049)	(0.049)	(0.046)	(0.049)
Fixed Effects	Brand-Market, Week, Store,	Brand-Market, Week, Store, Store Type	Brand-Market, Week, Store	Brand-Market, Week, Store

Source: Author generated from Nielsen data, 16,020,330 observations.
Note: *** denotes significance at 1%, ** at 5%, * at 10%. Numbers in parentheses denote standard errors. Subset of 10 cities home to acquired breweries; prices are CFPI deflated.

Table 7. Effect of acquisition on demand, by acquiring company

Company	Base Effect	Effect*Local	Net Local
Heineken	−0.222***	−0.163*	−0.385***
	(0.085)	(0.094)	(0.089)
Constellation	−0.094	0.282**	0.188
	(0.111)	(0.123)	(0.117)
Mahou	0.142	−0.092	0.050
	(0.0217)	(0.677)	(0.503)
ABInBev	−0.833***	0.540*	−0.293
	(0.236)	(0.284)	(0.261)
MillerCoors	−0.786***	−1.479***	−2.265***
	(0.301)	(0.379)	(0.342)

Company	Effect*ln(Price)	Effect*ln(Price)*Local	Net Local
Heineken	−0.114***	−0.070	−0.184***
	(0.042)	(0.047)	(0.044)
Constellation	−0.051	0.162**	0.111
	(0.071)	(0.072)	(0.071)
Mahou	0.056	−0.071	−0.015
	(0.035)	(0.335)	(0.248)
ABInBev	−0.467***	0.312**	−0.156
	(0.120)	(0.147)	(0.134)
MillerCoors	−0.472**	−0.718***	−1.190***
	(0.184)	(0.379)	(0.197)

Fixed Effects: Brand-Market, Week, Store

Source: Author generated from Nielsen data, 16,020,330 observations.
Note: *** denotes significance at 1%, ** at 5%, * at 10%. Numbers in parentheses denote standard errors.

Table 8. Own-price elasticity of demand for individual craft beers, local versus nonlocal

Sample	ln(Price)		ln(Price)*Local	
	β_5	S.E.	β_6	S.E.
1	−2.272***	(0.011)	0.146***	(0.024)
2	−2.253***	(0.011)	0.103***	(0.024)
3	−2.274***	(0.010)	0.225***	(0.023)
4	−2.249***	(0.027)	0.130***	(0.024)
5	−2.198***	(0.029)	0.131***	(0.027)
6	−2.192***	(0.029)	−0.129***	(0.033)
7	−2.302***	(0.025)	0.126***	(0.029)
8	−2.211***	(0.027)	−0.014	(0.028)
9	−2.139***	(0.026)	0.028	(0.027)
10	−2.294***	(0.026)	0.300***	(0.029)
11	−2.231***	(0.022)	0.119***	(0.028)
12	−2.217***	(0.030)	0.264***	(0.027)
13	−2.277***	(0.030)	0.094***	(0.027)
14	−2.203***	(0.032)	0.033	(0.029)
15	−2.272***	(0.026)	−0.100***	(0.026)
16	−2.221***	(0.022)	0.155***	(0.030)
17	−2.099***	(0.022)	0.053	(0.035)
18	−2.202***	(0.028)	−0.046*	(0.026)
19	−2.238***	(0.025)	0.032	(0.028)
20	−2.267***	(0.027)	0.336***	(0.023)
Average	−2.231***	(0.025)	0.099***	(0.028)

Source: Author generated from Nielsen data, 970,369,807 observations.

Note: *** denotes significance at 1%, * at 10%. Numbers in parentheses denote standard errors. Twenty random 5% samples without replacement are used; prices are CFPI deflated.

Table 9. Implicit value of local preference

Sample	α	S.E.	$/6-pack for 0.05 local preference	2014 Real Dollars
1	−0.151***	(0.019)	−0.544	−0.639
2	0.169***	(0.018)	0.608	0.715
3	0.037**	(0.018)	0.133	0.157
4	0.011	(0.011)	0.040	0.047
5	0.079***	(0.016)	0.284	0.334
6	−0.180***	(0.013)	−0.648	−0.762
7	0.096***	(0.012)	0.346	0.406
8	−0.279***	(0.014)	−1.004	−1.181
9	−0.137***	(0.017)	−0.493	−0.580
10	0.045**	(0.021)	0.162	0.190
11	−0.090***	(0.018)	−0.324	−0.381
12	0.080***	(0.020)	0.288	0.339
13	−0.050***	(0.018)	−0.180	−0.212
14	−0.113***	(0.016)	−0.407	−0.478
15	0.049**	(0.020)	0.176	0.207
16	0.157***	(0.015)	0.565	0.665
17	0.100***	(0.026)	0.360	0.423
18	0.080***	(0.028)	0.288	0.339
19	−0.103***	(0.015)	−0.371	−0.436
20	−0.077***	(0.019)	−0.277	−0.326
Average	−0.014	(0.018)	−0.050	−0.059

Source: Author generated from RateBeer and Nielsen combined data, 970,369,807 observations.
Note: *** denotes significance at 1%, ** at 5%. Numbers in parentheses denote standard errors.
Twenty random 5% samples without replacement are used; prices are CFPI deflated.

Table 10. State-specific implicit value of local preference

	Mean Estimates		Mean Net Effect		$/22 oz for 0.05 local preference	Lower and upper quartiles	
State	α_k	S.E.	$\alpha_0 + \alpha_k$	S.E.			
Base	−1.778***	(0.346)	−1.778***	(0.346)	−1.956	[−2.503,	0.759]
CA	1.769***	(0.349)	−0.009	(0.347)	−0.010	[−0.556,	0.554]
CO	3.417***	(0.378)	0.331	(0.373)	0.364	[0.227,	0.337]
GA	4.254***	(0.420)	0.033	(0.421)	0.036	[−0.008,	0.058]
IL	−0.783**	(0.340)	−0.155	(0.338)	−0.170	[−0.268,	−0.086]
MA	0.852***	(0.233)	−0.078	(0.231)	−0.086	[−0.121,	−0.016]
ME	−3.399***	(0.417)	−7.262***	(0.405)	−7.989	[−8.600,	−7.552]
MI	13.042***	(0.689)	0.490	(0.604)	0.539	[−0.090,	0.344]
MN	−5.925***	(0.532)	−3.648***	(0.467)	−4.013	[−4.233,	−2.818]
MO	−3.561***	(0.413)	−2.655***	(0.358)	−2.920	[−4.427,	−1.055]
NY	3.315***	(0.377)	1.925***	(0.373)	2.118	[1.853,	2.313]
OH	−1.226***	(0.320)	−0.524	(0.319)	−0.577	[−0.664,	−0.518]
OR	16.158***	(0.440)	14.215***	(0.381)	15.636	[15.094,	16.420]
PA	11.357***	(0.553)	0.611	(0.534)	0.672	[0.030,	0.900]
TX	4.074***	(0.473)	0.293	(0.474)	0.322	[0.064,	0.378]
WI	1.293***	(0.370)	2.032***	(0.365)	2.235	[1.761,	2.536]

Source: Author generated from RateBeer and Nielsen combined data, 970,369,807 observations.
Note*:* *** denotes significance at 1%, ** at 5%. Numbers in parentheses denote standard errors. Twenty random 5% samples without replacement are used; prices are CFPI deflated.