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Efficiencies brewed: pricing and consolidation in the US beer industry

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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 the brewers Miller and Coors was expected to increase concentration and reduce costs. All else equal, the average predicted increase in concentration led to price increases of 2%, 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 marginal cost reductions that give the combined firm an incentive to lower prices. This trade-off 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

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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.[1,2]

The objective of this study is to test whether efficiencies can counteract incentives to increase retail prices resulting from mergers of competitors. We do this by using detailed retail scanner data to study the effect of a large merger on pricing in the US brewing industry. In June 2008, the US Department of Justice (DOJ) 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 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, whereas Miller was brewed in six geographically dispersed locations. The merger was expected to allow the combined firm to economize on shipping costs primarily by moving the production of Coors beer into Miller plants. These cost savings represent changes in variable costs that could give the combined firm an incentive to reduce the prices of its products, potentially offsetting the incentive to increase prices resulting from a reduction in the number of independent brewers.

Two key features of the US 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 factors allow us to examine how the prices of identical products sold nationally in the United States were differentially affected by reductions in shipping distances and increases in concentration resulting from the merger.

We begin our analysis by showing that the merger largely raised concentration as anticipated. We then present 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. The plots 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 microdata 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 on prices and sales-weighted prices 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 census region-specific linear trends, or a trend interacted with how the merger was anticipated to raise concentration. We also estimate heterogeneity in the price effects over time and across markets. We then conduct an event study that allows us to separately estimate when the market power and efficiency effects of the merger affected retail prices. 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, and explore whether the price effects varied with premerger market structure. Finally, we estimate how the merger changed the overall quantity of beer sold and how the effects on volume 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 retail beer pricing. The merger was

[1] Williamson showed with a diagram that in a competitive industry where firms have identical and constant marginal cost, only small reductions in cost are necessary to offset losses in total surplus resulting from a price increase.

[2] Farrell and Shapiro (1990) formalize Williamson's argument in a model where firms sell homogeneous products and compete in quantities. They derive necessary and sufficient conditions for a merger to increase consumer surplus.

predicted to increase the Herfindahl Hirschman Index (HHI) (sum of squared revenue shares) by an average of 358 points across the regional markets in our data. In our preferred specification, all else equal, the predicted increase in concentration led to a 2% 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. Finally, we find that price increases were smaller in markets where the industry leader, Anheuser-Busch, had a larger presence and were thus initially more concentrated.

The effect of the increase in concentration on pricing was nearly exactly offset by efficiencies created by the merger in the average market. 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 1.8%. 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, the estimated timing of the efficiency effect from our event study coincides with industry press reports describing the operational efficiencies generated by the merger, which is consistent with the effect being causal.

Our results indicate that the merger impacted pricing 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 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 macrobrewers 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 article 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. Instead, these articles have 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. They attribute the difference between short-and long-run effects to efficiencies, but no changes in components of variable costs were directly measured.[3]

This article also contributes to a growing literature that attempts to evaluate antitrust policy toward 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 research design in this article uses geographic variation in changes in local market 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 (Prager and Hannan, 1998; Sapienza, 2002; Focarelli and Panetta, 2003; Allen, Clark, and Houde, 2013), airlines (Borenstein, 1990), (Kim and Singal, 1993), and gasoline (Hastings, 2004; Taylor and Hosken, 2007; Simpson and Taylor, 2008; Houde, 2012). Most of the research in this literature use panel data to study the effect of a change in the

[3] 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.

number of competitors on pricing while controlling for time-invariant differences across markets and common time shocks across all geographic markets.[4] 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, Duggan, and Ramanarayanan (2012) and use variation in how the merger was predicted to increase concentration (and reduce costs) across markets.[5] Dafny, Duggan, and Ramanarayanan (2012) 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 research, which measures the direct effect of the instrument (the predicted increase in concentration resulting from the merger) on prices. Our work differs from Dafny, Duggan, and Ramanarayanan (2012) 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.

The rest of the article is organized as follows. Section 2 provides background on the key institutional features of the brewing industry and the Miller/Coors merger. Section 3 describes our data. Section 4 describes our empirical approach and presents our results. Finally, we conclude.

2. Background on the US brewing industry and the Miller/Coors joint venture

□ **Background on the US brewing industry.** The US beer industry is similar to many other mature branded consumer goods industries. Manufacturers of branded beers 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 sale and distribution of alcohol. Although there are differences in regulation across states, with minor exceptions, all states prohibit brewers from directly selling their products to consumers, retailers, restaurants, or bars.[6] Instead, a brewer must first sell its products to a state-licensed distributor, who then sells those products to a retail outlet, bar, or restaurant.[7] In all cases, 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).[8]

State restrictions on the distribution of beer effectively split the United States into a number of distinct geographic markets at least as narrow as a state in which brewers 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

[4] Hortasu and Syverson (2007) use a similar research design and estimate that vertical mergers in the cement and ready-mixed concrete industries led to productivity gains and no evidence of foreclosure.

[5] Our research design is also similar to that in Hastings and Gilbert (2005), who use cross-market variation in the extent of vertical integration in gasoline refining and retailing to test whether vertical integration raises wholesale prices paid by rival retailers.

[6] Large brewers cannot sell directly to restaurants, but now restaurants that brew beer can sell beer directly to customers. For a detailed discussion of recent changes in federal and state regulation that have encouraged the entry of very small brewers, see Chapter 5 of (Tremblay and Tremblay, 2009).

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

[8] 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.

TABLE 1 Premerger Market Shares

Parent Company	Revenue Share
Anheuser-Busch	36.47%
Miller	17.52%
Molson/Coors	10.43%
Grupo Modelo	9.93%
Heineken	8.67%
InBev	2.99%
Boston Beer Co.	1.88%
Diageo Guinness USA	1.75%
Pabst Blue Ribbon	1.62%
D.G. Yuengling	0.9%
National HHI	1941
Predicted Δ HHI	365

Notes: Revenue shares were calculated using sales data on all beer sold in the 48 Information Resources Incorporated (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.

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 DOJ required InBev to divest the US rights to brew, market, and distribute Labatt beer (prior to the merger, an InBev brand) because of competition in parts of New York State.[9,10]

Although many different types of beer are sold in the United States, 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 microbrewers and the availability of imported beer, the US brewing industry has remained highly concentrated. Table 1 presents national revenue shares for the 10 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 US 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 higher price point than the beers of Anheuser-Busch, Coors, or Miller. The remaining US 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 United States).

□ **The Miller/Coors joint venture.** On October 9, 2007, Miller and Coors announced their intent to create a joint venture to combine their operations. Structurally, the merger appeared problematic. First, the US 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 US regions, we find that the overall premerger 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 "may raise significant concerns," whereas

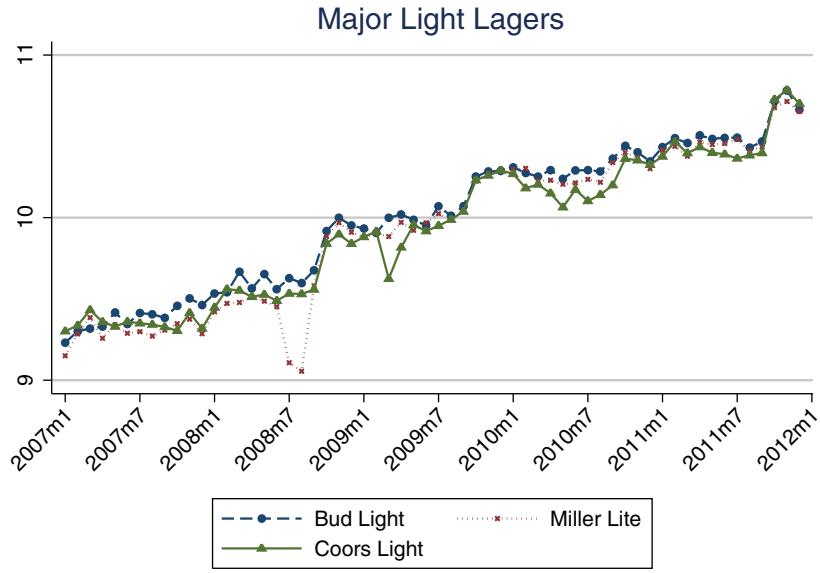
[9] Aside from Labatts, InBev primarily sold more expensive beer with much smaller market shares than Anheuser-Busch. This makes it unlikely that after the divestiture, this merger had any impact on the market for beer.

[10] See the press release announcing the settlement agreement between the US DOJ and Anheuser-Busch/InBev, November 14, 2008.

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 the Appendix.



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 Miller's 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 target similar consumers, were priced similarly, 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 US DOJ had aggressively challenged mergers in the beer industry. Between 1950 and 1989, the DOJ successfully challenged 16 brewer mergers, either blocking the transaction entirely or requiring significant modifications of the proposed merger. Although 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 DOJ or the Federal Trade Commission (FTC) 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 DOJ (Heyer, Shapiro, and Wilder, 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 bulky and heavy (being largely water), these distribution costs can be substantial. Although Coors' products were nationally distributed, it had only two US production facilities: its primary brewery in Golden, Colorado and a smaller secondary facility in

Elkton, Virginia. Miller operated six breweries spread across the United States.[11] In describing the merger's expected efficiencies (Heyer, Shapiro, and Wilder, 2008) state that, "Customers of the two firms' products were distributed throughout the country, and by, for example, moving Coors production into some of the Miller facilities (which did not appear in most cases to be operating at or near capacity), average shipping costs across the combined firms' plants could be reduced considerably." Thus, 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 Division's 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."[12] The DOJ approved the joint venture on June 5, 2008.

3. Data and sample construction

■ This study relies on retail scanner data collected by IRI. IRI sells data from three main channels of distribution: supermarkets, mass retailers, and drugstores. For each channel, 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 Universal Product Code (UPC) in the sample. We purchased data for the supermarket channel because it accounts for the largest share of beer sales of the three channels covered by IRI, with an estimated share of 23% in 2011.[13,14]

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 afterward. 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 11 of the IRI markets there are very little sales, either because very few supermarkets are permitted to sell beer in those regions or because they are permitted to sell only low alcohol content beer. We exclude these 11 markets from our sample.[15,16] In a few cases, 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 eight markets from the analysis.[17] This leaves us with a data set covering 48 distinct geographic markets, which are listed in the Appendix.

[11] The breweries were in Albany, Georgia; Eden, North Carolina; Trenton, Ohio; Dallas, Texas; Irwindale, California; and Milwaukee, Wisconsin.

[12] See DOJ closing statement: www.justice.gov/atr/public/press_releases/2008/233845.htm , last downloaded August 4, 2014.

[13] Mass retailers and drug stores accounted for 6.3% and 3% of off-premise sales, respectively. Convenience stores and liquor stores are the channels with the largest revenue shares. They are about 38% and 26%, respectively (McClain, 2012).

[14] All retailers within a region obtain their beer from the same distributors, so we expect retailers in different channels would face similar changes in their wholesale prices postmerger.

[15] 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.

[16] We drop observations from Minneapolis/Saint Paul, Wichita, Denver, Oklahoma City, Tulsa, Salt Lake City, and the Kansas City metropolitan areas because these cities are in states that allow only low alcohol content beer to be sold in supermarkets.

[17] 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 Metropolitan Statistical Areas.

We made three additional sample restrictions. First, we limited our sample to the top 40 selling lager-style beers.[18] 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 per 144 ounces was either less than $2 or greater than $30. These observations account for less 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.[19]

Although 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. 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 weekly to the monthly level. In the final data set, the observations vary by brand, package size, geographic region, and month.

□ **Key variables.** Our final data set 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, for example, the ratio of monthly sales to volume.[20] 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 United States 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 regions in our data. Following Dafny, Duggan, and Ramanarayanan (2012), we measure concentration in each market as the HHI, and we calculate the "simulated change in HHI" ($sim\Delta HHI$) as the anticipated change in the HHI that would have occurred immediately after the merger had nothing else changed, that is:

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

where $MillerShare_n$ and $CoorsShare_n$ are Miller's and Coors' revenue shares in geographic market n during the five 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 although the merger was predicted to cause large changes in concentration across all regions, there is substantial variation.

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.[21] Because there were six Miller plants and only two Coors plants, the merger primarily reduced the shipping distance for Coors brands. There were only 10 retail market observations where the merger could have reduced shipping distances for Miller brands. In these 10 regions the reduction in shipping distances was small, averaging only 123 miles. For this reason, we use the difference between the nearest Coors

[18] The brands included in our sample are listed in the Appendix.

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

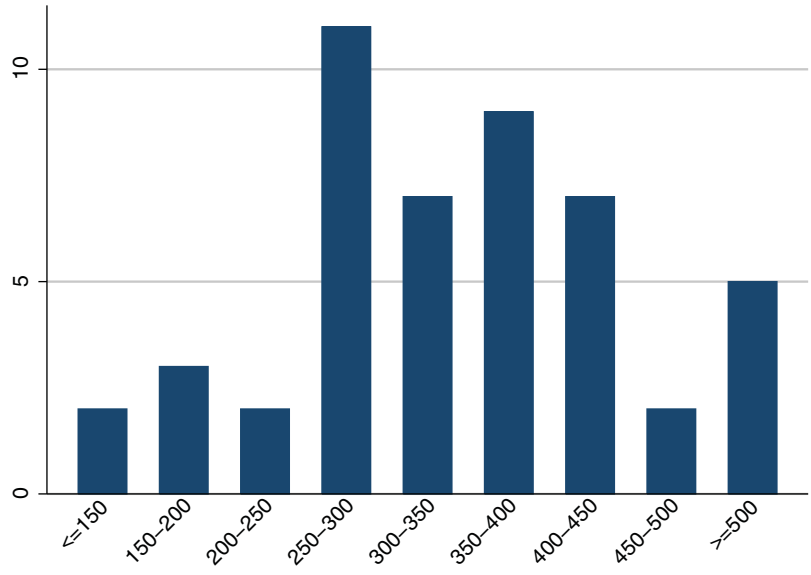
[20] Ideally, we would be able to identify whether the merger changed the frequency of sales. However, this is impossible with our data because the raw files we received were already aggregated to the market level, making it difficult to identify any store-specific temporary low prices.

[21] This was done using Google Maps and information on the location of each Miller and Coors brewery.

FIGURE 2

DISTRIBUTION OF SIMULATED CHANGE IN HHI RESULTING FROM MILLER/COORS MERGER

Notes: The figure plots the distribution of two times the product of Miller's 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 five months preceding the merger approval date (January 2008 through May 2008). These regions are listed in the Appendix.



plant and the nearest Miller plant as our measure of the reduction in distance.[22,23] 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 Bureau of Labor Statistics.

Table 2 presents summary statistics for the key variables in our data. The table also shows distributions of two variables related to the structure of competition in our markets. These variables are premerger concentration as measured by the HHI and the share of sales captured by the largest firm in the industry, Anheuser-Busch.

4. Empirical strategy and results

■ Below, we present evidence on the effects of the merger on postmerger concentration, pricing, and volume. First, we estimate the extent by which the anticipated increase in concentration resulting from the Miller/Coors merger translated into an actual increase in concentration.[24] Second, we present our main results: the effect of the merger on pricing. We estimate the direct

[22] Nine of these 10 regions were on the east coast. Although Coors had a brewery in Elkton, VA, it then had little capacity, and there may have been little scope for moving production of Miller brands into the smaller Elkton, VA plant. For these reasons, we code the reduction in distance as zero for these 10 regions.

[23] Our results are robust to instead dropping these regions, or by coding the reduction in distance in these 10 markets as the reduction in distance associated with moving production from the nearest Miller plant to the nearest Coors plant.

[24] These results can be viewed as a "first-stage" for a two-stage least squares estimate of the effect of concentration on pricing.

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.

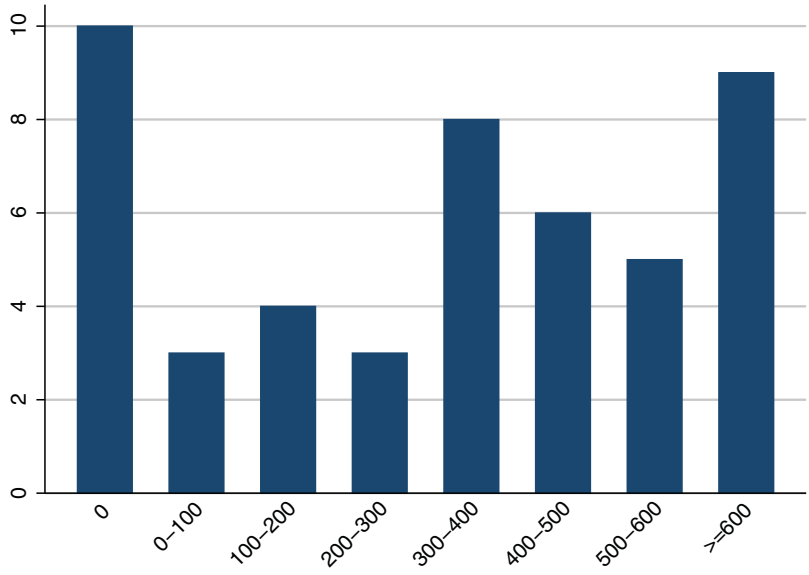


TABLE 2 Summary Statistics

	Average	1st Quartile	2nd Quartile	3rd Quartile	Minimum	Maximum
Price	9.82	7.91	9.82	12.75	2.00	37.49
Δ Distance	−364	−545	−339	−66	−987	0
Sim ΔHHI	358	280	333	416	115	843
Initial HHI	2372	1748	2499	2953	1091	4101
Initial Anheuser-Busch share	0.39	0.30	0.43	0.49	0.18	0.62

Notes: The first row shows moments of the distribution of the average price of beer measured in 144-ounce equivalent units ($\frac{sales}{volume}$). There are 345,379 brand/package size/region/month observations in the data. The table shows moments of the distribution of the reduction in driving distance to the nearest Coors brewery, the simulated increase in the HHI, initial HHI, and Anheuser-Busch's initial revenue share. Sim Δ HHI is twice the product of Miller's and Coors' shares of sales. Share variables were calculated using sales data on all beers from the five months preceding the merger's approval date of June 2008. The HHI is scaled from 0 to 10,000. There are 48 markets in the data.

effect of the merger on retail pricing by exploiting variation in how the merger was anticipated to increase concentration and reduce shipping distances across markets in our data.[25] We present graphs for visualization of the data and regression results for point estimates and standard errors. We use an event study to document the timing of any price effect and then explore whether the price effects vary by firm, with initial concentration prior to the merger, and with the extent of Anheuser-Busch's local presence prior to the Miller/Coors merger. Finally, we examine whether the merger resulted in changes in total volume sold, and whether those effects varied across firms.

[25] We study how the merger changed retail prices and not prices charged to distributors or retailers. We do not measure how price changes were passed through the distribution chain because we have no wholesale price data.

TABLE 3 Simulated Concentration Increases and Postmerger Concentration

	Dependent Variable=HHI				
	(1)	(2)	(3)	(4)	(5)
Sim ΔHHI*PostApproval	0.812				
	(0.138)				
Sim ΔHHI*ShortRun		0.904	0.908	1.021	0.999
		(0.106)	(0.111)	(0.0824)	(0.0890)
Sim ΔHHI*LongRun		0.733	0.735	0.986	0.933
		(0.168)	(0.172)	(0.125)	(0.142)
Covariates	No	No	Yes	Yes	Yes
Census region time trends	No	No	No	Yes	No
Sim ΔHHI*time trend	No	No	No	No	Yes
Number of observations	345,379	345,379	345,379	345,379	345,379
Number of regions	48	48	48	48	48

Notes: The unit of observation is a brand-package size-region-month. Brand/Package Size/Region and Manufacturer/Year/Month effects are included in all specifications. Column 1 also included $\Delta Distance * PostApproval$ as an independent variable. The remaining columns included $\Delta Distance * ShortRun$ and $\Delta Distance * LongRun$ as independent variables. The estimates include monthly scanner data from 48 IRI regions from January 2007 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five 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 nine US census regions. The fifth column replaces the census region time trends with a time trend interacted with $Sim\Delta HHI$. The sample contains the top 40 selling lager-style beers. The PostApproval dummy is equal to one from June 2008 through December 2011. The ShortRun dummy is equal to one from June 2008 until December 2009. The LongRun dummy is equal to one in 2010 and 2011. Standard errors clustered by geographic region are in parentheses.

□ **The effect of the merger on concentration.** Prior to the merger, Miller and Coors were the second and third largest firms in the US brewing industry. Figure 2 and Table 2 show that the merger was expected to raise concentration by substantial, but varying amounts across the regions in our data. If postmerger shares are the same as premerger shares, then $sim\Delta HHI_n$ will be the increase in concentration in market n. However, concentration will rise by less than anticipated if the merging firms lost share to competitors after the merger occurred. In order to determine if $sim\Delta HHI_n$ successfully predicted postmerger concentration, we fit the following equation to the data using OLS:

$$HHI_{nt} = \alpha_{isn} + \beta sim\Delta HHI_n * PostApproval_t + \gamma * \Delta distance_n * PostApproval_t + \lambda_{tm} + \epsilon_{isnt}, \tag{2}$$

where $Post\_Approval_t$ is a dummy variable equal to one during and after the month the merger was approved by the DOJ, June 2008. $sim\Delta HHI_n$ is the predicted change in the HHI, where the HHI is measured on a scale from zero to one, $\Delta distance_n$ is the reduction in distance to the nearest Coors plant measured in thousands of driving miles, λ_{tm} is a full set of year/month/manufacturer time effects, and α_{isn} is a brand/package size/region fixed effect.[26,27]

The results are in Table 3. Column 1 shows that a one-point increase in anticipated concentration led to a .8 point increase in actual concentration. The relationship between $sim\Delta HHI$ and actual concentration is statistically significant, with a robust F-statistic of 35 ($(\frac{.812}{.138})^2$). The second column tests whether the relationship was persistent by allowing the effect to differ across two time periods: the first year and a half after the merger was approved (ShortRun) and then

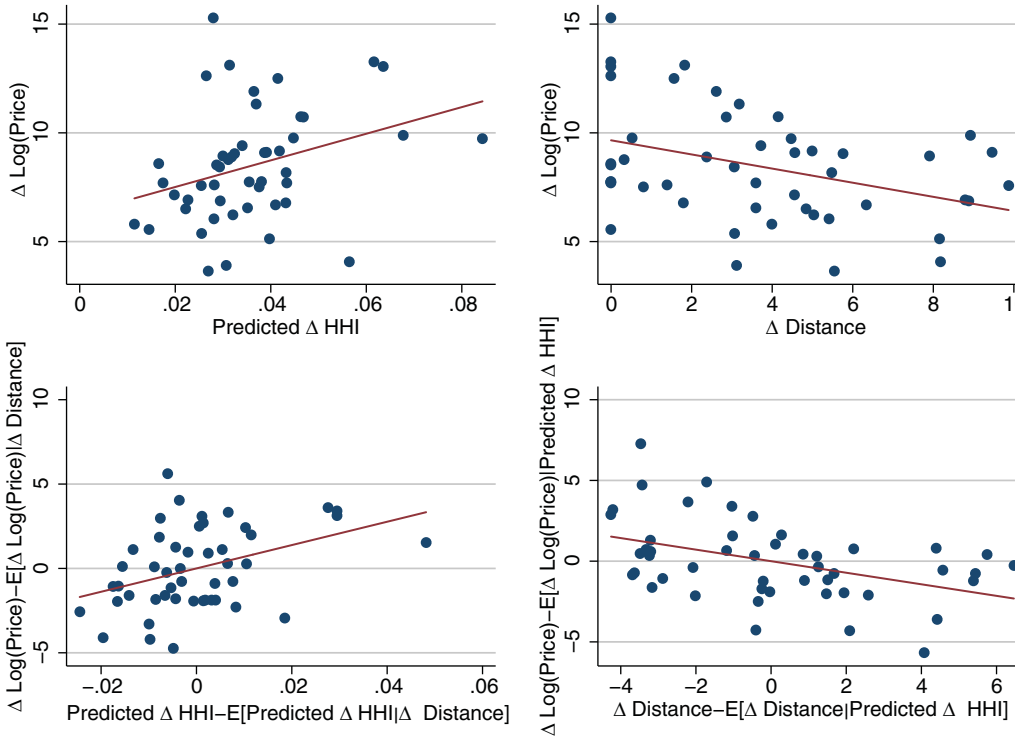
[26] We estimated this equation on product-level data.

[27] Our main pricing regressions are estimated on product level data so an IV estimate of the effect of concentration on pricing can be formed as the ratio of the estimates of the coefficient on $sim\Delta HHI_n * PostApproval_t$ in equation (2) to the coefficient in the price regression.

FIGURE 4

AVERAGE LOG 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 log price change in a lager-style beer after the Miller/Coors merger against the predicted increase in the HHI 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 five months preceding the merger's approval date of June 2008 and it is scaled between 0 and 1. The change in average log price is calculated using data from January 2007 through December 2011. The two graphs in the second row plot the residuals from a regression of the average log 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) on change in distance (or change in HHI). Least squares fitted lines are drawn through each scatter plot.



the remaining two years in our sample (LongRun). The results show that the relationship was stronger in the period just after the merger, but still strong during the last two years of our sample. The remaining three columns show robustness to additional controls. The third column of the table shows that the results are robust to controlling for regional unemployment rates and (log) earnings, the fourth column shows robustness to controlling for census region time trends, and the fifth column shows robustness to including a time trend interacted with the predicted change in concentration.

□ **The effect of the merger on pricing.** We next estimate the effect of the merger on pricing. Figure 4 provides the most direct illustration of the effects of the merger and depicts the essence of our research design. We calculated the average (log) price change of each beer 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 Coors brewery. Each point represents a separate geographic market, and an OLS 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. We correct for this by constructing regression adjusted scatter plots. These are presented 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 reduces the dispersion about the regression lines fitted through the figures.

Although suggestive, there are two potential problems with the scatter plots in Figure 4. First, there is substantial dispersion about the fitted regression lines, which may be reduced by controlling for other factors that determined how prices changed after the merger. This could increase the precision of our estimates. A second and more serious problem is that variation in the composition of beers sold over time within the regional markets could bias 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:

$$\log(price)_{inst} = \beta sim\Delta HHI_n * PostApproval_t + \gamma * \Delta distance_n * PostApproval_t + \alpha_{isn} + \lambda_{tm} + \epsilon_{isnt}. \quad (3)$$

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 different time effects for different brewers. The two key independent variables are the interaction terms $sim\Delta HHI_n * PostApproval_t$ and $\Delta distance_n * PostApproval_t$. The coefficient β divided by 100 is approximately the percentage change in price associated with a 100-point increase in the unscaled HHI (i.e., measured on a scale from 0 to 10,000), and the coefficient γ measures the percentage change in price associated with reducing the distance to the nearest Coors brewery by 1000 miles. 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 4 presents the results of estimating equation (3). We find that the estimated coefficient on $sim\Delta HHI_n * PostApproval_t$ is positive and the estimated coefficient on $\Delta distance_n * PostApproval_t$ is negative, as expected. Both coefficients are statistically significant at the .05 level. Across the 48 markets in our data, the average value of $sim\Delta HHI_n$ was 0.036. The point estimate of the coefficient on $sim\Delta HHI_n * PostApproval_t$ therefore implies that the increase in concentration led to a 1.29 (.036*.36)% 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

TABLE 4 Merger Effects on Log Prices

	Dependent Variable=log(price)				
	(1)	(2)	(3)	(4)	(5)
Sim Δ*HHI**PostApproval	0.360				
	(0.123)				
Sim Δ*HHI**AnnouncementPeriod		0.157	0.161	0.145	0.135
		(0.0801)	(0.0803)	(0.0936)	(0.0971)
Sim Δ*HHI**ShortRun		0.294	0.296	0.276	0.230
		(0.147)	(0.146)	(0.176)	(0.218)
Sim Δ*HHI**LongRun		0.563	0.564	0.526	0.434
		(0.175)	(0.173)	(0.193)	(0.283)
Δ Distance*PostApproval	−0.0311				
	(0.00709)				
Δ Distance*ShortRun		−0.011	−0.0112	−0.0144	−0.0112
		(0.00551)	(0.00561)	(0.00642)	(0.00560)
Δ Distance*LongRun		−0.0485	−0.0488	−0.0555	−0.0488
		(0.00979)	(0.00989)	(0.0107)	(0.00989)
Covariates	No	No	Yes	Yes	Yes
Census region time trends	No	No	No	Yes	No
Sim Δ*HHI**time trend	No	No	No	No	Yes
Average premerger price	9.73	9.73	9.73	9.73	9.73
Average -Δ Distance (thousands of miles)	0.364	0.364	0.364	0.364	0.364
Average Sim Δ*HHI*	0.036	0.036	0.036	0.036	0.036
Number of observations	345,379	345,379	345,379	345,379	345,379
Number of regions	48	48	48	48	48

Notes: The unit of observation is a brand-package size-region-month. Brand/Package Size/Region and Manufacturer/Year/Month effects are included in all specifications. The estimates include monthly scanner data from 48 IRI regions from January 2007 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five 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 nine US census regions. The fifth column replaces the census region time trends with a time trend interacted with $Sim\Delta HHI$. The sample contains the top 40 selling lager-style beers. The PostApproval dummy is equal to one from June 2008 through December 2011. The AnnouncementPeriod dummy is equal to one from October 2007 until May 2008. The ShortRun dummy is equal to one from June 2008 until December 2009. The LongRun dummy is equal to one in 2010 and 2011. Standard errors clustered by geographic region are in parentheses.

was .364 thousands of miles, and the point estimate on $\Delta distance_n * PostApproval_t$ implies that the reduction in shipping distance led to a 1.1 (−.031*.364)% reduction in the price of beer in the average market, all else equal.

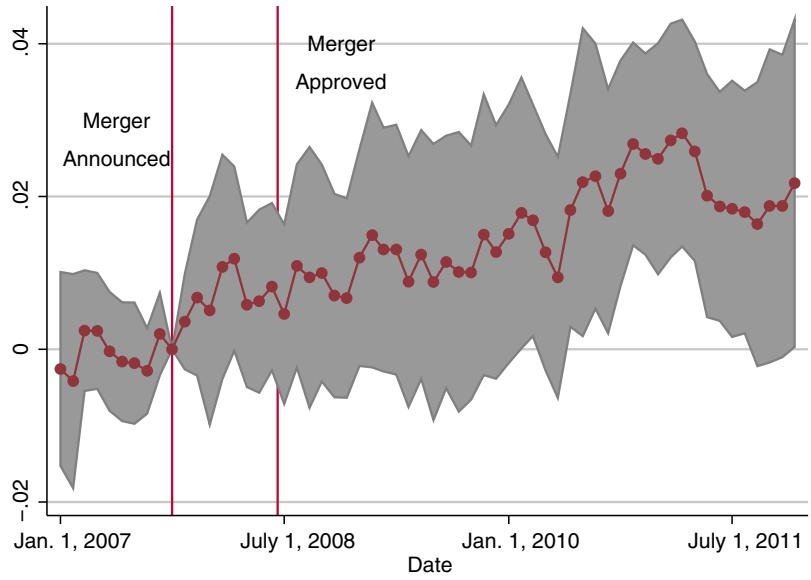
We next estimate a more flexible version of equation (3) that allows us to identify exactly when the two effects of the merger occurred. This is potentially important. Any efficiencies that were generated by the merger, including reductions in shipping costs, could not have been realized until the firms merged and had time to reoptimize their shipping and distribution network. This likely occurred with a delay, as statements by the merging firms indicate that it took more than a year and a half to fully reallocate production across the combined firms' plants.[28] Furthermore, it is not clear exactly when any cost reductions would affect pricing decisions. 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 comparison routes where there was no change in concentration as

[28] A November 2009 letter from Miller/Coors states, "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." See MillerCoors (2012).

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/brewer 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 sample includes the top 40 national selling 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 five months preceding the merger's approval date of June 2008.



soon as the mergers were announced and before they were actually approved or consummated. We explore the timing of the effects by estimating the following equation with OLS:

$$\log(price)_{inst} = \sum_{j=-9}^{j=30} \beta_j sim\Delta HHI_n * 1(\tau_t = j) + \sum_{j=-9}^{j=30} \gamma_j * \Delta distance_n * 1(\tau_t = j) + \alpha_{ins} + \lambda_{tm} + \epsilon_{inst}, \quad (4)$$

where τ_t measures the month relative to June 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 $\tau_t = -2$ 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.[29]

The results are in Figure 5 and Figure 6. Figure 5 shows that the increase in concentration eventually led to about a 2% price increase by the end of our sample period. There was a slight increase in prices following the merger's announcement and before the merger was approved, but it is small in magnitude. Although 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 the staggered renegotiation of contracts between manufacturers and individual distributors.

[29] 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.

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/brewer 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 sample includes the top 40 national selling 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 five months preceding the merger's approval date of June 2008 and it is scaled between 0 and 1.

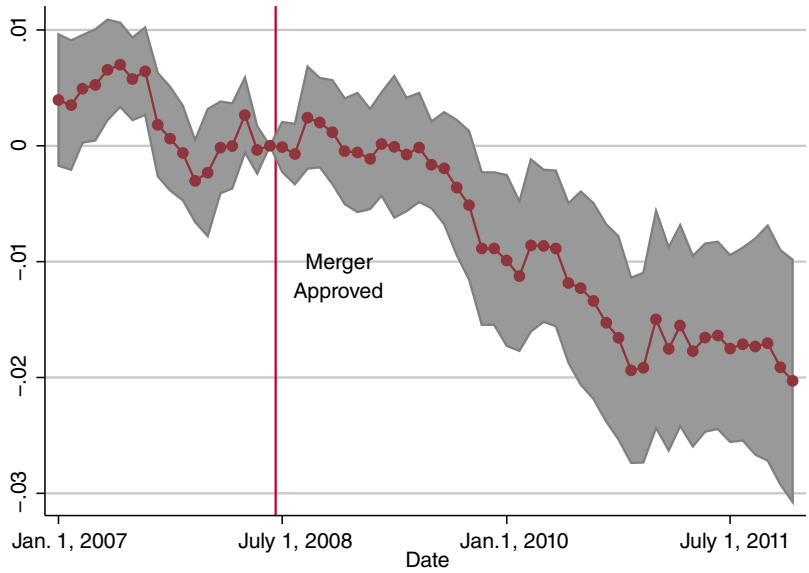


Figure 6 shows that in the long run, the reduction in distance nearly exactly offset the effect of increased concentration on prices on average. However, the effect of reducing the shipping distance was much more delayed, as expected given statements made by the merging firms. The effect of reducing shipping distances on pricing was not fully reflected in pricing until mid-2010.

We obtain point estimates by estimating a more constrained version of equation (4) that 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 to take on different values in three different periods: the time period between the announcement date and the consummation date, 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. We also allow the effect of the reduction in distance to differ in the first year and a half after the merger's approval date and in 2010 and 2011.

The results are presented in column 2 of Table 4. 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 a 0.57 (.157*0.036)% increase in price during the period between the merger's announcement date and approval date. The effect of the increase in concentration grew to 1.5% in the first year and a half after the merger was consummated, whereas the long-run effect was a 2% increase in price. The point estimates imply that reduction in shipping distances

led to a negligible .4% reduction in prices in the short run, but a 1.8% 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 regional earnings. The results are in column 3 of Table 4. 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.[30] Once again, the estimates are stable, which gives us added confidence in our identification assumption. Finally, column 5 adds a time trend interacted with the anticipated increase in concentration. This controls for preexisting trends in pricing correlated with the premerger presence of Miller and Coors. Although the point estimates are stable, controlling for this trend removes much of the variation used to identify our coefficients of interest and inflates the *p*-value associated with the test, that the long-run effect of the increase in concentration is zero to .12.[31]

□ **Heterogeneity in the price effects of the merger.** The estimated net effect of the merger on pricing was essentially zero in the average market, but there was 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 in the period a year and a half after the merger was approved and in the period two-and-a-half to three-and-a-half years after the merger was approved, using the estimates in column 2 of Table 4. For each region we multiplied the predicted increase in concentration and reduction in distance by the coefficient on the interaction term between the event dummies and the increase in concentration and change in distance, respectively, and added the two terms together. 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 was approved, it caused small price increases of less than 2.5% in 32 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 between 0 and 4.5%, and 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 5. The first column in each subpanel presents the results of estimating the most parsimonious model given by equation (2). The positive estimates of the coefficient on the interaction of the postmerger dummy and the predicted increase in concentration implies that relative prices increase in regions where the merger was predicted

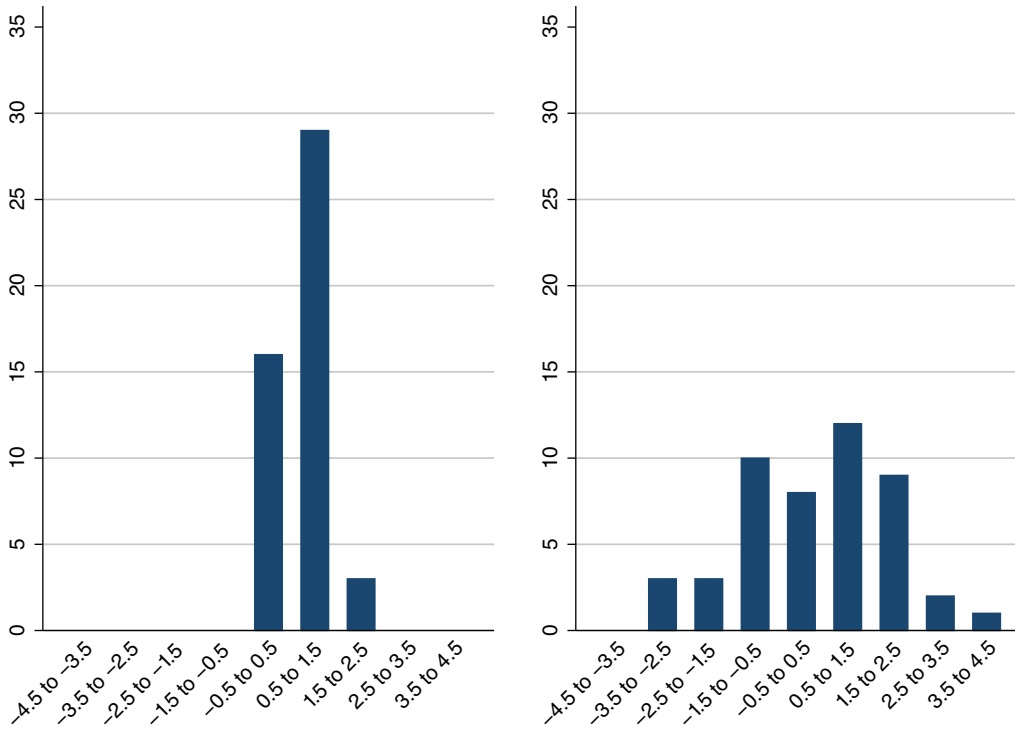
[30] Given limited statistical power, we were unable to obtain precise estimates from a more flexible model that allows IRI market-specific time trends.

[31] We also tested that leads of $sim\Delta HHI$ are not related to pricing prior to the merger's announcement data. The results are presented in Appendix Table A1. None of the interactions were individually significant at the 10% level, nor were they jointly significant, and there is no evidence of a pretrend.

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.



to increase concentration by more. The magnitude of the effect was a 1.5 (.036*.424)% increase for Miller and a 2.1 (.036*.576)% increase for Coors. Rivals increased their prices too, but by the slightly smaller amount of 1.1 (.036*.319)%. There was no detectable difference in the merging firms' response to the reduction in distance than 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 subpanel of Table 5 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 increase in prices associated with the increase in concentration in either the announcement period or the first year and a half after the merger. This is implied by the coefficient on the interaction of the predicted increase in concentration and *AnnouncementPeriod* and the interaction of the predicted increase in concentration and *ShortRun* column two of the third subpanel. The implied price increase was only .3% and the *t*-statistic is less than 1. In contrast, both Miller and Coors increased their prices in the short run by approximately 1.6 (.448*.036) and 1.3 (.361*.036)%, 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 1.8% increase for rivals, a 2.2% increase for Miller brands, and a 3.2% 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% price reduction across the three groups of

TABLE 5 Merger Effects on Log Prices By Firm

	Dependent Variable=log(price)					
	Miller		Coors		Rivals	
	(1)	(2)	(1)	(2)	(1)	(2)
Sim Δ*HHI**PostApproval	0.424		0.576		0.319	
	(0.231)		(0.132)		(0.132)	
Sim Δ*HHI**AnnouncementPeriod		0.216		0.139		0.131
		(0.0967)		(0.144)		(0.0811)
Sim Δ*HHI**ShortRun		0.448		0.361		0.233
		(0.254)		(0.172)		(0.139)
Sim Δ*HHI**LongRun		0.608		0.882		0.513
		(0.281)		(0.194)		(0.198)
Δ Distance*PostApproval	−0.0303		−0.0348		−0.0362	
	(0.0144)		(0.0080)		(0.00560)	
Δ Distance*ShortRun		−0.00862		−0.0107		−0.0154
		(0.0115)		(0.00692)		(0.00425)
Δ Distance*LongRun		−0.0502		−0.0556		−0.0538
		(0.0187)		(0.0110)		(0.00816)
Average premerger price	7.64	7.64	8.92	8.92	10.66	10.66
Number of observations	75,913	75,913	40,843	40,843	228,623	228,623
Number of regions	48	48	48	48	48	48

Notes: The unit of observation is a brand-package size-region-month. Brand/Package Size/Region and Manufacturer/Year/Month effects are included in all specifications. The estimates include monthly scanner data from 48 IRI regions from January 2007 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five months preceding the merger's approval date of June 2008. The HHI is scaled from 0 to 1. The sample contains the top 40 selling lager-style beers. The PostApproval dummy is equal to one from June 2008 through December 2011. The AnnouncementPeriod dummy is equal to one from October 2007 until May 2008. The ShortRun dummy is equal to one from June 2008 until December 2009. The LongRun dummy is equal to one in 2010 and 2011. Standard errors clustered by geographic region are in parentheses.

brands. In the Appendix, we present the results from specifications that control for our covariates, census time trends, and a trend interacted with the anticipated increase in concentration. As before, the results are stable.

We next estimated the extent that the effects of anticipated increases in concentration and reductions in shipping distances on pricing varied with the initial structure of competition across regional markets. We focused on whether the price changes varied with the sales share of Anheuser-Busch, the largest firm in the industry, and whether there was heterogeneity related to the initial level of concentration within a market. Specifically, we supplemented our most parsimonious model with the interaction of Anheuser-Busch's initial share and $sim\Delta HHI_n * PostApproval$ and the interaction of Anheuser-Busch's initial share with $\Delta distance_n * PostApproval$. Second, we allowed the effect to vary with the initial level of concentration by adding interactions of $distance_n * PostApproval$ and $sim\Delta HHI_n * PostApproval$ with the premerger HHI.[32] The results are in Table 6. We estimate a negative interaction between the effect of anticipated increases in concentration and Anheuser-Busch's premerger share, and we also estimate a similar negative interaction between anticipated increases in concentration and the initial level of concentration.[33] An increase of Anheuser-Busch's premerger market share of

[32] The HHI was calculated using sales shares calculated on sales in the six months preceding the merger's approval date.

[33] Ideally, we would be able to estimate both sets of interactions simultaneously, but this is impossible because of the high correlation (0.9) between the initial HHI and Anheuser-Busch's initial share. This makes it impossible to distinguish between these two reasons for heterogeneity in the price effects.

TABLE 6 Heterogeneity in Price Effects

	Dependent Variable=log(price)	
	Interaction Variables	
	Initial HHI	Anheuser-Busch Initial Share
Sim Δ*HHI**PostApproval	1.045	0.895
	(0.262)	(0.326)
Sim Δ*HHI**PostApproval*(variable)	−2.929	−1.479
	(1.124)	(0.821)
Δ Distance*PostApproval	−0.0298	−0.0502
	(0.0113)	(0.0198)
Δ Distance*PostApproval*(variable)	0.0124	0.0530
	(0.0500)	(0.0454)
Average pre-merger price	9.73	9.73
Average -Δ Distance (thousands of miles)	0.364	0.364
Average Sim Δ*HHI*	0.036	0.036
Average (variable)	0.24	0.40
Number of observations	345,379	345,379
Number of regions	48	48

Notes: Brand/Package Size/Region and Manufacturer/Year/Month effects were also included. The unit of observation is a brand-package size-region-month. The estimates include monthly scanner data from 48 IRI regions from January 2007 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five months preceding the merger's approval date of June 2008. The HHI is scaled from 0 to 1. The PostApproval dummy is equal to one from June 2008 through December 2011. The AnnouncementPeriod dummy is equal to one from October 2007 until May 2008. The ShortRun dummy is equal to one from June 2008 until December 2009. The LongRun dummy is equal to one in 2010 and 2011. Standard errors clustered by geographic region are in parentheses.

0.18 (the interquartile range) causes the price increase associated with the average anticipated increase in concentration to fall by 1.2 percentage points, showing that the merger led to small price increases when Anheuser-Busch had a stronger presence. Similarly, we estimate that an increase in the initial, premerger HHI of 1209 points (the interquartile range) reduces the price increase associated with the anticipated increase in concentration by 1.3 percentage points. The interactions between the reduction in distance and initial HHI and the interaction between the reduction in distance and Anheuser-Busch's share were small in magnitude and imprecisely estimated.

□ **Sales weighted effect of the merger on prices.** The regressions reported in Tables 4–6 are unweighted and therefore estimate the average price increase of a product, giving equal weight to each brand/package size. To give more weight to products with higher sales, we reestimated each of our pricing regressions while weighting by a brand/package size's national sales in each time period. The weighted least squares estimates can be interpreted as the percentage price change of an aggregate price index for beer. The results are in Tables 7–8, and they are very similar to the unweighted results. Column 2 of Table 7 shows that the anticipated increase in concentration led to a .9 (.036*.259)% price increase in the short run and a 1.6% price increase in the long run, where as the reduction in shipping distance led to a 1.6% price reduction in the long run, all else equal. The results by firm are also similar to the unweighted results.

□ **The effects of the merger on the volume of beer sold.** 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:

$$\log volume_{nt} = \alpha_n + \beta sim\Delta HHI_n * PostApproval_t + \gamma * \Delta distance_n * PostApproval_t + \lambda_t + \epsilon_{nt}, \quad (5)$$

TABLE 7 Merger Effects on Log Prices Weighted By Sales

	Dependent Variable=log(price)				
	(1)	(2)	(3)	(4)	(5)
Sim Δ*HHI**PostApproval	0.275				
	(0.118)				
Sim Δ*HHI**AnnouncementPeriod		0.173	0.177	0.157	0.150
		(0.0851)	(0.0875)	(0.101)	(0.0962)
Sim Δ*HHI**ShortRun		0.259	0.254	0.221	0.184
		(0.116)	(0.116)	(0.133)	(0.176)
Sim Δ*HHI**LongRun		0.443	0.439	0.369	0.298
		(0.166)	(0.167)	(0.157)	(0.256)
Δ Distance*PostApproval	−0.0281				
	(0.00764)				
Δ Distance*ShortRun		−0.0105	0.00978	−0.0133	−0.00979
		(0.00550)	(0.00547)	(0.00538)	(0.00547)
Δ Distance*LongRun		−0.0443	−0.0431	−0.0503	−0.0431
		(0.0106)	(0.0104)	(0.00933)	(0.0104)
Covariates	No	No	Yes	Yes	Yes
Census region time trends	No	No	No	Yes	No
Sim Δ*HHI**time trend	No	No	No	No	Yes
Number of observations	345,379	345,379	345,379	345,379	345,379
Number of regions	48	48	48	48	48

Notes: The unit of observation is a brand-package size-region-month. Brand/Package Size/Region and Manufacturer/Year/Month effects are included in all specifications. The estimates include monthly scanner data from 48 IRI regions from January 2007 through December 2011. 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five 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 nine US census regions. The fifth column replaces the census region time trends with a time trend interacted with $Sim\Delta HHI$. Each observation was weighted by the square root of the product/package size's national sales in that time period. The sample contains the top 40 selling lager-style beers. The PostApproval dummy is equal to one from June 2008 through December 2011. The AnnouncementPeriod dummy is equal to one from October 2007 until May 2008. The ShortRun dummy is equal to one from June 2008 until December 2009. The LongRun dummy is equal to one in 2010 and 2011. Standard errors clustered by geographic region are in parentheses.

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 $sim\Delta HHI_n * PostApproval_t$ and $\Delta distance_n * PostApproval_t$ are treatment variables defined as before. The results are in Table 9. Unfortunately, the estimates are imprecisely estimated. Although the point estimates of the coefficient on the predicted increase in concentration interactions suggest that volume fell by about 4.6 (–1.275*.036)% in the short run and by about 7% in the long run, the estimates are not significant at conventional levels ($p < .19$) 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 10 presents the results of estimating equation (5) 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. Although Coors' volume increased as a result of the reduction in distance, Miller's volume was reduced.

□ **Discussion.** We find that the relative retail price of beer fell in markets that became closer to a Coors brewery following the consummation of the merger and interpret this as resulting from a reduction in distribution costs. Although the timing of the estimated price reduction coincides

TABLE 8 Merger Effects Log Prices By Firm Weighted By Sales

	Dependent Variable=log(price)					
	Miller		Coors		Rivals	
	(1)	(2)	(1)	(2)	(1)	(2)
Sim Δ*HHI**PostApproval	0.436		0.378		0.216	
	(0.184)		(0.137)		(0.116)	
Sim Δ*HHI**AnnouncementPeriod		0.210		0.259		0.149
		(0.138)		(0.151)		(0.0813)
Sim Δ*HHI**ShortRun		0.409		0.311		0.209
		(0.238)		(0.155)		(0.0969)
Sim Δ*HHI**LongRun		0.657		0.652		0.354
		(0.228)		(0.208)		(0.169)
Δ Distance*PostApproval	−0.0206		−0.0294		−0.0299	
	(0.0153)		(0.00881)		(0.00686)	
Δ Distance*ShortRun		−0.00244		−0.00475		−0.0135
		(0.0123)		(0.00759)		(0.00481)
Δ Distance*LongRun		−0.0392		−0.0501		−0.0448
		(0.0194)		(0.0124)		(0.00972)
Average premerger price	8.89	8.89	9.45	9.45	11.23	11.23
Number of observations	75,913	75,913	40,843	40,843	228,623	228,623
Number of regions	48	48	48	48	48	48

Notes: The unit of observation is a brand-package size-region-month. Brand/Package Size/Region and Manufacturer/Year/Month effects are included in all specifications. The estimates include monthly scanner data from 48 IRI regions from January 2007 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five months preceding the merger's approval date of June 2008. The HHI is scaled from 0 to 1. Each observation was weighted by the square root of the product/package size's national sales. The sample contains the top 40 selling lager-style beers. The PostApproval dummy is equal to one from June 2008 through December 2011. The AnnouncementPeriod dummy is equal to one from October 2007 until May 2008. The ShortRun dummy is equal to one from June 2008 until December 2009. The LongRun dummy is equal to one in 2010 and 2011. Standard errors clustered by geographic region are in parentheses.

with when MillerCoors reported moving the production of Coors beers to Miller breweries, we do not have data necessary to directly measure how the merger changed distribution costs. To help validate our estimate of merger-induced price reductions, we conduct a back-of-the-envelope calculation using an estimate of the reduction in production costs from an external market analysis, and then compare the pass-through elasticity implied by our results to other estimates from the literature.

When the merger was announced, Miller and Coors forecast that it would ultimately result in cost savings of $500 million per year with roughly 60% of those savings resulting from production efficiencies and reductions in shipping costs (van Brugge et al., 2007). Moreover, these forecasts appear to have been realized. As of November 2010, MillerCoors reported that 95% of its projected savings had been achieved.[34] In reports analyzing the joint venture, van Brugge, Stirling, Choi, and Gottolli (2007) and van Brugge, Stirling, Choi, DeRise, and Segal (2007) estimated that Coors' marginal cost of producing a barrel of beer would be reduced by between 8 and 11%.[35,36] Given that we estimate that retail prices in the average market fell by 1.8%, these estimates imply

[34] Miller Coors Presentation, November 30, 2010. Available at //www.sabmiller.com/files/presentations/2010/301110/miller_divisional_seminar.pdf, last downloaded July 28, 2014.

[35] Bernstein Research estimated that Coors' marginal cost of producing a barrel of beer was $87 and that the Miller/Coors merger would reduce Coors' shipping costs by $7 a barrel (an 8% reduction in marginal cost) (van Brugge et al., 2007).

[36] Bernstein later increased its estimate by 35%, implying an 11% reduction in marginal cost (van Brugge et al., 2007).

TABLE 9 Merger Effects on Log Market Volume

	Dependent Variable=log(volume)				
	(1)	(2)	(3)	(4)	(5)
Sim ΔHHI*PostApproval	−1.023				
	(1.001)				
Sim ΔHHI*AnnouncementPeriod		−1.395	−1.448	−1.115	−1.561
		(0.605)	(0.597)	(0.707)	(0.577)
Sim ΔHHI*ShortRun		−1.275	−1.383	−0.506	−1.674
		(0.715)	(0.673)	(0.945)	(0.727)
Sim ΔHHI*LongRun		−2.001	−2.091	−0.410	−2.666
		(1.501)	(1.391)	(1.682)	(1.180)
Δ Distance*PostApproval	0.00589				
	(0.0471)				
Δ Distance*ShortRun		−0.0157	−0.00113	0.00434	−0.00113
		(0.0321)	(0.0386)	(0.0252)	(0.0386)
Δ Distance*LongRun		0.0229	0.0472	0.0619	0.0472
		(0.0622)	(0.0709)	(0.0485)	(0.0709)
Covariates	No	No	Yes	Yes	Yes
Census region time trends	No	No	No	Yes	Yes
Average premerger volume	598,640	598,640	598,640	598,640	598,640
Average -Δ Distance (thousands of miles)	0.364	0.364	0.364	0.364	0.364
Average Sim ΔHHI	0.037	0.037	0.037	0.037	0.037
Number of observations	2880	2880	2880	2880	2880
Number of regions	48	48	48	48	48

Notes: The unit of observation is a region/month. Each specification includes region and year/month effects. The estimates include monthly scanner data from 48 IRI regions from January 2007 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five 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 nine US census regions. The fifth column replaces the census region time trends with a time trend interacted with $Sim\Delta HHI$. The underlying data contains volume from the top 40 selling lager-style beers. The PostApproval dummy is equal to one from June 2008 through December 2011. The AnnouncementPeriod dummy is equal to one from October 2007 until May 2008. The ShortRun dummy is equal to one from June 2008 until December 2009. The LongRun dummy is equal to one in 2010 and 2011. Standard errors clustered by geographic region are in parentheses.

that between 16%–22.5% of the reduction in production costs resulting from the joint venture were passed through in the form of lower retail prices.

Three recent articles have estimated the pass-through of costs to retail prices in the beer industry. Hellerstein (2008) and Goldberg and Hellerstein (2013) estimate how changes in exchange rates affect the retail price of imported beers in the United States and found that 20% and 26%, respectively, of a proportional change in the exchange rate is passed through to retail prices.[37] Part of the explanation offered for the incomplete pass-through of changes in exchange rates is that only costs incurred in the exporting country are affected by changes in the exchange rate. Hellerstein (2008), for example, estimates that only 60% of a manufacturer's costs of exporting beer to the United States are incurred in the producing country. To be more comparable to our estimated pass-through elasticity (which is expressed as a fraction of total costs), we rescale Hellerstein's and Goldberg's (2013) and Hellerstein's (2008) estimates proportionately (multiplied by 1/.6) to 33% and 43%. Rojas (2008) estimates how a large change in the excise tax for beer raised consumer prices. Using Rojas's (2008) estimates, we calculate that the tax increase resulted in a

[37] See Table 6 of Hellerstein (2008) and Table A1 of Goldberg and Hellerstein (2013).

TABLE 10 Merger Effects on Log Market Volume By Firm

	Dependent Variable=log(volume)					
	Miller		Coors		Rivals	
	(1)	(2)	(1)	(2)	(1)	(2)
Sim Δ*HHI**PostApproval	0.150		−0.836		−1.340	
	(1.508)		(1.493)		(1.065)	
Sim Δ*HHI**AnnouncementPeriod		−0.530		−1.350		−1.591
		(0.594)		(0.889)		(0.726)
Sim Δ*HHI**ShortRun		0.286		−0.967		−1.773
		(0.852)		(1.070)		(0.916)
Sim Δ*HHI**LongRun		−0.405		−1.871		−2.338
		(2.209)		(2.256)		(1.592)
Δ Distance*PostApproval	−0.128		−0.108		0.0209	
	(0.0754)		(0.0905)		(0.0522)	
Δ Distance*ShortRun		−0.109		0.0373		−0.000352
		(0.0457)		(0.0581)		(0.0381)
Δ Distance*LongRun		−0.142		0.164		0.0377
		(0.104)		(0.120)		(0.0660)
Number of observations	2880	2880	2880	2880	2880	2880
Number of regions	48	48	48	48	48	48

Notes: The unit of observation is region-month. Each specification includes region and year/month effects. The estimates include monthly scanner data from 48 IRI regions from January 2007 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five months preceding the merger's approval date of June 2008. The HHI is scaled from 0 to 1. The sample contains the top 40 selling lager-style beers. The PostApproval dummy is equal to one from June 2008 through December 2011. The AnnouncementPeriod dummy is equal to one from October 2007 until May 2008. The ShortRun dummy is equal to one from June 2008 until December 2009. The LongRun dummy is equal to one in 2010 and 2011. Standard errors clustered by geographic region are in parentheses.

7.2% increase in the costs of premium beers (such as Coors Light and Miller Lite), which resulted in a 5.2% price increase, or a proportional pass-through of roughly 72%.[38]

The pass-through estimates in Hellerstein (2008), Goldberg and Hellerstein (2013), and Rojas (2008) result from changes in costs that affect a number of firms (exchange rates) or the entire industry (excise taxes) that are different from the firm-specific cost reduction we study. As a result, the levels of the elasticities are not directly comparable. However, the relative magnitudes of the pass-through elasticities are consistent with our theoretic priors: the industry-wide cost shock resulted in the largest pass-through elasticity (72%), exchange rate adjustments affecting many (but not all) manufacturers resulted in a more modest pass-through elasticity (33%–43%), and the pass-through elasticity corresponding to a single firm's cost reduction was the smallest (16%–22.5%).

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 horizontal mergers 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. The failure of the literature to directly identify

[38] Rojas (2008) found that the average price of a case of premium beer increased by $0.73 (from $14.1) following the $0.64 tax increase. Rojas (2008) also estimates that the average margin on premium beer implied by Bertrand pricing is $0.37. This estimated margin implies an average cost of premium beer of $8.88.

merger efficiencies is due to data limitations. To identify merger efficiencies, researchers need to observe pricing for a relatively long time postmerger, and observe variation in 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 2% 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 slightly 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%. 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 study only one merger. As a result, the ability to generalize from our findings may be limited. However, though we study just one merger, it changed concentration and costs differently across 48 distinct local markets in our data. Therefore, this one merger can be viewed as generating 48 small experiments that differentially varied expected increases in 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, not all oligopoly models yield a relationship between pricing and concentration. 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.[39] Because of the HHI's prevalence, we believe it is useful to examine whether it predicts postmerger pricing. Finally, any price changes resulting from the merger that were common to all markets and not correlated with anticipated increases in concentration or reductions in distance will not be reflected in our estimates.

Appendix

The appendix includes a list of the IRI regional markets and the brands included in the analysis data, along with the robustness checks mentioned in the paper.

□ **IRI regions included in sample.**

1. Albany, NY
2. Atlanta, GA
3. Baltimore, MD /Washington, DC
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

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

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/Fort 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

□ **Brands included in sample.**

1. Anheuser-Busch/InBev
   (a) Bud Light Lime
   (b) Beck's Lager
   (c) Bud Light Lager
   (d) Budweiser Lager
   (e) Budweiser Select Lager
   (f) Budweiser Select 55 Lager
   (g) Busch Lager
   (h) Busch Light Lager
   (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) Milwaukee's Best Ice Lager
   (g) Milwaukee's Best Lager
   (h) Milwaukee's Best Light Lager
4. Coors
   (a) Coors Lager
   (b) Coors Light Lager
   (c) George Killian's 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

□ **Additional regressions.**

TABLE A1 Price Trends Prior to Merger

	Dependent Variable=log *price*
Sim Δ*HHI**(Month_-6)	0.114
	(0.0874)
Sim Δ*HHI**(Month_-5)	0.0498
	(0.104)
Sim Δ*HHI**(Month_-4)	0.0162
	(0.109)
Sim Δ*HHI**(Month_-3)	0.00324
	(0.0819)
Sim Δ*HHI**(Month_-2)	−0.0214
	(0.141)
Sim Δ*HHI**(Month_-1)	0.0801
	(0.0972)
F-test of joint significance (p-value)	0.19
Observations 345,379	

Notes: Additional controls include $Sim\Delta HHI * (PostAnnounce)$, $\Delta distance * (Post)$, region/brand/package size fixed effects, and time/manufacturer effects. Standard errors were clustered by region. 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five months preceding the merger's approval date of June 2008. The HHI is scaled from 0 to 1. The sample contains the top 40 selling lager-style beers.

TABLE A2 Merger Effects on Log Prices By Firm

	Dependent Variable=log(price)									
	Miller					Coors				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Sim Δ*HHI**PostApproval	0.424					0.576				
	(0.231)					(0.132)				
Sim Δ*HHI**AnnouncementPeriod		0.216	0.243	0.224	0.297		0.139	0.148	0.144	0.0776
		(0.0967)	(0.0956)	(0.127)	(0.124)		(0.144)	(0.143)	(0.155)	(0.147)
Sim Δ*HHI**ShortRun		0.448	0.477	0.462	0.616		0.361	0.369	0.376	0.188
		(0.254)	(0.247)	(0.263)	(0.347)		(0.172)	(0.171)	(0.216)	(0.287)
Sim Δ*HHI**LongRun		0.608	0.631	0.613	0.904		0.882	0.889	0.909	0.533
		(0.281)	(0.269)	(0.302)	(0.417)		(0.194)	(0.190)	(0.256)	(0.357)
Δ Distance*PostApproval	−0.0303					−0.0348				
	(0.0144)					(0.00799)				
Δ Distance*ShortRun		−0.00862	−0.0110	−0.0103	−0.0110		−0.0107	−0.0116	−0.00834	−0.0116
		(0.0115)	(0.0111)	(0.0109)	(0.0111)		(0.00692)	(0.00683)	(0.00803)	(0.00682)
Δ Distance*LongRun		−0.0502	−0.0539	−0.0514	−0.0538		−0.0556	−0.0570	−0.0501	−0.0570
		(0.0187)	(0.0179)	(0.0168)	(0.0179)		(0.0110)	(0.0105)	(0.0128)	(0.0105)
Average premerger price	7.64	7.64	7.64	7.64	7.64	8.92	8.92	8.92	8.92	8.92
Number of observations	75,913	75,913	75,913	75,913	75,913	40,843	40,843	40,843	40,843	40,843
Covariates	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Census region time trends	No	No	No	Yes	No	No	No	No	Yes	No
Sim Δ*HHI**time trend	No	No	No	No	Yes	No	No	No	No	Yes
Number of regions	48	48	48	48	48	48	48	48	48	48

(Continued)

TABLE A2 Continued

	Dependent Variable=log(price)				
	Rivals				
	(1)	(2)	(3)	(4)	(5)
Sim Δ*HHI**PostApproval	0.319				
	(0.132)				
Sim Δ*HHI**AnnouncementPeriod		0.131	0.124	0.105	0.0792
		(0.0811)	(0.0819)	(0.0910)	(0.0935)
Sim Δ*HHI**ShortRun		0.233	0.220	0.191	0.104
		(0.139)	(0.134)	(0.159)	(0.199)
Sim Δ*HHI**LongRun		0.513	0.501	0.439	0.275
		(0.198)	(0.195)	(0.199)	(0.277)
Δ Distance*PostApproval	−0.0362				
	(0.00560)				
Δ Distance*ShortRun		−0.0154	−0.0139	−0.0201	−0.0139
		(0.00425)	(0.00445)	(0.00567)	(0.00444)
Δ Distance*LongRun		−0.0538	−0.0513	−0.0643	−0.0513
		(0.00816)	(0.00840)	(0.0102)	(0.00840)
Average premerger price	10.66	10.66	10.66	10.66	10.66
Number of observations	228,623	228,623	228,623	228,623	228,623
Covariates	No	No	Yes	Yes	No
Census region time trends	No	No	No	Yes	No
Sim Δ*HHI**time trend	No	No	No	No	Yes
Number of regions	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 2007 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five 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 nine US census regions. The fifth column replaces the census region time trends with a time trend interacted with $Sim\,\Delta HHI$. The sample contains the top 40 selling lager-style beers. The PostApproval dummy is equal to one from June 2008 through December 2011. The AnnouncementPeriod dummy is equal to one from October 2007 until May 2008. The ShortRun dummy is equal to one from June 2008 until December 2009. The LongRun dummy is equal to one in 2010 and 2011. Standard errors clustered by geographic region are in parentheses.

TABLE A3 Merger Effects on Log Prices By Firm Weighted By Sales

	Dependent Variable=log(price)									
	Miller					Coors				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Sim Δ*HHI**PostApproval	0.436					0.378				
	(0.184)					(0.137)				
Sim Δ*HHI**AnnouncementPeriod		0.210	0.227	0.212	0.197		0.259	0.265	0.249	0.216
		(0.138)	(0.139)	(0.155)	(0.177)		(0.151)	(0.153)	(0.173)	(0.182)
Sim Δ*HHI**ShortRun		0.409	0.430	0.417	0.353		0.311	0.311	0.278	0.181
		(0.238)	(0.236)	(0.230)	(0.366)		(0.155)	(0.155)	(0.200)	(0.321)
Sim Δ*HHI**LongRun		0.657	0.675	0.662	0.521		0.652	0.651	0.581	0.393
		(0.228)	(0.217)	(0.227)	(0.438)		(0.208)	(0.209)	(0.251)	(0.470)
Δ Distance*PostApproval	−0.0206					−0.0294				
	(0.0153)					(0.00881)				
Δ Distance*ShortRun		−0.00244	−0.00476	−0.00205	−0.00476		−0.00475	−0.00454	−0.00427	−0.00455
		(0.0123)	(0.0122)	(0.0110)	(0.0122)		(0.00759)	(0.00760)	(0.00878)	(0.00760)
Δ Distance*LongRun		−0.0392	−0.0428	−0.0356	−0.0428		−0.0501	−0.0497	−0.0485	−0.0497
		(0.0194)	(0.0185)	(0.0153)	(0.0185)		(0.0124)	(0.0118)	(0.0126)	(0.0118)
Average premerger price	8.89	8.89	8.89	8.89	8.89	9.45	9.45	9.45	9.45	9.45
Number of observations	75,913	75,913	75,913	75,913	75,913	40,843	40,843	40,843	40,843	40,843
Covariates	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Census region time trends	No	No	No	Yes	No	No	No	No	Yes	No
Sim Δ*HHI**time trend	No	No	No	No	Yes	No	No	No	No	Yes
Number of regions	48	48	48	48	48	48	48	48	48	48

(Continued)

TABLE A3 Continued

	Dependent Variable=log(price)				
	Rivals				
	(1)	(2)	(3)	(4)	(5)
Sim Δ*HHI**PostApproval	0.216				
	(0.116)				
Sim Δ*HHI**AnnouncementPeriod		0.149	0.149	0.127	0.127
		(0.0813)	(0.0848)	(0.0954)	(0.0890)
Sim Δ*HHI**ShortRun		0.209	0.199	0.161	0.141
		(0.0969)	(0.0967)	(0.112)	(0.139)
Sim Δ*HHI**LongRun		0.354	0.345	0.262	0.229
		(0.169)	(0.171)	(0.152)	(0.216)
Δ Distance*PostApproval	−0.0299				
	(0.00686)				
Δ Distance*ShortRun		−0.0135	−0.0119	−0.0175	−0.0119
		(0.00481)	(0.00474)	(0.00493)	(0.00474)
Δ Distance*LongRun		−0.0448	−0.0421	0.0538	−0.0421
		(0.00972)	(0.00962)	(0.00940)	(0.00962)
Average premerger price	11.23	11.23	11.23	11.23	11.23
Number of observations	228,623	228,623	228,623	228,623	228,623
Covariates	No	No	Yes	Yes	No
Census region time trends	No	No	No	Yes	No
Sim Δ*HHI**time trend	No	No	No	No	Yes
Number of regions	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 2007 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five 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 nine US census regions. The fifth column replaces the census region time trends with a time trend interacted with $Sim\Delta HHI$. Each observation was weighted by the square root of the product/package size's national sales in that time period. The sample contains the top 40 selling lager-style beers. The PostApproval dummy is equal to one from June 2008 through December 2011. The AnnouncementPeriod dummy is equal to one from October 2007 until May 2008. The ShortRun dummy is equal to one from June 2008 until December 2009. The LongRun dummy is equal to one in 2010 and 2011. Standard errors clustered by geographic region are in parentheses.

TABLE A4 Merger Effects on Log Market Volume By Firm

	Dependent Variable=log(volume)									
	Miller					Coors				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Sim Δ*HHI**PostApproval	0.150					−0.836				
	(1.508)					(1.493)				
Sim Δ*HHI**AnnouncementPeriod		−0.530	−0.676	−0.392	−0.722		−1.350	−1.485	−1.406	−1.609
		(0.594)	(0.599)	(0.706)	(0.778)		(0.889)	(0.846)	(1.042)	(0.731)
Sim Δ*HHI**ShortRun		0.286	0.0517	0.706	−0.0672		−0.967	−1.260	−1.024	−1.580
		(0.852)	(0.788)	(1.048)	(1.098)		(1.070)	(0.957)	(1.295)	(1.060)
Sim Δ*HHI**LongRun		−0.405	−0.599	0.497	−0.834		−1.871	−2.117	−1.862	−2.749
		(2.209)	(1.903)	(1.938)	(1.494)		(2.256)	(1.925)	(2.383)	(1.719)
Δ Distance*PostApproval	−0.128					0.108				
	(0.0754)					(0.0905)				
Δ Distance*ShortRun		−0.109	−0.0783	−0.106	−0.0783		0.0373	0.0768	0.0288	0.0768
		(0.0457)	(0.0495)	(0.0458)	(0.0495)		(0.0581)	(0.0672)	(0.0529)	(0.0672)
Δ Distance*LongRun		−0.142	−0.091	−0.141	−0.091		0.164	0.23	0.138	0.23
		(0.104)	(0.104)	(0.0820)	(0.104)		(0.120)	(0.124)	(0.108)	(0.124)
Number of observations	2880	2880	2880	2880	2880	2880	2880	2880	2880	2880
Covariates	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes
Census region time trends	No	No	No	Yes	No	No	No	No	Yes	No
Sim Δ*HHI**time trend	No	No	No	No	Yes	No	No	No	No	Yes
Number of regions	48	48	48	48	48	48	48	48	48	48

(Continued)

TABLE A4 Continued

	Dependent Variable=log(price)				
	Rivals				
	(1)	(2)	(3)	(4)	(5)
Sim Δ*HHI**PostApproval	−1.340				
	(1.065)				
Sim Δ*HHI**AnnouncementPeriod		−1.591	−1.622	−1.250	−1.781
=		(0.726)	(0.711)	(0.812)	(0.634)
Sim Δ*HHI**ShortRun		−1.773	−1.843	−0.926	−2.265
		(0.916)	(0.889)	(1.077)	(0.684)
Sim Δ*HHI**LongRun		−2.338	−2.396	−0.671	−3.311
		(1.592)	(1.537)	(1.780)	(1.067)
Δ Distance*PostApproval	0.0209				
	(0.0522)				
Δ Distance*ShortRun		−0.000352	0.00903	0.0148	−0.000352
		(0.0381)	(0.0437)	(0.0335)	(0.0381)
Δ Distance*LongRun		0.0377	0.0533	0.0709	0.0377
		(0.0660)	(0.0754)	(0.0606)	(0.0660)
Number of observations	2880	2880	2880	2880	2880
Covariates	No	No	Yes	Yes	No
Census region time trends	No	No	No	Yes	No
Sim Δ*HHI**time trend	No	No	No	No	Yes
Number of regions	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 2007 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's and Coors' shares of sales by region and was calculated using sales data on all beers from the five 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 nine US census regions. The fifth column replaces the census region time trends with a time trend interacted with $Sim\,\Delta HHI$. The sample contains the top 40 selling lager-style beers. The PostApproval dummy is equal to one from June 2008 through December 2011. The AnnouncementPeriod dummy is equal to one from October 2007 until May 2008. The ShortRun dummy is equal to one from June 2008 until December 2009. The LongRun dummy is equal to one in 2010 and 2011. Standard errors clustered by geographic region are in parentheses.

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