Efficiencies Brewed : Pricing and Consolidation in the U.S. Beer Industry

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Abstract

Merger efficiencies provide the primary justification for why mergers of competitors may benefit consumers. Surprisingly, there is little evidence that efficiencies can offset incentives to raise prices following mergers. We estimate the effects of increased concentration and efficiencies on pricing by using panel scanner data and geographic variation in how the merger of Miller and Coors breweries was expected to increase concentration and reduce costs. All else equal, the average predicted increase in concentration lead to price increases of two percent, but at the mean this was offset by a nearly equal and opposite efficiency effect.

1 Introduction

Whether a merger of large firms in the same industry increases prices depends on two opposing forces. In theory, a merger increases prices to the extent it allows the merged firm to internalize pricing externalities or facilitates tacit collusion. Simultaneously, a merger can result in reductions in marginal cost that provide the combined firm with an incentive to lower prices. This tradeoff has provided the economic framework for the antitrust analysis of horizontal mergers since at least Williamson (1968), yet there is very little direct empirical evidence that efficiencies can offset the incentive to raise prices. This lack of direct evidence is likely due to the inherent difficulties in measuring if (and by how much) mergers lower firms marginal costs. [1]

The objective of this study is to test whether efficiencies can counteract incentives to increase prices resulting from mergers of competitors. We do this by using detailed retail scanner data to study the effect on pricing of a large merger in the U.S. brewing industry. In June of 2008 the U.S. Department of Justice approved a joint venture between Miller and Coors, the second and third largest firms in the industry. Despite substantially increasing concentration in an already concentrated industry, the merger was approved by the antitrust authority partially because it was expected to reduce shipping and distribution costs (Heyer, Shapiro and Wilder 2008). Prior to the merger Coors was brewed in only two locations, while Miller was brewed in six locations more widely distributed across the United States. The merger was expected to allow the combined firm to economize on shipping costs primarily by moving the production of Coors products into Miller plants. These cost savings represent changes in variable costs that could give the combined firm

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[1]Williamson considered a competitive industry where each firm has identical constant marginal cost. He showed with a simple diagram that if a merger increases price above marginal cost only small reductions in the constant marginal cost curve are needed for total surplus to increase. The same reasoning holds if the welfare standard is consumer surplus instead of total surplus, but greater unit costs reductions will be needed. Farrell and Shapiro (1990) formalize Williamson's argument in a model where firms sell homogenous products and compete in quantities. They derive necessary and sufficient conditions for a merger to increase consumer surplus.

an incentive to reduce the prices of its products, potentially offsetting any incentive to increase prices resulting from a reduction in the number of independent brewers.

Two key features of the U.S. beer industry assist us in estimating the effects of the merger. First, due to regulations on the distribution of beer, different metropolitan areas can be viewed as separate markets. Second, there was substantial variation in how the merger was expected to reduce shipping costs and increase concentration across the 48 regional markets observed in our data. Together, these two factors allow us to examine how the prices of identical products sold nationally in the U.S. were differentially affected by the reductions in shipping distances and increases in concentration resulting from the merger.

We begin our analysis by constructing simple scatter plots of the change in the average price of beer in a market against two variables: the predicted increase in concentration resulting from the merger and a proxy for merger-specific efficiencies, the reduction in distance between the retailer and the nearest Coors brewery. These figures show that larger predicted increases in concentration were associated with larger price increases, and larger reductions in shipping distances were associated with smaller price increases. We then conduct an analysis of brand level micro data to better account for differences in the composition of beers sold across markets. Specifically, we estimate the effects of increased concentration and reductions in distance to the nearest brewery using panel data regressions with controls for product/region fixed effects and manufacturer specific time effects. In this model, identification requires that there are no region specific trends in pricing that are correlated with the predicted increase in concentration or the reduction in distance to the nearest brewer. Our results are robust to controlling for possible confounders and region specific linear trends in pricing. We also estimate the timing of the effects of the merger on consumer prices. We begin by conducting a graphical analysis using an event study that allows us to separately identify the timing of when the merger

caused prices to change as a result of increased market concentration or reduced shipping distances. This is particularly important for estimating when any efficiencies were passed through into pricing because changes in the firms' distribution may have only occurred with some time. Furthermore, it is possible that any realized reductions in costs will be passed through to prices with a lag. We then present short and longer run distributions of the net effect of the merger on prices across the regional markets in our data. Finally, we estimate how the merger changed the over-all quantity of beer sold and how the effects on volume sold varied across firms.

We find small but statistically significant effects of both predicted increases in concentration and reductions in our measure of shipping distances on beer pricing. The merger was predicted to increase the Herfindahl Hirschman Index (sum of squared revenue shares) by an average of 370 points across the regional markets in our data. In our preferred specification, all else equal, the predicted increase in concentration led to a 1.7 percent increase in the price of all lager style beers in the average market. We also examined whether the merger differentially affected the pricing of beers owned by the merging firm relative to rivals. We find that the increase in concentration led to an increase in the prices of rival firms' brands as well, but by a smaller amount than the brands of the merging firms and with a lag relative to when the merging firms increased the prices of their brands.

The effect of the increase in concentration on pricing was nearly exactly offset by efficiencies created by the merger. The merger reduced the average distance between a local market and a Coors brewery by 364 miles, and our estimates imply that, all else equal, this reduced the average price of all lager style beers by approximately 2 percent. We were unable to detect a differential impact of the reduction in distance on the prices of brands owned by the merging firms relative to the brands of rivals. However, an event study analysis reveals that the timing of the change in prices resulting from the reduction in distance is consistent with the effect being causal as well as industry press reports on

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the operations of the merging firms.

Our results indicate that the merger impacted pricing both through a market power effect and through an efficiency effect, but the firms responded to the change in market power more quickly than the efficiencies were realized. We find some evidence that prices began increasing gradually as soon as the merger was announced in markets where the merger increased market concentration. On the other hand, our estimates indicate that cost reductions did not start to impact pricing until a year after the merger was approved and were not fully incorporated into pricing until about two years after the merger's approval date. On net, we find that despite reducing the number of macro brewers from three to two efficiencies created by the merger offset the incentive to increase prices in the average regional market in the long-run.

This paper adds to the literature on the effects of horizontal mergers on market outcomes by providing direct evidence that merger-specific efficiencies influence pricing. Previous studies have been unable to directly test whether efficiencies change pricing because of a lack of data on how mergers changed determinants of variable costs. At best, previous research has provided evidence on the role of efficiencies by comparing short and long-run estimates of how mergers changed pricing. For example, in their study of bank mergers Focarelli and Panetta (2003) compare the change in prices in markets affected by bank mergers to the change in prices in a sample of comparison markets. They find that prices in markets where mergers occurred increased relative to comparison markets in the first two years after mergers were completed, but prices decreased relative to comparison markets after more time had passed. The difference between the short and long-run effects were attributed to efficiencies, but no changes in components of variable costs were directly measured.[2]

The research design in this paper uses geographic variation in changes in local market

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[2]Focarelli and Panetta (2003) study the effects of the bank mergers on interest rates for deposits, so price increases are interest rate reductions and price decreases are interest rate increases.

structure to study how mergers change pricing decisions. This research design has been used to study the effects of horizontal mergers of health insurance providers (Dafny, Duggan and Ramanarayanan 2012), banks (Allen, Clark and Houde 2013), (Sapienza 2002), (Focarelli and Panetta 2003), (Prager and Hannan 1998), airlines (Borenstein 1990), (Kim and Singal 1993), and gasoline (Hastings 2004), (Hosken and Taylor 2007), (Simpson and Taylor 2008), (Houde 2012). Most of the papers in this literature use panel data to study the effect of a change in the number of competitors on pricing while controlling for time-invariant differences across markets and common time shocks across all geographic markets.[3] This approach is not possible in the beer industry because the merging firms had a presence in all geographic markets in our data. For that reason, we follow Dafny et al. (2012) and use variation in how the merger was predicted to increase concentration (and costs) across markets. Dafny et al. study the effect of changes in concentration on premiums in the health insurance industry. They estimate the relationship between health insurance premiums and provider concentration by using the predicted increase in concentration resulting from a large merger of two health insurance providers as an instrumental variable. Our main specification is very similar to the "reduced form" in their paper, which measures the direct effect of the instrument (the predicted increase in concentration resulting from the merger) on prices. Our work differs from Dafny et al. and the rest of the literature because we also study how efficiencies generated by mergers can offset the incentive to raise prices. This is possible in our case because we have variation across geographic markets in how the merger was expected to generate efficiencies that is independent of variation in how it was predicted to increase concentration. This allows for a more direct estimate of how efficiencies created by mergers influence pricing decisions than has been possible in prior studies.

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[3]While not a study of horizontal mergers, Hortasu and Syverson (2007) use a similar research design to study the impact of vertical mergers in the ready-mix concrete industry on prices, output, and entry rates. They find evidence that vertical integration in that industry led to productivity gains and no evidence of foreclosure.

Our paper also contributes to a growing literature that attempts to evaluate antitrust policy towards horizontal mergers by estimating the price effects of large mergers that were heavily scrutinized but nevertheless passed (Carlton 2009). A meta-analysis of this literature is provided by Kwoka (2013). These studies focusing on mergers that were "close calls" have typically estimated price increases.

The rest of the paper is organized as follows. Section II provides background on the key institutional features of the brewing industry and the Miller/Coors merger. Section III describes our data. Section IV describes our empirical approach and presents our results. Finally, we conclude.

2   Background on the U.S. Brewing Industry and the Miller/Coors Joint Venture

2.1   Background on the U.S. Brewing Industry

The U.S. beer industry is similar to many other mature branded consumer goods industries. Manufacturers of branded beers earn relatively high margins and compete with rivals by introducing new products, advertising, and offering periodic sales on their products. What most differentiates brewing from typical consumer goods markets is that the sale and distribution of beer is highly regulated which, in turn, has important implications for geographic market definition. Following the repeal of Prohibition, individual states were given the right to regulate the within state sale and distribution of alcohol. While there are important differences in regulation across states, with minor exceptions, all states prohibit brewers from directly selling their products to consumers, retailers, restaurants or bars.[4] Instead, a brewer must first sell its products to a state licensed dis-

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[4]For example, in all states, very small brewers are now able to sell their products directly to consumers (e.g., brew pubs) (Tremblay and Tremblay 2009).

tributor who then sells those products to a retail outlet, bar or restaurant[5]. In all cases, distributors are limited to selling products within the state they operate in; that is, it is illegal for a distributor to transport alcohol from one state to another. In many states, state law further limits distributors to serving specific regions within a state (mandated exclusive territories).[6]

State restrictions on the distribution of beer effectively split the U.S. into a number of distinct geographic regions at least as narrow as a state in which a brewer can charge different wholesale prices without fear that these price differences can be arbitraged away by transshipment. By contrast, most other consumer goods manufacturers are much more limited in their ability to price discriminate by region. Retailers or distributors can likely arbitrage away wholesale price differences across regions by transshipping items from regions with low wholesale price to those with high wholesale price. The importance of local markets in the beer industry can be seen in antitrust enforcement. In its review of the merger of Anheuser-Busch and InBev in 2008, the Department of Justice required InBev to divest the U.S. rights to brew, market, and distribute Labatt beer (prior to the merger an InBev brand) because of competition in parts of New York State. Aside from Labatt's, Inbev primarily sold more expensive beer with much smaller market shares than Anheuser Busch. This makes it unlikely that after the divestiture this merger had any impact on the market for beer.[7]

While many different types of beers are sold in the U.S.–Belgian Ales, Pale Ales, Brown

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[5]This is often referred to as the three-tiered distribution system: brewers, distributors, and retailers

[6]Rojas (2012) reports that 25 states require brewers to sign exclusive territory agreements with their distributors. Asker (2004) provides a useful discussion of the supply chain in the beer industry in a paper that tests for anticompetitive effects of exclusive dealing contracts between brewers and distributors in Chicago.

[7]See the press release announcing the settlement agreement between the U.S. Department of Justice and Anheuser Busch/Inbev, November 14, 2008. The DOJ's press release stated, "In the large majority of markets in the United States, InBev accounts for less than two percent of beer sales and engages in very little competition with Anheuser-Busch. In contrast, sales of InBev's Labatt beer brands in Buffalo, Rochester and Syracuse account for a significant portion of beer sales. The Department concluded that in those markets, the elimination of the competition between InBev and Anheuser Busch would have resulted in higher prices for consumers."

Ales, Porters, Stouts, Hefeweizens–the lion's share of sales goes to a single variety, lagers. Lagers account for 92.7% of beer volume and 89% of beer revenue in our data. Moreover, despite some recent entry by micro-brewers and the availability of imported beer, the U.S. brewing industry has remained highly concentrated. Table 1 presents national revenue shares for the ten largest firms calculated on the sales data of all beers during the five months prior to the merger. Prior to the merger, Anheuser Busch, Molson/Coors and Miller together accounted for about 65% of market revenue in our data. These firms sell the leading U.S. brands of beer: Budweiser Light, Miller Light, Budweiser, and Coors Light. The next four largest firms sell either imported beers (Corona, Heineken, Guinness) or "super premium" domestic beer (Samuel Adams), which is offered at a much higher price point than the beers of Anheuser Busch, Coors, or Miller. The remaining U.S. beer manufacturers are very small. The ninth largest company, Pabst Blue Ribbon, has a revenue share of only 1.6% and is a holding company that contracts out the brewing of its beer, a collection of brands associated with now defunct brewers including Pabst Blue Ribbon, Old Style, and Lone Star. The remaining independent domestic brewers have more regional distribution (e.g. D.G. Yuengling, which at the time of the merger was offered almost exclusively in the mid-Atlantic Region of the U.S.).

2.2   The Miller/Coors Joint Venture

On October 9th, 2007 Miller and Coors announced their intent to create a joint venture to combine their operations. Structurally, the merger appeared to be problematic. First, prior to the merger, the U.S. beer market was already quite concentrated, and the merger combined the second and third largest brewers. Using data on all beer sales from our sample of the 48 U.S. regions, we find that overall pre-merger HHI was about 2000 with an increase in the HHI of about 382. According to the 2010 Horizontal Merger Guidelines, mergers resulting in an HHI of between 1500 and 2500 with a change of more than 100

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"may raise significant concerns", while mergers resulting in an HHI of more than 2500 with a change in HHI of more than 200 will be presumed to be likely to increase market power. Second, many of Coors and Millers products appeared to be close substitutes for one another. The big three brewers (then Anheuser-Busch, Miller, and Coors) all offered products serving each of the mass-market beer tiers: premium (Budweiser, Miller Genuine Draft, and Coors), premium light (Budweiser Light, Miller Lite, and Coors Light), popular (Busch, Keystone, Miller High Life), and popular light (Busch Light, Miller High Life Light, and Keystone Light). Within a market segment, beers from each of these brewers appeared to targeted similar consumers, were priced at roughly the same level, and, over time, these products prices move very closely together. This is shown in figure 1, which plots the average price of a 144 ounce package of each of the largest popular light beer brands over our sample period. Third, historically the U.S. Department of Justice had aggressively challenged mergers in the beer industry. Between 1950 and 1989, the Department of Justice successfully challenged 16 brewer mergers, either blocking the transaction entirely or requiring significant modifications of the proposed merger. While many of these enforcement actions took place in time periods with different enforcement standards than today, the decision to allow the merger of Miller and Coors represented a big break with its previous enforcement decisions in the industry. In concluding their discussion of antitrust issues in their extensive review of the beer industry, Tremblay and Tremblay (2009) state that, "Cooperative behavior is more likely with just three major firms (Anheuser-Busch, Miller and Coors), and the Department of Justice or the Federal Trade Commission should challenge any major merger attempt and closely monitor the behavior of firms."

There were, however, significant efficiencies claimed by the parties that apparently received a great deal of weight from the Department of Justice (Heyer et al. 2008). One of the leading costs of selling beer is distribution. Beer sold at retail outlets is bottled

or canned at a brewery and then shipped to consumers. Because beer is both bulky and heavy (being largely water), these distribution costs can be substantial. While Coors products were nationally distributed, it had only two U.S. production facilities: its primary brewery in Golden, Colorado and a smaller secondary facility located in Elkton, Virginia. Miller operated six breweries fairly evenly spread throughout the U.S.: Albany, Georgia, Eden, North Carolina, Trenton, Ohio, Dallas, Texas, Irwindale, California, and Milwaukee, Wisconsin. Because Millers breweries were not capacity constrained, the combined firm could significantly lower its shipping costs by moving some Coors production to breweries closer to its ultimate consumers. In its closing statement, the DOJ stated that, the Division verified that the joint venture is likely to produce substantial and credible savings that will significantly reduce the companies costs of producing and distributing beer. These savings meet the Divisions criteria of being verifiable and specifically related to the transaction and include large reductions in variable costs of the type that are likely to have a beneficial effect on prices. The DOJ approved the joint venture on June 5, 2008.

3 Data and Sample Construction

This study relies on retail scanner data collected by Information Resources Incorporated (IRI). IRI sells data from three main channels of distribution: supermarkets, mass retailers, and drugstores. For each of these channels IRI collects revenue and unit sales information directly from bar code scanners in a sample of stores within different geographic markets. IRI then projects sales and volume to the regional market level using proprietary weights for each week and UPC in the sample. We purchased data from the supermarket channel because of the three available channels it covers the largest fraction of off-premise beer sales, with an estimated revenue share of 23% in 2011.[8]

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[8]Mass retailers and drug stores accounted for only 6.3% and 3% of off-premise sales, respectively. The two largest retail channels were convenience stores and liquor stores with estimated revenue share of 38% and 26%, respectively. (McClain 2012)

The raw data is an unbalanced panel, and the unit of observation is a week-UPC-geographic region. The data spans the time period from January 1, 2007 through December 31, 2011, giving us a year and five months of data before the merger was approved and three years and seven months of data afterwards. A UPC corresponds to a unique brand, package size, and container type (e.g. a 12 pack of Miller Lite bottles). There are 64 geographic markets in the original data. The markets are agglomerations of counties, typically covering major metropolitan areas.

In eleven of the IRI markets there are very little sales, either because very few supermarkets are permitted to sell beer in those regions or because supermarkets in these markets are permitted to sell only low alcohol content beer. We exclude these eleven markets from out sample.[9] In a few cases the IRI markets cover areas much larger than metropolitan areas. In order to reduce error in our measures of the distance to the nearest brewery and the predicted change in concentration, we exclude these markets from the analysis.[10] This leaves us with a dataset covering 48 distinct geographic markets, which are listed in the appendix.

We made three additional sample restrictions. First, we limited our sample to the top 40 selling lager style beers. While many different types of beers are now sold in the U.S., Miller and Coors competed most directly in the market for lagers. Lagers account for about 89% of revenue and 93% of volume in our data.[11] Second, we trim week/upc/region observations in the raw data that had implausible prices. Specifically, we drop observations in the raw data when the price of a 144 ounce package was either less than two dollars or greater than three dollars. These observations account for less

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[9]The markets we drop include Philadelphia, Pittsburgh, Harrisburg/Scranton, and Providence, because with a few exceptions these states do not permit supermarkets to sell beer. We drop observations from Minneapolis/St Paul, Wichita, Denver, Oklahoma City, Tulsa, Salt Lake City, and Kansas because these cities are in states that only allow low alcohol content beer to be sold in supermarkets.

[10]These regions were Mississippi, New England, New Orleans/Mobile, South Carolina, and West Texas/New Mexico. Some of the remaining IRI regions span larger regions, but in these cases the regions are typically two adjacent MSA's.

[11]The brands included in our sample are listed in the appendix.

than .001% of total sales and each individual record that we dropped always had very small sales. Finally, we restricted our sample to the seven most popular package sizes of beer.[12]

While the most important package sizes for the major brands of beer are sold in nearly every week/city market, some UPCs have no sales in many week/markets. In order to fully leverage the geographic and temporal variation in our data, we aggregated over two dimensions in our data. Specifically, we aggregated over container type (cans or bottles), which should not induce much measurement error into our final measure of price because there are only small differences in the price of a beer across container types. We also aggregated our data from the week up to the monthly level. This leaves us with a dataset where the observations vary by brand, package size, geographic region, and month.

3.1 Key Variables

Our final dataset includes the following key variables: price, the predicted change in the market-level HHI, and the reduction in distance to the nearest brewery. Our measure of price is average monthly price, e.g. the ratio of monthly sales to volume.[13] There are significant volume discounts for beer across package sizes, so we refrain from aggregating over package size in order to minimize the extent of measurement error in our data.

Prior to the merger, Miller and Coors were the second and third largest brewers in the U.S. Their brands were sold in all 48 markets in our data, but there was significant variation in the share of sales each firm captured across the geographic markets. Therefore, the merger was predicted to increase concentration by different amounts across the regions in our data. Following Dafny et al. (2012), we measure concentration in each market as the HHI, and we calculate the "simulated change in HHI" ($sim\Delta HHI$) as the anticipated

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[12]These package sizes were 59.6, 72, 96, 144, 216, 240, and 288 ounces.

[13]Ideally we would be able to identify whether the merger changed the frequency of sales. However, this is impossible with our data because the raw files we received were already aggregated to the market level, making it difficult to identify any store specific temporary low prices.

change in the HHI that would have occurred immediately after the merger had nothing else changed, i.e.:

$$\Delta HHI_n = 2 * MillerShare_n * CoorsShare_n \tag{1}$$

where $MillerShare_n$ and $CoorsShare_n$ are Miller and Coors' revenue shares in geographic market n during the 5 months preceding the merger's approval date. Figure 2 documents the distribution of predicted changes in market share across geographic regions, where the HHI is scaled by a factor of 10000 as in the Horizontal Merger Guidelines. The figure shows that while the merger was predicted to cause large changes in concentration across all regions, there is substantial variation in the change across regions.

We supplement our data with information on a key efficiency created by the merger: the reduction in distance between each retail market and the nearest brewery resulting from the merger. We assume that beer is shipped by truck to each retail location from the nearest brewery, and we calculated the reduction in driving distance for each retail market.[14] Because there were six Miller plants and only two Coors plants, the merger primarily reduced the shipping distance for Coors brands. Furthermore, we have only 11 retail market observations where the merger would have reduced shipping distances for Miller brands. In these 11 regions the reduction in shipping distances was small, averaging only 123 miles.[15] For this reason, we use the difference between the nearest Coors plant and the nearest Miller plant as our measure of the reduction in distance. Figure 3 plots the distribution of the reduction in shipping distance for Coors brands. The merger resulted in some large reductions in the driving distance, with substantial variation across the 48 regions.

Finally, we added information on local labor markets to our data. We obtained monthly unemployment rates and quarterly earnings information by market from the

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[14]This was done using google maps and information on the location of each Miller and Coors brewery.

[15]9 of these 11 regions were on the east coast. While Coors had a brewery in Elkton, VA, this brewery had little capacity at the time of the merger. There may have been little scope for reducing the shipping distance of Miller brands by moving them into the smaller Elkton, VA plant.

Bureau of Labor Statistics.

4   Empirical Strategy and Results

Below we present evidence on the effects of the merger on pricing, the timing of when the merger had any effect, and the differential effect of the merger on the prices of the merging firms' brands and the rivals. We present graphs for visualization of the data and regression results for point estimates and standard errors. We then examine whether any changes in pricing because of the merger resulted in changes in the total volume of beer sold. Finally, we explore the effect of the merger on the volume sold by the merging firms and their rivals.

The key challenge in estimating the causal effect of the merger on pricing is identifying how prices would have evolved had the merger not occurred. We focus our empirical analysis on two channels through which the combination of Miller and Coors may have changed pricing: by reducing the number of independent firms and by reducing shipping and distribution costs. Importantly, there is substantial independent variation across geographic markets in how the merger was predicted to increase concentration and reduce shipping distances. This variation allows us to identify the effects of the merger while simultaneously controlling for other factors that had a common effect on pricing across markets.

Figure 4 provides the most direct illustration of the effects of the merger and depicts the essence of the research design employed in the paper. We calculated the average (log) price change of all beers in our sample before and after the merger for each of the 48 regions in our data. The graph in the first panel in the first row of the figure is a scatter plot of these average price changes against the predicted increase in the HHI, and the second graph is a scatter plot of the average price change against the reduction in distance to the nearest brewery. Each point in the graphs represents a separate geographic

market, and an OLS fitted regression line is drawn through each of the scatter plots.

The upper left graph in figure 4 shows that prices increased by more on average in regions where concentration was predicted to increase by more. Similarly, the upper right graph in the figure shows that prices increased by less in regions where the distance to the nearest Coors brewery fell by more. However, the predicted increase in concentration and the reduction in distance have a correlation of .11 across the 48 regions in our data. For this reason, the bivariate relationships shown in the two graphs of the raw data do not capture how the distribution of cross regional price changes varies with the independent variable of interest independently of the omitted independent variable. For this reason, we display regression adjusted scatter plots in the second row of figure 4. The first of these two figures plots the residual from a bivariate cross-market regression of the change in the average log price on the reduction in distance against the residual from a cross-market bivariate regression of the predicted change in concentration against the reduction in distance. We then use OLS to fit a regression through the scatter plot of residuals. By the Frisch-Waugh-Lovell partitioned regression theorem, the regression line through the cloud of residuals has the same slope as the coefficient on distance that would be obtained by estimating a regression of the change in price on the change in distance and the predicted change in the HHI. Given the small correlation in the two independent variables, adjusting the figures does not alter the scatter plots by much. The adjustment also slightly reduces the dispersion about the regression lines fitted through the figures.

While suggestive, there are two potential problems with the simple scatter plots in figure 4. First, there is substantial dispersion about the fitted regression lines, which may be reduced by accounting for other factors that predict how prices changed after the merger. Accounting for these factors could increase the precision of our estimates. A second and more serious problem stems from the fact that not all brand/package sizes are sold in all markets and all time periods. Thus it is possible that variation in the

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composition of beers sold over time within the regional markets could be confounding the estimated relationship between price changes and our key regressors. We try to account for these problems by analyzing brand level panel data that allows us to better control for time invariant beer/market specific differences in prices. We do this by fitting the following equation to the data using OLS:

$$\log(price)_{isnt} = \alpha_{isn} + \beta \Delta simHHI_n * post_t + \gamma * \Delta distance_n * Post_t + \lambda_{tm} + \epsilon_{isnt} \quad (2)$$

The dependent variable is the log price of beer brand i of package size s in region n at monthly time period t. α_{isn} is a full set of brand/package size/region fixed effects that capture time invariant differences in prices across cities, package sizes, and brands. λ_{tm} is a full set of year/month/manufacturer fixed effects that capture changes in beer prices common across brands, package sizes, and regions. These time effects are allowed to vary freely by manufacturer m, allowing for differential time effects to different brewers. $Post_t$ is a dummy variable equal to one during and after the month the merger was approved by the Department of Justice, June 2008. ΔHHI_n is the predicted change in the HHI, where the HHI is measured on a scale from zero to one, and $\Delta distance_n$ is the reduction in distance to the nearest Coors plant measured in thousands of driving miles. The two key independent variables are the interaction terms $sim\Delta HHI_n * post_t$ and $\Delta distance_n * post_t$. The coefficient β is approximately the percentage change in price caused by a $simHHI$ predicted increase in concentration, and the coefficient γ measures the percentage change in price caused by a $\Delta distance$ reduction in the distance to the nearest Coors brewery. We allow for heteroskedasticity and arbitrary correlations in the error term over time and across brand/package sizes by clustering our standard errors by region.

The first column of table 2 presents the results of estimating equation 2. We find that the estimated coefficient on $sim\Delta HHI_n * post_t$ is positive and the estimated coefficient on $\Delta distance_n * post_t$ is negative, as expected. Both coefficients are statistically significant

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at the .05 level. Across the 48 markets in our data, the average values of $sim\Delta HHI_n$ was 0.037. The point estimate of the coefficient on $sim\Delta HHI_n * post_t$ therefore implies that the increase in concentration led to a (.037*.329) 1.2 percent increase in the average price of lager style beer in the average market, all else equal. Similarly, the average value of the reduction in distance was .364 thousands of miles, and the point estimate on $\Delta distance_n * post_t$ implies that the reduction in shipping distance led to a (-.032*.364) 1.2 percent reduction in the price of beer in the average market, all else equal.

We next estimated a more flexible version of equation 2 that allows us to identify exactly when the two effects of the merger occurred. This is potentially important. Any efficiencies that were generated by the merger, including reductions in shipping costs, could not have been realized until the firms merged and had time to reoptimize their shipping and distribution network. This likely occurred only with a substantial delay, as statements by the merging firms indicate that it took over a year and a half after the merger was consummated to fully reallocate production across the combined firms' plants.[16] On the other hand, any softening of competition due to increased concentration likely occurred much more rapidly. In their study of airline mergers, Kim and Singal (1993) found that the fares of merging airlines increased relative to fares on similar routes where there was no change in concentration as soon as the mergers were announced and before they were actually approved or consummated. Fortunately, our data spans a period of nine months before the merger's announcement date on October 9, 2007 and three and a half years after the merger was approved by the DOJ. We trace out the timing of the

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[16]Trade industry documents confirm that it took about a year and a half for the merged firm to fully reoptimize their distribution network. A November 2009 letter from Miller/Coors states, "Network optimization savings continue to be realized from shifting production of Coors and Miller brands into the larger MillerCoors brewery network, a process which will continue for the next nine months." Available at `http://www.sabmiller.com/index.asp?pageid=149&newsid=1097`, last accessed 4/30/2012.

merger's effects by estimating the following equation with OLS:

$$\log(price)_{inst} = \alpha_{ins} + \sum_{j=-9}^{j=30} \beta_j \Delta simHHI_n * 1(\tau_t = j) + \sum_{j=-9}^{j=30} \gamma_j * \Delta distance_n * 1(\tau_t = j) + \lambda_{tm} + \epsilon_{inst}$$

(3)

where τ_t measures the month relative to June of 2008, the month in which the merger was approved. For example, $\tau_t = 2$ in the second month after the merger's approval date and $\tau = -2$ two months prior to the merger's approval date. We normalize $\beta_0 = 0$ and $\gamma_0 = 0$. We plot the estimated effects of the predicted increase in HHI and the reduction in distance at the mean in the data.[17]

The results are in figure 5 and figure 6. Figure 5 shows that the increase in concentration eventually led to about a two percent price increase by the end of our sample period. There was a slight increase in prices during the announcement period and before the merger was approved, but it is quite small in magnitude. While the figure shows that prices started increasing soon after the merger was approved (and possibly slightly beforehand), the price increase was gradual and not fully completed until a little over a year after the merger was approved. This may be due to infrequent manufacturer price adjustments or staggered renegotiation of contracts between the manufacturers and individual distributors.

Figure 6 shows that in the long run the reduction in distance nearly exactly offset the effect of increased concentration on prices. However, the effect of reducing the shipping distance was much more delayed, as expected given statements made by the merging firms. The effect of reducing shipping distances on pricing seems to have started a little over a year after the merger was approved, and was not fully reflected in pricing until mid 2010.

We obtain point estimates by estimating a more constrained version of equation 2 that

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[17]This was done by multiplying the estimated coefficients β_j and γ_j by the average change in concentration and the average reduction in distance across the 48 markets in our data, respectively.

still allows for the effects of the increase in concentration and reduction in distance to vary over time. Specifically, we allow the effect of the predicted increase in concentration and reduction in shipping distance to take on different values in two periods: a "short-run" effect during the first year and a half after the merger's approval date and a "long-run" effect during 2010 and 2011, the remaining two subsequent years in our data. The results are presented in column 2 of Table 1. Both effects are larger in the long run, but much more so for our measure of the efficiency gain from the merger–the absolute value of the ratio of the long run effect to the short run effect is over twice as large for the effect of the reduction in distance versus the effect of the predicted increase in concentration. Given the average value of the reduction in distance and increase in concentration, the short run effect of the increase in concentration was $(.197 * 0.037)$ a 0.7 percent increase in price while the long run effect was a 1.7 percent increase in price. The point estimates imply that reduction in shipping distances led to a negligible .4 percent reduction in prices in the short run, but a 1.8 percent reduction in prices in the long run. The net effect of the merger on prices in the average market is essentially zero, as the efficiencies we measure offset the price increase resulting from the reduction in the number of independent brewers.

The key identifying assumption for our approach is that there are no time-varying and market-specific factors correlated with price and the predicted increase in concentration or the reduction in distance to the nearest Coors brewery. A potential concern is that the merger occurred during the 2008 recession, which had a stronger effect in some regions than in others. It is possible that the recession changed the demand for beer to be consumed at home differently across regions, and if this is correlated with the effects of the merger our base specification would be biased. We address this issue by adding regional unemployment rates and (log) aggregate earnings. The results are in column 3 of Table 1. All of the estimates are essentially unchanged after adding these potential confounders. Column 4 adds linear time trends that vary across each of the nine census

regions in the United States.[18] Once again, the estimates are stable, which gives us added confidence in our identification assumption.

While the net effect of the merger on pricing was essentially zero in the average market, there was moderate heterogeneity in how the merger changed pricing across the different regional markets. We explored this heterogeneity in both the short and long-run by plotting histograms of the implied effect on pricing across the 48 markets in our data. We calculated the distribution of net effects by estimating the specification described in column 2 of Table 1. Next we multiplied the predicted increase in concentration and reduction in distance in each market by the coefficient on the interaction term between the event dummies and the increase in concentration and change in distance, respectively. The histograms of these effects are displayed in Figure 7. The first panel shows that in the first year and a half after the merger caused small price increases of less than 2.5 percent in 44 of the 48 markets. The second panel shows the distribution of long-run price changes, which were calculated between one and a half and three and a half years after the merger was approved. The distribution of long run effects has a wider support because of the gradual impact of the market power effect documented in the event study graphed in Figure 5 and especially because of the delayed effect of the reduction in distance documented in the second event study in Figure 6. In the long run, 22 of the 48 markets experienced price decreases less than 4.5 percent, while the remaining markets experienced small price increases.

We next explored heterogeneity in the effects of the merger across three groups of brands: those owned by Miller prior to the merger, those owned by Coors prior to the merger, and brands owned by rivals to Miller and Coors. We did this by estimating equation 2 separately for each of these three groups with OLS. The results are reported in Table 3. The first column in each sub-panel presents the results of estimating the

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[18]Given limited statistical power, we were unable to obtain precise estimates from a more flexible model that allows IRI market-specific time trends.

most parsimonious model given by equation 2. The positive estimates of the coefficient on the interaction of the post-merger dummy and the predicted increase in concentration implies that relative prices increase in regions where the merger was predicted to increase concentration by more. The magnitude of the effect was a 1.4 (.037*.388) percent increase for Miller and a 2.1 (.037*.562) percent increase for Coors. Rivals increased their prices too, but by the slightly smaller amount of 1.1 (.037*.285) percent. There was no detectable difference in the merging firms response to the reduction in distance from rivals. The estimate of the reduction in distance on pricing was stable at about a percent price decrease across each of the three groups of brands.

Column 2 of each sub-panel of Table 2 presents the short and long run effects of the merger for Miller brands, Coors brands, and rival brands. For rivals, there was no economically or statistically significant short-run increase in prices associated with the increase in concentration. This is implied by the coefficient on the interaction of the predicted increase in concentration and the dummy for the first year and a half after the merger in column two of the third sub-panel. The implied price increase was only .3 percent and the t-statistic is less than 1. In contrast, both Miller and Coors increased their prices in the short-run by approximately (.325*.037) 1.2 and (.290*.037) 1.1 percent, respectively. In the long-run, the rivals followed the merging firms and increased their prices in response to the increase in concentration as well. The long-run effect of the increase in concentration was a 1.5 percent increase for rivals, a 1.7 percent increase for Miller brands, and a 2.9 percent increase for Coors brands. The coefficients on the distance effects show a delayed response to the reduction in shipping distances by both the merging firms and their rivals. The impact of the reduction in distance was about a 2 percent price reduction across the three groups of brands. As before, each of these results are unchanged after adding our covariates and census time trends.

We have also explored the effects of the merger on the volume of beer sold. This was

done by calculating the total volume of beer sold in each region/month/year and fitting the following equation to the data using OLS:

$$\log volume_{nt} = \alpha_n + \beta \Delta simHHI_n * post_t + \gamma * \Delta distance_n * Post_t + \lambda_t + \epsilon_{nt} \quad (4)$$

where α_n is a region specific fixed effect that allows the level of volume sold to vary across regions, λ_t is a full set of year/month fixed effects that allow for common changes in the (log) volume of beer sold across regions, and $\Delta simHHI_n * post_t$ and $\Delta distance_n * Post_t$ are treatment variables defined as before. The results are in Table 3. Unfortunately, the estimates are imprecisely estimated. While the point estimates of the coefficient on the predicted increase in concentration interactions suggest that volume fell by about (-.672*.037) 2.5 percent in the short-run and by about 5.5 percent in the long-run, the estimates are not significant at conventional levels ($p < .27$) and are not robust to the inclusion of regional time trends. The estimates of the coefficients on the reduction in distance interactions have even smaller t-statistics, implying confidence intervals that make it impossible to rule out a fairly wide range of estimates.

Table 4 presents the results of estimating equation 3 separately for Miller, Coors, and rivals. Not surprisingly given the results for total volume, most of the parameters are imprecisely estimated. However, a clear pattern emerges when examining the effect of the reduction in distance on the volume sold of Miller and Coors brands. While Coors volume increased as a result of the reduction in distance, this was offset by a reduction in the volume of Miller brands. The effect on output of the combined firm is given by the sum of the Miller and Coors coefficients, and it is close to zero.

5 Conclusion

When mergers of large firms in the same industry are announced, the firms involved nearly always claim that consolidation would benefit consumers through lowering costs. To date, there is little evidence that potentially problematic mergers-those increasing concentration in already concentrated industries- result in efficiencies that offset the merged firms' incentive to increase price. The evidence we do have is indirect: observing whether prices rise or fall following a merger. Focarelli and Panetta (2003), for example, estimate that following a series of banking mergers in Italy that deposit rates paid to consumers fell in the years directly following mergers and then later increased. They argue that the short-run reduction in deposit rates is the result of increased market power (which can be exploited almost immediately), while the long-run increase in deposit rates paid to consumers is the result of merger efficiencies that can only be realized as the merging firms consolidate their operations. The failure of the literature to directly identify merger efficiencies is due to data limitations. To identify merger efficiencies researchers need to observe pricing for a relatively long time post-merger, and observe variation in both the change in market power induced by a merger and variation in the size of merger efficiencies. Given the unique structure of beer markets, we are able to conduct a stronger and more direct test for merger-specific efficiencies.

We draw several conclusions from our analysis. Price increases occurred in regions where the merger increased concentration by more. We estimate that, all else equal, the average market experienced a price increase of just under two percent because of the merger. Our estimates are robust to controlling for firm specific time shocks common to all markets, potential confounders associated with local business cycles, and region specific time trends. We also found that rivals increased their prices in response to the increase in concentration, but by a smaller amount and with a lag relative to the merging firms.

Despite the price increases associated with the merger, on net it had little effect on pricing because of efficiencies resulting from the combined Miller/Coors. The efficiencies created by the merger led to price decreases that nearly exactly offset the price increases in the average market, eventually resulting in price decreases in the average market of 1.8 percent. The price decreases associated with the reductions in shipping distance occurred more slowly than the price increases associated with the increases in concentration. This is consistent with industry documents and existing, more indirect evidence on the effects of merger specific efficiencies on pricing.

Some caveats are in order. First, as with most studies in this literature, we only study one merger. As a result, the ability to generalize from our findings may be limited. However, while we observe only one event, it induced variation in concentration and efficiencies across 48 distinct markets in our data. Therefore this one merger can be viewed as generating 48 small experiments that differentially varied expected increases in both concentration and reductions in costs. Second, we have estimated a relationship between market prices and the predicted change in market concentration (HHI). To be sure, only a handful of oligopoly models yield a relationship between pricing and concentration.[19] However, the HHI is easy to calculate using information determined prior to the merger, and it is the most commonly used measure of market concentration.[20] Because of the HHI's prevalence, we believe it is useful to examine whether it predicts post-merger pricing. Finally, any efficiencies created by the merger that were common to all markets will not be reflected in our estimates because they rely on across market variation. If any efficiencies common to all markets changed pricing, our estimates will be a lower bound.

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[19]In standard oligopoly models, a theoretical relationship between concentration and prices exists only under Cournot competition between firms selling homogenous products (Farrell and Shapiro 1990) or under Bertrand competition of firms selling differentiated products and strong assumptions on demand (Willig, Salop and Scherer 1991).

[20]The HHI is used as an initial screening device for identifying problematic mergers in the joint FTC/DOJ Merger Guidelines.

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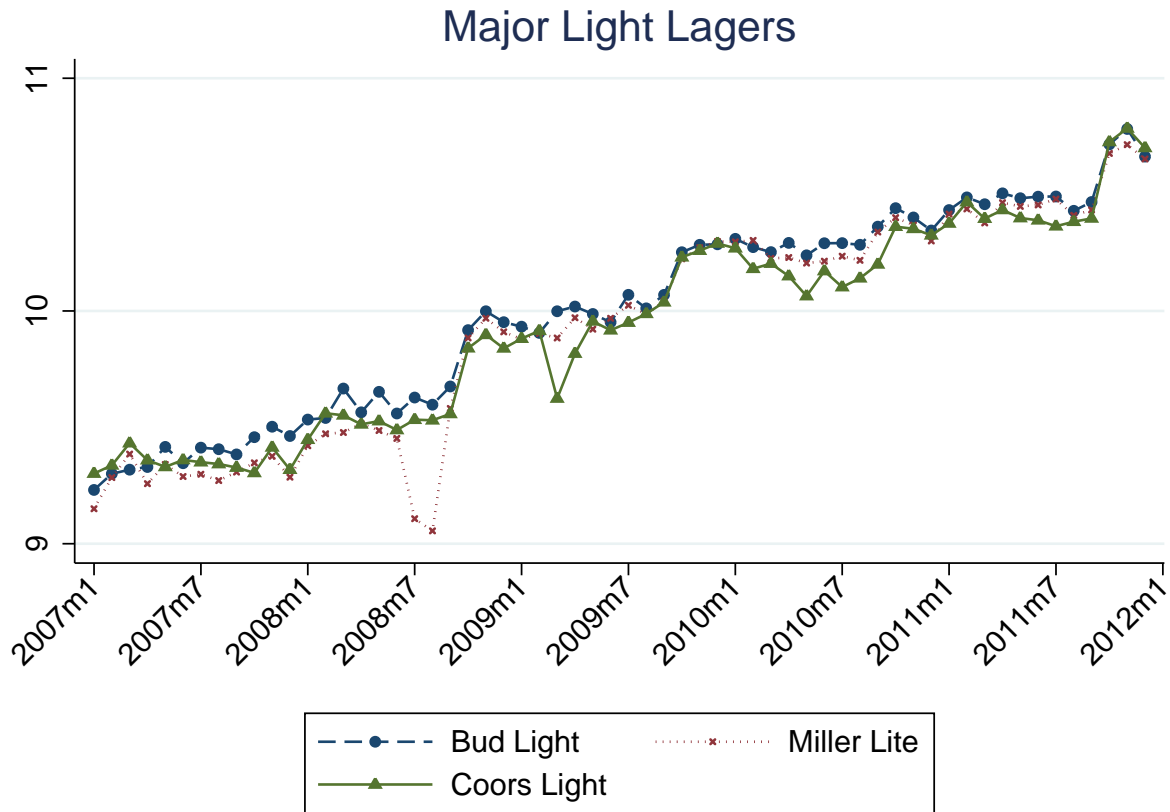
Figure 1: Average National Price of Major Light Lagers, 2007-2011

Notes: The figure plots the average price of a 144 ounce package of beer by brand over the 48 regions in our data. The regions are listed in an appendix.
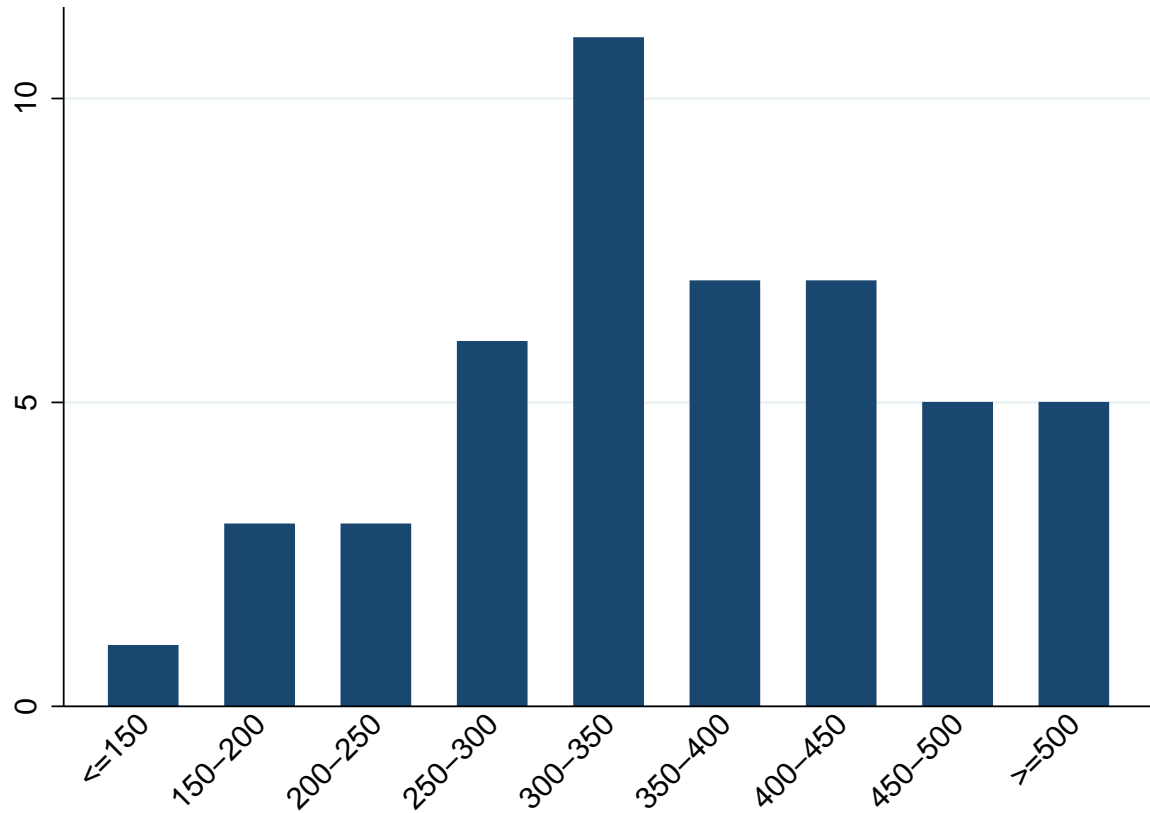
Figure 2: Distribution of Simulated Change in HHI Resulting from Miller-Coors Merger

Notes: The figure plots the distribution of 2 times the product of Miller and Coors' revenue shares across geographic markets. The revenue shares were calculated on IRI scanner data covering the supermarket channel from 48 regions during the 5 months preceding the merger approval date (January 2008 through May 2008). These regions are listed in an appendix.

Figure 3: Distribution of Change in Distance to Nearest Coors Brewery Resulting from Miller-Coors Merger

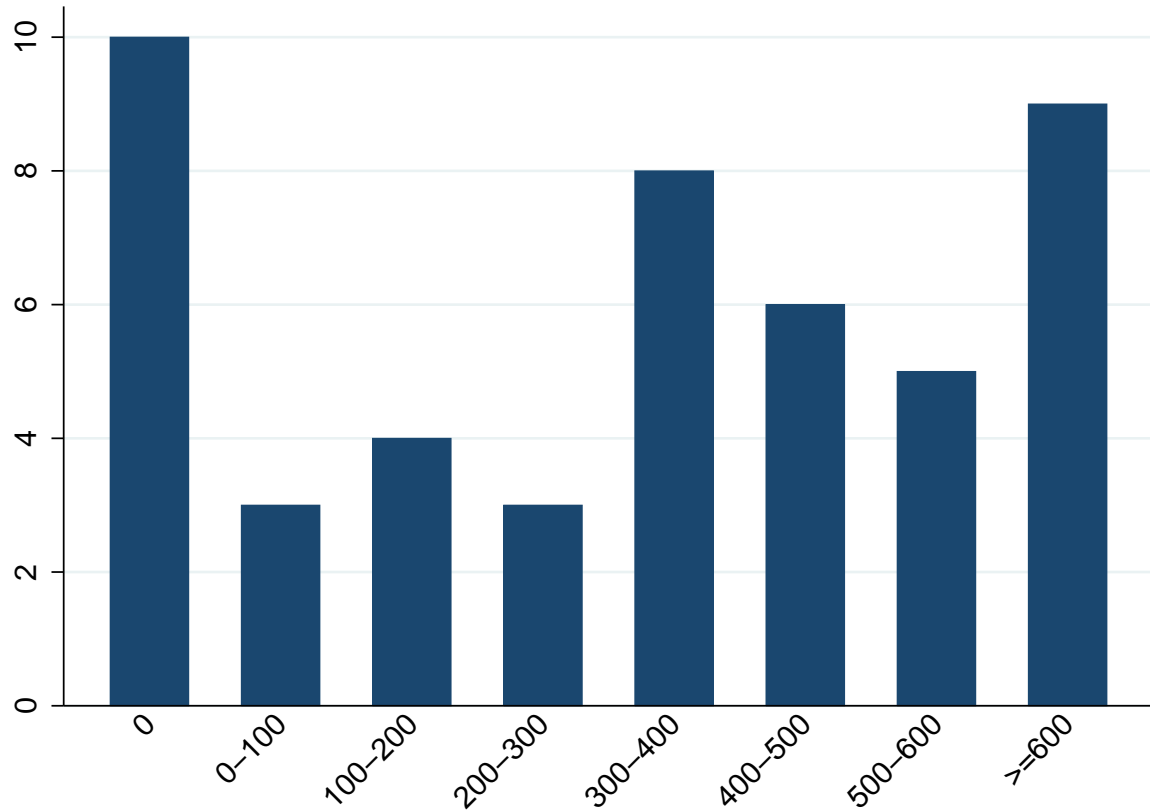Notes: The figure plots the distribution of the change in the number of miles to the nearest Coors brewery from each of the 48 IRI regions. Distances were calculated as the number of road miles between each IRI region and each brewery using google maps. The IRI regions are listed in the appendix.
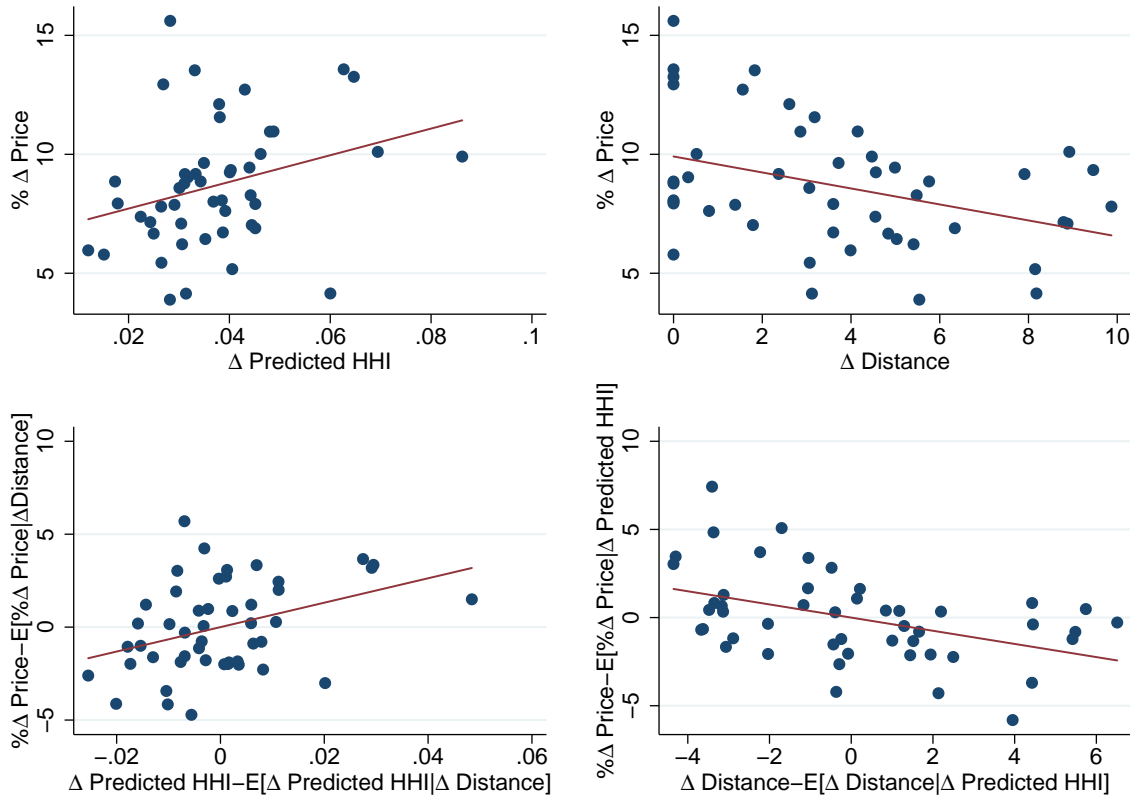
Figure 4: Percentage Price Changes against Predicted Change in HHI and Reduction in Distance to Nearest Coors Brewery by Market

Notes: The two graphs in the first row plot the average percentage price change in a lager style beer after the Miller/Coors merger against the predicted increase in the Herfindahl/Hirschman Index and the reduction in distance to the nearest Coors brewery. Each point represents one of 48 geographic markets. Distance is measured as the reduction in hundreds of driving miles to the nearest Coors brewery. The predicted change in HHI is calculated using sales data on all beers from the 5 months preceding the merger's approval date of June 2008 and it is scaled between 0 and 1. The change in price is calculated using data from January 2008 through December 2011. The two graphs in the second row plot the residuals from a regression of the percentage price change on the reduction in distance (or change in HHI) against the residuals from a regression of the change in HHI (or change in distance). Least squares fitted lines are drawn through each scatter plot.
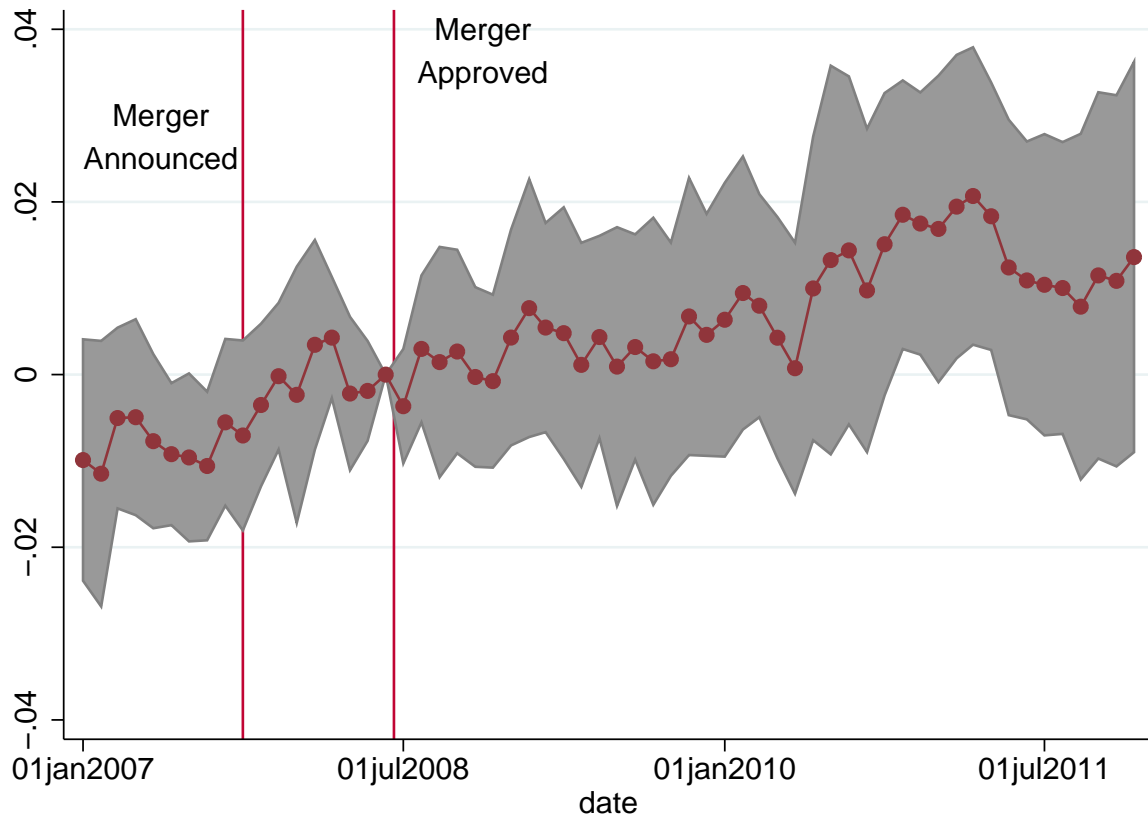
Figure 5: Event Study of the Effect of Concentration Increase on Log Prices

Notes: An OLS regression of log price on brand/package size/region effects, year/month effects, year/month effects interacted with the predicted increase in the HHI, and year/month effects interacted with the reduction in distance to the nearest Coors brewery was estimated on data where an observation is a brand/package size/region/month. The estimated sample includes lager style beers. The figure plots the coefficients on the year/month effects interacted with the predicted increase in the HHI scaled by the average predicted increase in the HHI. The shaded area represents the scaled coefficient plus or minus 1.96 times its standard error. The predicted change in HHI was calculated using sales data on all beers from the 5 months preceding the merger's approval date of June 2008. Distance was measured in hundreds of driving miles.
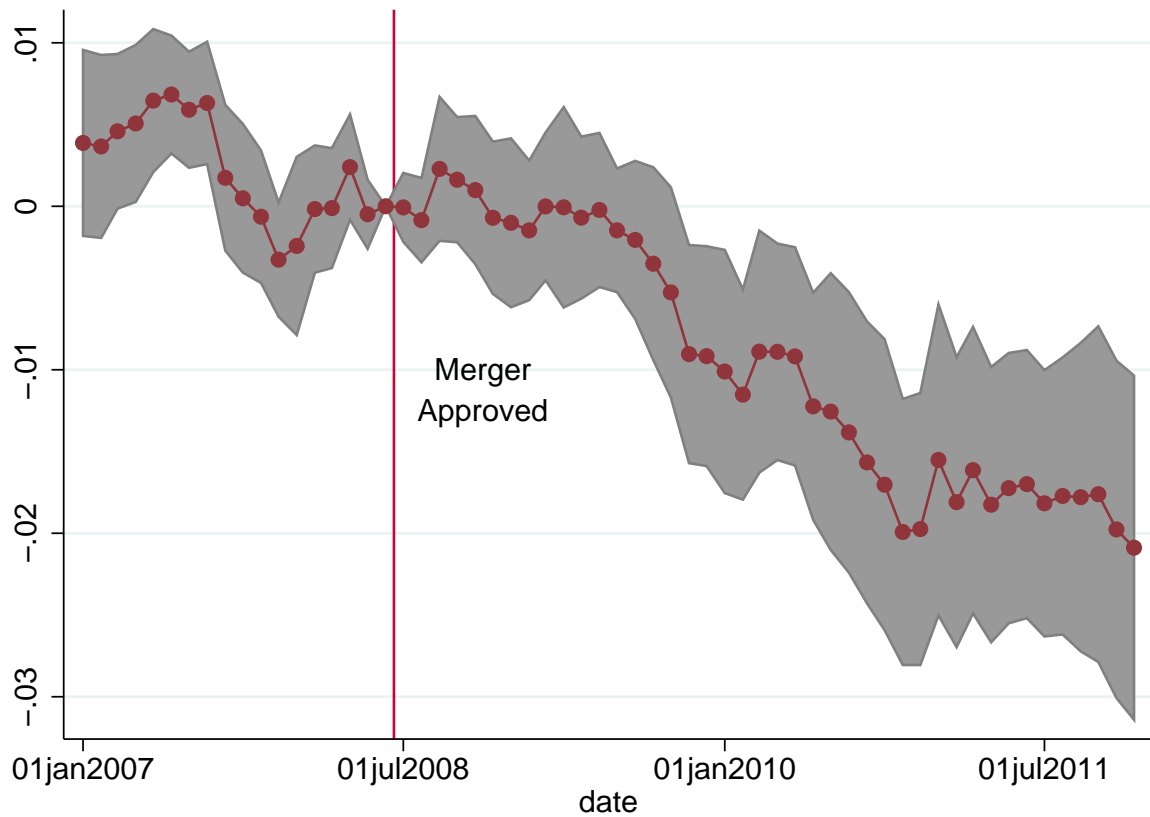
Figure 6: Event Study of the Effect of Reduction in Distance to the Nearest Coors Brewery on Log Prices

Notes: An OLS regression of log price on brand/package size/region effects, year/month effects, year/month effects interacted with the predicted increase in the HHI, and year/month effects interacted with the reduction in distance to the nearest Coors brewery was estimated on data where an observation is a brand/package size/region/month. The estimated sample includes lager style beers. The figure plots the coefficients on the year/month effects interacted with the reduction in distance scaled by the average reduction in distance. The shaded area represents the scaled coefficient plus or minus 1.96 times its standard error. The predicted change in HHI was calculated using sales data on all beers from the 5 months preceding the merger's approval date of June 2008 and it is scaled between 0 and 1.
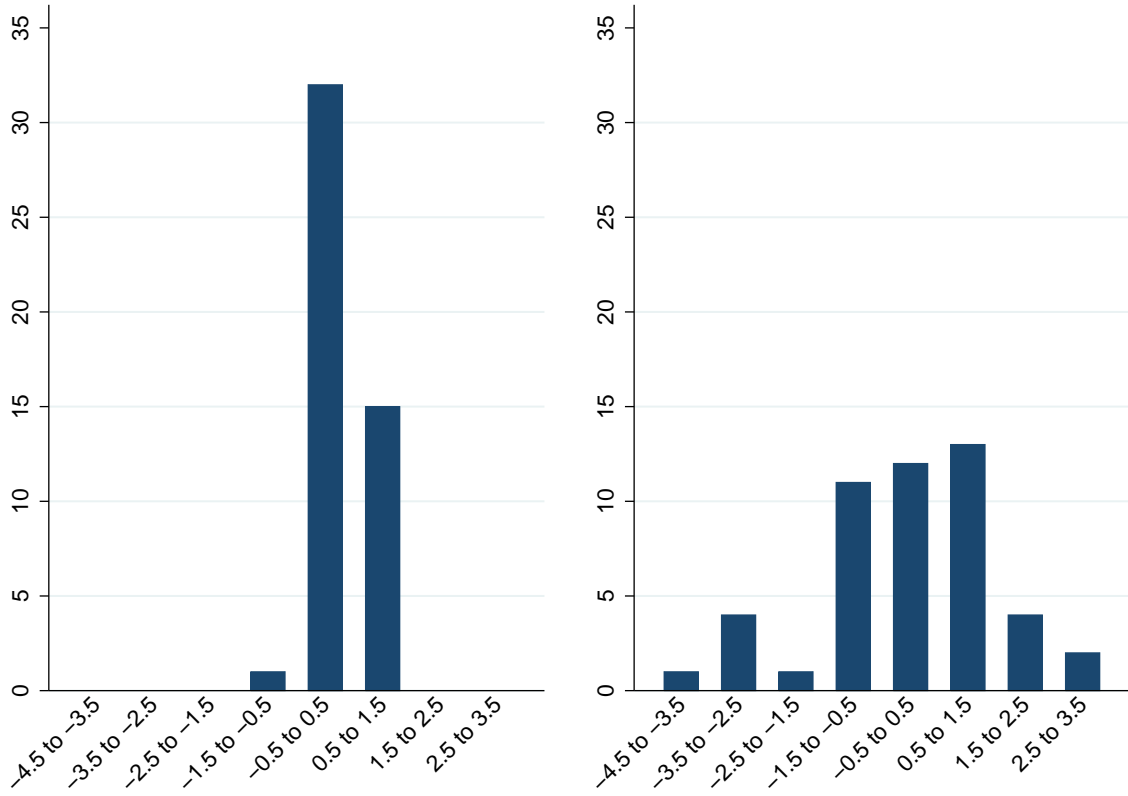
Figure 7: Short Run and Long Run Net Effects

Notes: The figure on the left plots the distribution of net effects over the first year and a half after the merger across geographic regions. The figure on the right plots the distribution of net effects over the next two years across geographic regions. The net effects were calculated using the model corresponding to column 2 of Table 1. Details in text.

Table 1: Pre-Merger Market Shares

Parent Company	Revenue Share
Anheuser Busch	36.52%
Miller	17.45%
Molson/Coors	10.95%
Grupo Modelo	9.94%
Heineken	8.68%
Inbev	2.99%
Boston Beer Co	1.88%
Diageo Guinness USA	1.75%
Pabst Blue Ribbon	1.60%
D.G. Yuengling	0.009%
National HHI	1953
Predicted Δ HHI	382

Notes: Revenue shares were calculated using sales data on all beer sold in the 48 IRI regions for which we have complete data. Shares were calculated from sales data from January 2008 through May 2008. The table contains national revenue shares for the 10 largest firms.

Table 2: Merger Effects on Log Prices

	Dependent Variable=log(price)			
	(1)	(2)	(3)	(4)
Sim ΔHHI*(Post Merger)	0.329			
	(0.127)			
Sim ΔHHI*(Year2008&Month>5 or Year2009)		0.197	0.198	0.196
		(0.117)	(0.116)	(0.135)
Sim ΔHHI*(Year2010 or Year2011)		0.449	0.449	0.441
		(0.166)	(0.164)	(0.162)
Δ Distance*(Post Merger)	-0.032			
	(0.007)			
Δ Distance*(Year2008&Month>5 or Year2009)		-0.011	-0.011	-0.015
		(0.006)	(0.006)	(0.006)
Δ Distance*(Year2010 or Year2011)		-0.050	-0.050	-0.057
		(0.010)	(0.010)	(0.011)
Covariates	No	No	Yes	Yes
Census Region Time Trends	No	No	No	Yes
Average Pre-Merger Price	9.73	9.73	9.73	9.73
Average -Δ Distance (Thousands of Miles)	0.364	0.364	0.364	0.364
Average Sim ΔHHI	0.037	0.037	0.037	0.037
Number of Observations	341,388	341,388	341,388	341,388
Number of Regions	48	48	48	48

Notes: The unit of observation is a brand-package size-region-month. The estimates include monthly scanner data from 48 IRI regions from January 2008 through December 2011. Some brand/package size combinations are not sold in particular region/months. Distance is measured as the reduction in thousands of miles to the nearest Coors brewery. Sim Δ HHI is calculated as twice the product of Miller and Coors shares of sales by region and was calculated using sales data on all beers from the 5 months preceding the merger's approval date of June 2008. The HHI is scaled from 0 to 1. The third column adds regional unemployment rates and log(earnings). The fourth column adds region specific linear time trends for each of the 9 U.S. census regions. The sample contains the top 40 selling lager style beers. Standard errors clustered by geographic region are in parentheses.

Table 3: Merger Effects on Log Prices by Firm

	Dependent Variable=log(price)											
	Miller				Coors				Rivals			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Sim ΔHHI*(Post Merger)	0.388				0.562				0.285			
	(0.231)				(0.133)				(0.134)			
Sim ΔHHI*(Year2008&Month>5		0.325	0.339	0.342		0.290	0.293	0.300		0.146	0.139	0.128
or Year2009)	(0.224)	(0.217)	(0.215)		(0.129)	(0.128)	(0.159)		(0.107)	(0.105)	(0.121)	
Sim ΔHHI*(Year2010		0.458	0.463	0.473		0.796	0.797	0.814		0.409	0.404	0.371
or Year2011)		(0.274)	(0.263)	(0.262)		(0.183)	(0.179)	(0.217)		(0.180)	(0.178)	(0.165)
Δ Distance*(Post Merger)	-0.031				-0.035				-0.037			
	(0.014)				(0.008)				(0.006)			
Δ Distance*(Year2008&Month>5		0.009	-0.011	-0.011		-0.011	-0.012	-0.009		-0.015	-0.014	-0.020
or Year2009)		(0.012)	(0.011)	(0.011)		(0.007)	(0.007)	(0.008)		(0.004)	(0.005)	(0.006)
Δ Distance*(Year2010		-0.050	-0.054	-0.053		-0.056	-0.058	-0.051		-0.055	-0.053	-0.066
or Year2011)		(0.019)	(0.018)	(0.017)		(0.011)	(0.011)	(0.013)		(0.008)	(0.009)	(0.010)
Average Pre-Merger Price	7.64	7.64	7.64	7.64	8.92	8.92	8.92	8.92	10.66	10.66	10.66	10.66
Average -Δ Distance (Thousands of Miles)	0.364	0.364	0.364	0.364	0.364	0.364	0.364	0.364	0.364	0.364	0.364	0.364
Average Sim ΔHHI	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037
Number of Observations	75,913	75,913	75,913	75,913	40,843	40,843	40,843	40,843	224,632	224,632	224,632	224,632
Covariates	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Census Region Time Trends	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Number of Regions	48	48	48	48	48	48	48	48	48	48	48	48

Notes: The unit of observation is a brand-package size-region-month. The estimates include monthly scanner data from 48 IRI regions from January 2008 through December 2011. Some brand/package size combinations are not sold in particular region/months. Distance is measured as the reduction in thousands of miles to the nearest Coors brewery. Sim Δ HHI is calculated as twice the product of Miller and Coors shares of sales by region and was calculated using sales data on all beers from the 5 months preceding the merger's approval date of June 2008. The HHI is scaled from 0 to 1. The third column adds regional unemployment rates and log(earnings). The fourth column adds region specific linear time trends for each of the 9 U.S. census regions. The sample contains the top 40 selling lager style beers. Standard errors clustered by geographic region are in parentheses.

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Table 4: Merger Effects on Log Market Volume

	Dependent Variable=log(Volume)			
	(1)	(2)	(3)	(4)
Sim ΔHHI*(Post Merger)	-1.086			
	(0.980)			
Sim ΔHHI*(Year2008&Month>5 or Year2009)		-0.677	-0.741	-0.031
		(0.573)	(0.532)	(0.689)
Sim ΔHHI*(Year2010 or Year2011)		-1.411	-1.450	0.061
		(1.346)	(1.252)	(1.412)
Δ Distance*(Post Merger)	0.007			
	(0.047)			
Δ Distance*(Year2008&Month>5 or Year2009)		-0.015	-0.001	0.005
		(0.032)	(0.039)	(0.027)
Δ Distance*(Year2010 or Year2011)		0.025	0.048	0.063
		(0.062)	(0.071)	(0.048)
Covariates	No	No	Yes	Yes
Census Region Time Trends	No	No	No	Yes
Average Pre-Merger Volume	569,980	569,980	569,980	569,980
Average -Δ Distance (Thousands of Miles)	0.364	0.364	0.364	0.364
Average Sim ΔHHI	0.037	0.037	0.037	0.037
Number of Observations	2880	2880	2880	2880
Number of Regions	48	48	48	48

Notes: The unit of observation is a region/month. The estimates include monthly scanner data from 48 IRI regions from January 2008 through December 2011 (N=48*60=2880). The dependent variable is the log of total volume measured in 144 ounce equivalent units. Distance is measured as the reduction in thousands of miles to the nearest Coors brewery. Sim Δ HHI is calculated as twice the product of Miller and Coors shares of sales by region and was calculated using sales data on all beers from the 5 months preceding the merger's approval date of June 2008. The HHI is scaled from 0 to 1. The third column adds regional unemployment rates and log(earnings). The fourth column adds region specific linear time trends for each of the 9 U.S. census regions. The underlying data contains volume from the top 40 selling lager style beers. Standard errors clustered by geographic region are in parentheses.

Table 5: Merger Effects on Log Volume by Firm

	Miller				Coors				Rivals			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Sim ΔHHI*(Post Merger)	0.0958				-0.838				-1.370			
	(1.496)				(1.498)				(1.047)			
Sim ΔHHI*(Year2008&Month>5 or Year2009)		0.463	0.339	0.798		-0.345	-0.520	-0.355		-1.059	-1.101	-0.359
		(0.791)	(0.711)	(0.864)		(0.866)	(0.805)	(0.902)		(0.691)	(0.670)	(0.771)
Sim ΔHHI*(Year2010 or Year2011)		-0.195	-0.265	0.591		-1.229	-1.338	-1.164		-1.616	-1.643	-0.0796
		(2.128)	(1.854)	(1.783)		(2.052)	(1.792)	(1.973)		(1.371)	(1.327)	(1.452)
Δ Distance*(Post Merger)	-0.128				0.109				0.0226			
	(0.0754)				(0.0905)				(0.0523)			
Δ Distance*(Year2008&Month>5 or Year2009)		-0.109	-0.0784	-0.107		0.0377	0.0768	0.0298		0.000804	0.00993	0.0161
		(0.0457)	(0.0496)	(0.0455)		(0.0579)	(0.0670)	(0.0527)		(0.0381)	(0.0438)	(0.0332)
Δ Distance*(Year2010 or Year2011)		-0.142	-0.0909	-0.141		0.165	0.230	0.141		0.0399	0.0551	0.0735
		(0.104)	(0.104)	(0.0809)		(0.120)	(0.124)	(0.107)		(0.0661)	(0.0756)	(0.0599)
Average Pre-Merger Volume	129,066	129,066	129,066	129,066	62,201	62,201	62,201	62,201	378,773	378,773	378,773	378,773
Average -Δ Distance (Thousands of Miles)	0.364	0.364	0.364	0.364	0.364	0.364	0.364	0.364	0.364	0.364	0.364	0.364
Average Sim ΔHHI	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037
Number of Observations	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880
Covariates	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Census Region Time Trends	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Number of Regions	48	48	48	48	48	48	48	48	48	48	48	48

Notes: The unit of observation is a region-month. The estimates include monthly scanner data from 48 IRI regions from January 2008 through December 2011 (N=48*60=2880). Distance is measured as the reduction in thousands of miles to the nearest Coors brewery. Sim Δ HHI is calculated as twice the product of Miller and Coors shares of sales by region and was calculated using sales data on all beers from the 5 months preceding the merger's approval date of June 2008. The HHI is scaled from 0 to 1. The third column adds regional unemployment rates and log(earnings). The fourth column adds region specific linear time trends for each of the 9 U.S. census regions. The sample contains the top 40 selling lager style beers. Standard errors clustered by geographic region are in parentheses.

A   Appendix

A.1   IRI Regions Included in Sample

1. Albany, NY

2. Atlanta, GA

3. Baltimore/Washington

4. Birmingham/Montgomery, AL

5. Boise, ID

6. Boston, MA

7. Buffalo/Rochester, NY

8. Charlotte, NC

9. Chicago, IL

10. Cincinatti/Dayton, OH

11. Cleveland, OH

12. Columbus, OH

13. Dallas/Fort Worth, TX

14. Des Moines, IA

15. Detroit, MI

16. Grand Rapids, MI

17. Green Bay, WI

18. Hartford/Springfield

19. Houston, TX

20. Indianapolis, IN

21. Jacksonville, FL

22. Knoxville, TN

23. Las Vegas, NV

24. Little Rock, AR

25. Los Angeles, CA

26. Louisville, KY

27. Memphis, TN

28. Miami/Ft Lauderdale, FL

29. Milwaukee, WI

30. Nashville, TN

31. New York, NY

32. Omaha, NE

33. Orlando, FL

34. Peoria/Springfield, IL

35. Phoenix/Tucson, AZ

36. Portland, OR

37. Raleigh/Greensboro, NC

38. Richmond/Norfolk, VA

39. Roanoke, VA

40. Sacramento, CA

41. San Diego, CA

42. San Francisco/Oakland, CA

43. Seattle/Tacoma, WA

44. Spokane, WA

45. St Louis, MO

46. Syracuse, NY

47. Tampa/St Petersburg, FL

48. Toledo, OH

A.2   Brands Included in Sample

1. Anheuser Busch/Inbev

   (a) Bud Light Lime (Premium)

   (b) Becks Lager (Import)

   (c) Bud Light Lager (Premium)

   (d) Budweiser Lager (Premium)

   (e) Budweiser Select Lager (Premium)

   (f) Budweiser Select 55 Lager (Premium)

   (g) Busch Lager (Popular)

   (h) Busch Light Lager (Popular)

   (i) Michelob Light Lager

   (j) Michelob Ultra Lager

   (k) Natural Ice Lager

   (l) Natural Light Lager

   (m) Rolling Rock Extra Pale Lager

2. Boston Beer Company

   (a) Samuel Adams Boston Lager

   (b) Samuel Adams Seasonal Assorted

3. Miller

   (a) Icehouse Lager

   (b) Miller Genuine Draft

   (c) Miller Genuine Draft Light 64

   (d) Miller High Life Light Lager

   (e) Miller Light Pilsner

   (f) Milwaukees Best Ice Lager

   (g) Milwaukees Best Lager

   (h) Milwaukees Best Light Lager

4. Coors

   (a) Coors Lager

   (b) Coors Light Lager

(c) George Killians Irish Red Lager

(d) Keystone Light Lager

5. Heineken

   (a) Amstel Light Lager

   (b) Dos Equis XX Lager

   (c) Heineken Light Lager

   (d) Heineken Lager

   (e) Tecate Lager

6. D.G. Yuengling

   (a) Yuengling Traditional Lager

7. Grupo Modelo

   (a) Corona Extra Lager

   (b) Corona Light Lager

   (c) Modelo Especial Lager

   (d) Negra Modelo Lager

   (e) Pacifico Clara Lager

8. Pabst Blue Ribbon

   (a) Pabst Blue Ribbon Lager