

# How Does Advertising Depend on Competition? Evidence from U.S. Brewing\*

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## Abstract

The relationship between market structure and advertising has been extensively studied, but has generated sharply opposing theoretical predictions, as well as inconclusive empirical findings, likely due to severe endogeneity concerns. We exploit the 2008 merger of Miller and Coors in the U.S. brewing industry to examine how changes in local concentration affect firms' advertising behavior. Well-established regional preferences over beer brands, and the sharp increase in concentration from the merger, make this an excellent setting to analyze this question. We find a significant positive effect of local market concentration on advertising expenditures: a 100-point increase in the HHI measure of concentration increases advertising per capita by 6%. We then use this result to evaluate competing theories of advertising. We conclude that the most likely explanation is that advertising has positive spillovers, thus supporting recent findings in a range of settings.

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# 1 Introduction

The relationship between competition and the propensity of firms to advertise is both complex and ambiguous, due to two opposing forces. Changes in advertising should, in principle, affect firm outcomes and therefore are likely to influence market concentration. At the same time, variation in industry structure will alter the incentives of member firms to invest in advertising. Not surprisingly, the theoretical literature on this topic has generated sharply opposing predictions, as we describe below. Moreover, the empirical literature has heavily emphasized causality running in a single direction—from advertising to market structure. While the endogeneity concern has been repeatedly acknowledged, it has rarely been satisfactorily addressed; perhaps as a result, the findings have been inconclusive.

Empirically identifying the relationship between advertising and market structure is important for at least two reasons. First, understanding how market structure affects advertising provides a valuable insight into how firms themselves view advertising. This is especially important because the vast literature on advertising has focused on the consequences for consumer choice, profitability and market structure, but has devoted relatively little attention to understanding how firms choose to deploy this tool. Second, by pinning down the causal effect of concentration on advertising we can determine whether reverse causality creates bias in previous studies which have examined how advertising affects concentration, but which did not account for endogeneity.

In this paper, we exploit a large, recent change in market structure in the U.S. brewing industry to estimate the causal effect of concentration on advertising. The brewing industry is an excellent setting in which to investigate this question, for a number of reasons. First, advertising is a key strategic variable for brewers, and beer is, in general, one of the most heavily advertised products.<sup>1</sup> Second, the change in market structure that we examine was driven by the 2008 merger between Miller and Coors—previously the second and third largest brewers in the country—which led to huge increases in concentration. Third, there are well-established regional preferences over beer brands in the United States, and therefore a nation-wide merger of these two large firms had very different effects in different markets, which enables our identification strategy. Finally, the merger itself can reasonably be viewed as exogenous to the advertising market, since the main considerations while reviewing the merger centered around price increases and reductions in shipping costs.

Our results imply that greater industry concentration leads to higher advertising per-capita. We establish our results using simple panel-data methods. We first estimate panel

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<sup>1</sup>Source: *Advertising Age*, 2010. In terms of advertising to sales ratios, beer is well ahead of carbonated soft drinks and other heavily advertised goods.

fixed-effect regressions that estimate the effect of concentration on advertising within local markets. We then employ the predicted impact of the merger on concentration as an instrumental variable to correct for any endogeneity. In both cases, we find a positive and quantitatively important effect of changes in local market concentration on local advertising. The IV estimates imply that a 100-point increase in the HHI measure of concentration raises per capita advertising by an average of 6%.

Our results help to sort out long-standing, but competing, theories of advertising. These theories offer conflicting predictions, since they can imply a positive, negative, or even zero effect of concentration on advertising. As far back as [Marshall \(1890\)](#), some economists have viewed advertising as ‘combative’, suggesting that firms employ it primarily as an instrument of competition, which implies that concentration should have a negative effect on the propensity to advertise.<sup>2</sup> The same prediction, though motivated by a different theory, follows from [Becker and Murphy \(1993\)](#), who argue that, if advertising is complementary to the product and viewed as a good by consumers, then firms with market power will undersupply advertising just as they undersupply the good itself.

By contrast, a different view of advertising—dating back to at least [Telser \(1964\)](#)—is that it can have positive externalities on rivals. Indeed, as we discuss below, recent empirical studies have found compelling evidence of such externalities in a number of different settings. These positive externalities would be internalized by a monopolist, implying that concentrated markets should see greater advertising. A similar prediction, but again deriving from a different theory, is by [Dorfman and Steiner \(1954\)](#), who argue that higher margin goods are more likely to be advertised. Since these higher margins are more likely achieved by firms with market power, there is again a prediction of a positive effect of concentration on advertising.<sup>3</sup>

We make a number of contributions to this literature on the relationship between market structure and advertising. First, the empirical research on this topic has focused on estimating the effect of advertising on concentration; few studies have examined the reverse effect.<sup>4</sup> Moreover, among both types of these studies, the methodology has involved comparing advertising-to-sales ratios across a cross-section of industries. By contrast, we

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<sup>2</sup>See the survey by [Bagwell \(2007\)](#) for an exhaustive summary of the various views of advertising.

<sup>3</sup>Other predictions of the relationship between advertising and concentration are also possible. For example, the two opposing effects described above may operate simultaneously, in which case the relationship may be non-monotonic ([Greer \(1971\)](#)). Further, some authors assume that advertising-to-sales ratios are constant in the short-to-medium term, primarily because firms allocate a constant share of revenues to their advertising budgets ([Comanor and Wilson \(1974\)](#) and [Sutton \(1991\)](#)). This would predict no effect of market structure changes on advertising.

<sup>4</sup>Examples of the former include [Mueller and Rogers \(1980\)](#), [Mueller and Rogers \(1984\)](#) and [Sass and Saurman \(1995\)](#). Examples of the latter include [Buxton et al. \(1984\)](#) and [Uri \(1988\)](#).

examine a single industry and exploit local changes in concentration driven by an arguably exogenous national merger. In addition, our results help to uncover the direction of bias in previous empirical studies that did not fully account for the endogeneity in the advertising-concentration relationship. This endogeneity has been acknowledged by multiple authors, but it has been too complex to completely address; according to [Bagwell \(2007\)](#), “...the endogeneity concern is formidable.”

Most importantly, we can use our results to evaluate the conflicting theoretical predictions regarding the relationship between advertising and market structure. Our finding that concentration has a large positive effect on advertising argues against the predictions of a negative relationship by [Marshall \(1890\)](#) and [Becker and Murphy \(1993\)](#). Instead our findings are consistent with both [Dorfman and Steiner \(1954\)](#) and with the notion of positive spillovers that was first described in [Telser \(1964\)](#). We then investigate these theories further. Dorfman and Steiner’s prediction is that the positive relationship between concentration and advertising is driven by the greater profitability of goods sold in concentrated markets. A feature of the Miller-Coors merger is that it sharply reduced shipping costs for Coors brands in a number of markets, as we discuss in more detail below, which would have increased margins on Coors products in these markets. Thus, the Dorfman and Steiner model would predict higher advertising in markets with the greatest reduction in shipping costs. However, the data do not support this prediction, as we find no consistent effect of cost reductions on advertising; in contrast, these cost reductions have been shown to directly reduce beer prices.

We then turn to the possibility of positive externalities. Recent research provides good reasons to believe that this theory explains our main findings. A number of studies in the Marketing literature have uncovered evidence that advertising has positive spillovers for rival brands, in various settings. Many of these provide strong evidence based on large randomized trials with compelling identification: [Anderson and Simester \(2013\)](#) establish positive spillovers at a large retailer, [Sahni \(2014\)](#) finds the same effect on a restaurant search website, and [Lewis and Nguyen \(2015\)](#) find these spillovers in three distinct goods based on display advertising at Yahoo. In addition, [Shapiro \(2013\)](#) finds evidence of positive spillovers from television advertising for antidepressant drugs.<sup>5</sup>

Importantly, no previous study has examined whether advertising firms are aware of positive spillovers, and therefore whether this phenomenon affects their behaviour. [Shapiro \(2013\)](#) perhaps comes the closest to this issue, as he recognizes that firms will under-advertise

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<sup>5</sup>One possible exception to these studies is [Sinkinson and Starc \(2015\)](#) who analyze spillovers in television advertising for anti-cholesterol drugs. While they estimate that a given brand’s advertising creates a small positive spillover for non-advertised brands, they also find a much larger business stealing effect for other advertised brands.

as a result of free-riding on each others' advertising, and estimates that this reduces advertising by a factor of almost six. However, a direct consequence of the positive spillover effect is that firms should advertise less in more competitive markets, i.e. that the extent of advertising should depend on market structure.

Our findings are consistent with the notion that firms are aware of advertising having positive spillovers, as they tend to increase advertising spending the most in markets that saw greater concentration following the merger. Moreover, we estimate that these effects are larger for the two merging firms—Miller and Coors—than for the other brewers, as would be expected if the main motivation is to internalize the beneficial effects of rival advertising. We also find some supporting evidence that rival advertising has a weakly positive effect on a given brewer's sales. Given all of this, we believe that the notion of positive spillovers is the most likely explanation for our findings.

This paper also contributes to the Industrial Organization literature on mergers. This literature is large, consisting of both merger simulations and analyses of consummated mergers.<sup>6</sup> However, the emphasis in both parts of the literature has overwhelmingly been on price effects. While this is understandable from the perspective of economists concerned about welfare and antitrust law, merging firms often have a number of strategic instruments at their disposal with which to maximize profits, such as quality or the variety of products offered. Unfortunately, as noted by [Farrell et al. \(2009\)](#), the IO literature has little to say about the non-price effects of mergers.<sup>7</sup> This is an important omission since, in industries where non-price competition is an important strategic variable, mergers may well affect outcomes—and therefore, indirectly, welfare—other than prices or profitability. The brewing industry is, in fact, an important setting where firms compete fiercely for market share by deploying their advertising budgets. By showing the effect of concentration on advertising in an industry where advertising competition is economically very important, we extend our understanding of the economic effects of mergers.

To summarize, this paper makes three main contributions. First, we help to resolve sharp disagreements in the theoretical literature on the relationship between competition and advertising, by presenting a cleanly identified empirical study that establishes the causal effect of market structure on advertising. Second, we contribute to a recent literature that finds positive spillovers in advertising, by presenting evidence that firms are aware of this phenomenon and that they reduce advertising in competitive markets. Third, we add to the literature on the effects of mergers, which is dominated by studies of price effects, by

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<sup>6</sup>See [Ashenfelter et al. \(2014a\)](#) for a survey.

<sup>7</sup>A number of recent papers have acknowledged that firms can change more than just prices in response to increased market power, and some work now exists that endogenizes product choice or variety. See [Draganska et al. \(2009\)](#) and [Mazzeo et al. \(2014\)](#) for two examples and also for a discussion of related papers.

showing that non-price effects can be important as well, which is especially consequential in a setting such as ours where non-price competition is a key strategic variable.

This paper proceeds as follows. In Section 2 we provide background on the brewing industry and the merger between Miller and Coors. In Section 3 we present the data used in our study. We discuss our identification strategy in Section 4. In Section 5 we present our empirical findings. In Section 6 we discuss the implications of these results in the context of the previous literature, and we conclude in Section 7.

## 2 Industry Background and the Miller-Coors Joint Venture

The beer industry is an excellent setting to analyze our question of interest, for at least three reasons. First, beer advertising is economically very important and advertising forms an important strategic variable for brewers. Advertising-to-sales ratios are very high in the brewing industry; Tremblay and Tremblay (2005) estimate that this ratio is 8.7, which is considerably more than in other industries with high advertising propensities, such as pharmaceuticals and automobiles. Advertising expenditures by the beer industry were over 800 million dollars in each year of our data, to be described in the next section.<sup>8</sup>

The second reason has to do with the nature of consumer preferences in this industry. As is commonly known, there are strong and well-established regional preferences over beer brands in the United States. While Anheuser-Busch is the clear market leader with its Budweiser and associated brands, its dominance is particularly apparent in the South, and in the region around St. Louis where it operates its largest brewery. By contrast, Coors is the market leader in many markets in the West of the country, particularly California, and Colorado, where its primary brewery is located. Miller's largest brewery is located in Milwaukee and Miller brands are dominant in the Upper Midwest. These regional preferences imply that the merger had very different predicted—and actual—effects in different markets, thus providing considerable variation in market concentration for us to identify our main effects.

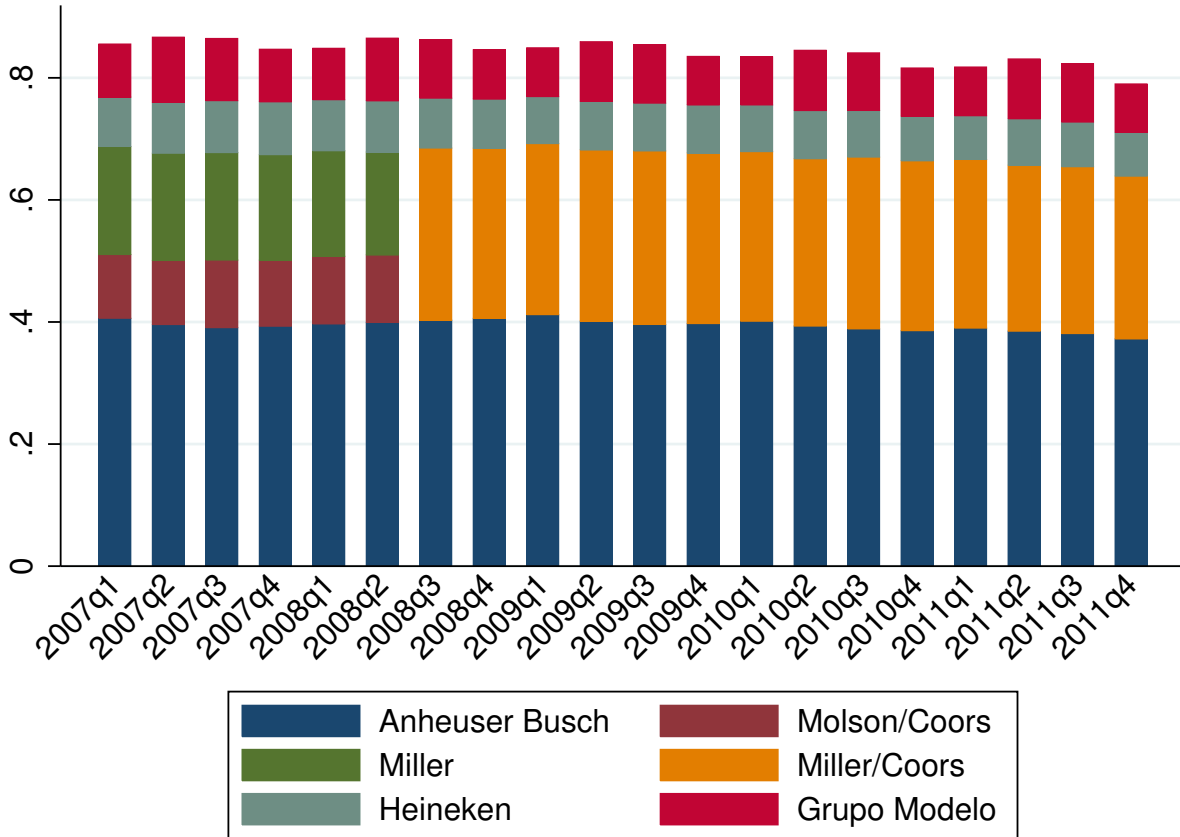
The third reason that we believe this setting is favorable is the nature of the merger itself. Prior to the merger, the beer industry was already very concentrated, with a handful of firms accounting for the vast majority of beer sales in the country.<sup>9</sup> However, the Miller-

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<sup>8</sup>As we will describe, our data cover a subset of media markets. Total beer advertising in this period exceeded 1 billion dollars annually, according to various industry estimates; see, for example, <https://www.cspinet.org/booze/FactSheets/AlcAdExp.pdf>.

<sup>9</sup>This is despite the recent increase in sales of domestic craft and imported beers. These beers have grown

Figure 1: Quarterly Concentration Ratios: 2007-2011



*Notes:* The figure plots quarterly revenue shares for the SAB Miller, Molson-Coors, and their three largest rivals based on supermarket sales across 46 geographic markets.

Coors merger caused national concentration to jump dramatically in 2008. Figure 1 presents quarterly revenue shares of what were the five largest firms in the industry prior to the Miller/Coors merger, and shows the rise in concentration caused by the merger in the third quarter of 2008. Clearly, the merger led to a large and discontinuous jump in national concentration. In Section 5 we show that this increase in concentration varied substantially across regional markets. Specifically, the merger caused large increases in concentration in regions where both Miller and Coors had significant market shares prior to the merger—while causing much smaller increases in concentration in others.

Moreover, there are compelling reasons to view the merger as being exogenous to the advertising market, due to the reasons for its approval. Miller and Coors announced their joint venture on October 9, 2007, and at that time were the second and third largest firms

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rapidly in some parts of the country, especially the West and the Northeast, but remain relatively small in comparison to the big three brewers. See Tremblay et al. (2011) for details.

in the industry.<sup>10</sup> Importantly for our purposes, there is no *ex ante* evidence that the joint venture was proposed because of expectations about changes in concentration, price growth, or the market for advertising. Instead, the merger was proposed, and ultimately approved, mainly because it was expected to result in efficiencies related to shipping and distribution. Because beer is primarily water, it is bulky and heavy and expensive to ship long distances. Prior to the merger, Coors beers were primarily produced in Golden, CO, with some production in a smaller, secondary facility in Elkton, VA. Miller was produced in six plants more evenly located across the United States. The merger was expected to reduce shipping costs significantly, by moving the production of Coors brands into Miller plants and closer to retail locations (Heyer et al. (2009)). For these reasons, the Department of Justice approved the merger after a lengthy review on June 5, 2008.

In summary, we believe that the beer industry, especially during the period of the Miller–Coors merger, provides an excellent context around which to examine the relationship between advertising and market structure. This is because of the sharp increase in average concentration, with widely varying effects across markets, driven by a merger that can reasonably be considered exogenous to the advertising market, and in an industry where advertising is an important strategic variable whose value can be measured accurately in each local market.

### 3 Data

We use data from two main sources. We obtain data on beer sales by month and geographic market from Information Resources Incorporated (IRI). IRI sells data from three main channels of distribution: supermarkets, mass retailers, and drugstores. For each retail channel, IRI collects sales and volume information by UPC code from barcode scanners for a sample of stores, and then uses proprietary weights to form estimates of regional sales and volume by UPC code and week. This paper uses data covering supermarkets. Among the retail outlets for which data is available, supermarkets cover the largest share of beer sales.<sup>11</sup> We dropped markets in states that have restrictions against beer sales in supermarkets, including those states that only permit low-alcohol beer to be sold in supermarkets.

We use Kantar media’s Ad\$ponder database to obtain information on advertising by

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<sup>10</sup>Their union is described as a joint venture, rather than a merger, because it only applied to the U.S. market. Miller and Coors remain separate companies outside of the U.S. For our purposes, the joint venture is identical to a merger, since the two firms combined production, advertising and all other operations within the U.S. The Justice Department routinely referred to the joint venture as a merger.

<sup>11</sup>In 2011 it was estimated that supermarkets cover 23 percent of off-premise sales. Mass retailers cover 6.3 percent and drug stores cover 3 percent (McClain, 2012).



brewers. Kantar monitors advertising occurrences and expenditures for most brands in all major industries, and across a wide range of media: national and local television, newspapers, magazines and radio, as well as outdoor advertising (primarily on billboards). We queried the Kantar database to obtain monthly advertising expenditures by all major beer brands in each of these media for the years 2007–2011. We then summed up expenditures by manufacturer, and then further summed these across local media, to obtain a monthly database of local advertising for 96 major media markets.<sup>12</sup> These media markets are defined by Kantar, but generally follow the Designated Market Area (DMA) definitions used by Nielsen.

We then merged the Kantar and IRI databases to obtain a final database containing local advertising and market shares, for each of the three major beer manufacturers: Anheuser-Busch, Miller, and Coors as well as Heineken, and a composite category that contains advertising spending of all other firms. We focus on these four firms because they account for over 75% of sales and over 80% of advertising in our data. Moreover, these are the only firms with significant sales in all regions of the country; the remaining brands are mostly small or regional players and are unlikely to significantly affect the advertising market.<sup>13</sup> The final dataset contains monthly advertising data, by manufacturer, for 46 markets, across 26 states, for the years 2007–2011. The regression sample is a balanced panel with 13800 observations, which correspond to every combination of 46 markets, 5 manufacturers and 60 year-months.<sup>14</sup>

Summary statistics on this regression sample are provided in Table 1. Average advertising expenditures for a manufacturer-month are approximately \$44,000, which varies widely across both manufacturers and markets. The mean Herfindahl-Hirschmann Index is 0.31, indicating a concentrated industry.<sup>15</sup> The predicted increase in the HHI following the merger, which we computed using the pre-merger market shares of Miller and Coors, varies between 0.8 and 9 percentage points. Table 1 also presents statistics on market-level economic indicators which we will use as controls in certain specifications.

We emphasize the large variation in advertising intensity across markets, which helps identify our results. In Figure 2 we present a scatter plot of aggregate advertising in the year 2008, summed across all manufacturers, against market sizes. Note that both axes are shown on a log scale. The figure shows that advertising expenditures are closely linked to

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<sup>12</sup>National media expenditures on beer advertising are economically very important and significantly larger than expenditures on local media. However, there is no way to exploit national advertising given our research design.

<sup>13</sup>The results are similar if we focus only on the top four firms, or even drop Heineken and restrict the sample to the Big 3 firms.

<sup>14</sup>Technically there are 4 manufacturers in our sample along with a composite comprising all other firms.

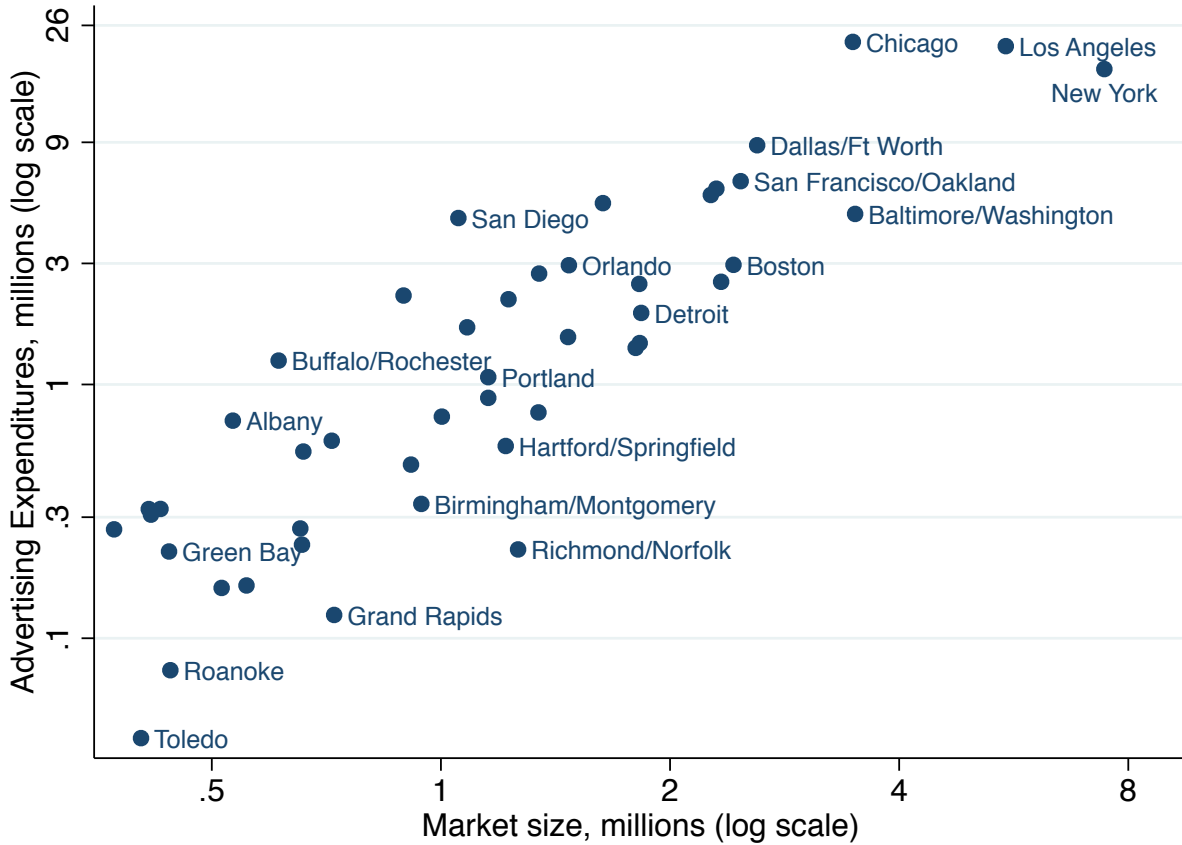
<sup>15</sup>The Herfindahl-Hirschmann Index is the sum of the firms squared revenue shares. Here, we measure it on a scale from zero to one.

Table 1: Summary Statistics: Regression Sample

	Mean	SD	Min.	Max.
Ad Expenditures (1000s)	43.6	111.4	0	1497.9
Ad Expenditures per Thousand Capita	19.9	35.5	0	483.8
HHI	0.306	0.080	0.139	0.514
Predicted change in HHI	0.036	0.014	0.008	0.089
Unemployment Rate	0.075	0.026	0.025	0.169
Average Weekly Earnings	886.9	142.2	652.8	1555.4

Note: N=13800. An observation is a combination of market, year, month and manufacturer.

Figure 2: Scatter Plot of Market sizes and Advertising Expenditures, 2008



Notes: Market sizes from IRI, based on Nielsen media markets. Advertising Expenditures from Kantar, representing aggregate local advertising across all beer brands.

population sizes, but that brewers vary their advertising expenditures widely across markets, both in absolute terms, and on a per-capita basis. For example, Chicago has the highest aggregate advertising expenditures, although its population is about half that of New York.

We note that there is considerable volatility in advertising spending over time, even

within a given firm and market. This conforms to a well-established fact about the nature of advertising. A large number of prior studies have found evidence of “pulsing” whereby firms frequently switch advertising on and off.<sup>16</sup> Such observations have been made in a wide range of industries and it appears that beer advertising is no exception. As a result, there are many observations where a firm has zero monthly advertising in a market in our data. Although this is not problematic for our identification strategy, such behaviour adds noise to our estimates and makes it harder to establish statistically significant effects.

While pulsing is commonly observed in other industries, it is helpful to think about the reasons that firms may engage in such behaviour in the beer industry in particular, and how this should affect our empirical strategy. Beer consumption is strongly seasonal, peaking in July in every market in our sample, and reaching its lowest point in February. As a result, beer advertising is also seasonal, although advertising is also affected by sporting events and economic conditions. However, these seasonal trends exhibit considerable variation across the country. The average jump in beer consumption between February and July is around 20% in warmer cities such as Phoenix, Miami and Orlando, but over 80% in colder cities such as Milwaukee, Buffalo and New York.

Thus, the volatile nature of beer advertising results from different seasonal trends in different markets. Moreover, these trends are not restricted to seasons within a year, but can also change from year to year; a key reason for this in our study is the deep economic recession, which occurred in the middle of our sample period, and which affected various parts of the country with different intensities and at different times. As a result, it is important to control for market-specific trends in our study, or else interactions of markets with year-month indicators. We provide more details in Section 5.

## 4 Identification Strategy

We now discuss our strategy for identifying the causal effect of market concentration on the propensity of firms to advertise. Our approach exploits the effects of the national merger between Miller and Coors on local advertising. This approach has been used in a number of recent studies of mergers, including [Hastings and Gilbert \(2005\)](#), [Dafny et al. \(2015\)](#), and [Ashenfelter et al. \(2014b\)](#). In particular, our analysis closely parallels that of [Dafny et al. \(2015\)](#), who use variation in how a merger of two large health insurance companies increased concentration across local markets to study how concentration influences insurance premiums. We believe this research design is particularly well suited for analyzing mergers

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<sup>16</sup>For examples and possible explanations, see [Dubé et al. \(2005\)](#), [Doganoglu and Klapper \(2006\)](#) and [Freimer and Horsky \(2012\)](#).

in the beer industry due to the unique nature of consumer preferences over beer brands. As we had discussed in Section 2, there are strong and well-established regional preferences over beer brands in the United States. Each of the three major manufacturers has a set of markets in which they are clearly dominant.

As a result, the national merger led to very different changes in concentration in different markets, in a manner that was highly predictable at the time of the merger. Indeed, there are generally only small differences between *predicted* changes in concentration—based on the market shares of Miller and Coors immediately prior to the merger—and *actual* changes in concentration, which we computed for the period following the merger. In other words, the merger can reasonably be viewed as generating an exogenous change to concentration, and one that varied widely across different markets.

Nevertheless, we acknowledge that endogeneity may still be a concern for our study. An important reason for this may be reverse causality; in fact, the prior literature has explicitly considered a direct link from advertising to market concentration, specifically in the beer industry. For example, Greer (1971) and Tremblay and Tremblay (1995) argue that advertising has contributed to increased concentration among brewers. Additionally, George (2009) shows that the rise of national television markets may have helped the large national brands to exploit economies of scale in advertising at the expense of small, local brewers. Moreover, a high level of advertising raises sunk costs for incumbent firms, making it harder for new firms to enter, or for established firms to enter new markets (Sutton, 1991).

However, the design of our study avoids most of these endogeneity concerns for a number of reasons. First, there is no reason to believe that the merging firms in this particular case were motivated by the advertising market. As discussed in Section 2, the main reason the Department of Justice approved the merger—which would otherwise have been controversial, given that it combined the second and third largest firms in the industry—was that it was expected to increase efficiency by sharply reducing shipping costs. In their lengthy review of the various arguments surrounding the merger, Heyer et al. (2009) do not mention the advertising market at all.

Second, as we have already emphasized, our study examines *local* changes in advertising expenditures driven by the *national* merger. In this context, it is unlikely that unobserved factors affecting advertising at the level of individual local markets are correlated with local changes in concentration that are driven by a merger in the national market.

Finally, we will present results using both OLS and Instrumental Variable methods, in order to minimize any concerns about the endogeneity of the market concentration measure. We will use the predicted change in the HHI in each market as an instrument for the actual HHI. A similar strategy was employed by Dafny et al. (2015) and Ashenfelter et al. (2014b).

In summary, advertising may well have incremental effects on market concentration over time. However, by studying the differential effects of a national merger on local markets, we examine how a one-time, discontinuous change in concentration affected the propensity of firms to advertise. Moreover, we can use instrumental variables—derived from the predicted effects of the merger, which vary considerably based on regional beer preferences—to account for any residual endogeneity.

## 5 Regressions to Explain Advertising Expenditures

### 5.1 OLS Estimates of the Relationship between Advertising and Concentration

We start by estimating OLS panel regressions relating advertising spending per capita to market concentration. We exploit the panel-structure of our data and include market fixed-effects in each specification, so that the relationship is identified by changes in concentration within each designated market area in our data. Specifically, we estimate versions of the following equation using OLS:

$$Y_{jnt} = \beta HHI_{nt} + \alpha_{jn} + \gamma_{jt} + \theta_{nt} + \epsilon_{jnt} \quad (1)$$

Here,  $Y_{jnt}$  is firm  $j$ 's advertising spending per thousand capita in market  $m$  during month  $t$ .  $\alpha_{jn}$  is a full set of dummy variables for each designated market area/firm combination. Including  $\alpha_{jn}$  allows the typical amount of monthly advertising to vary freely across regions and firms. For example, it allows Anheuser Busch/Inbev to have persistently high advertising in Saint Louis and SAB Miller to have persistently high advertising in Chicago.  $\gamma_{jt}$  is a set of dummy variables for each year/month/firm combination. These dummies capture firm-specific changes in advertising common across designated market areas. This allows the 2008-09 recession, for example, to have a different effect on Anheuser Busch/Inbev advertising spending across all markets than on Coors advertising spending.

The key independent variable in Equation 1 is  $HHI_{nt}$ , which is the sum of squared revenue shares across firms in market  $n$  during time period  $t$ . We expand on Equation 1 by adding potential confounders related to local economic conditions that vary over time within each market and may predict advertising, including local unemployment rates and log earnings. We also include  $\theta_{nt}$  which represents a set of dummy variables for each census region/year/month combination. As discussed in Section 3 it is important to include market/time interactions to account for the differing effects of seasons and economic conditions

across markets. But including these will make it impossible to identify our main variable of interest—the HHI variable—which also varies at the market/month level. Thus, we include time effects that are allowed to vary across census regions, which are more broadly defined, but which are likely to have common effects of seasons and the economic recession for constituent cities.<sup>17</sup> Throughout the paper, when conducting inference, we allow the variance of a firms’ residual advertising to differ across markets, correlation in unobserved advertising across firms within a market, and arbitrary serial dependence in residual advertising within a market by clustering our standard errors at the designated market area level (Bertrand et al., 2004).

Table 2 presents the results of estimating different specifications of equation 1. Column 1 estimates the most parsimonious version of the model. This specification includes only market-fixed effects and common time effects, both constrained to be the same across different firms. The results indicate a positive relationship between market concentration and advertising. Column 2 allows the time and market fixed-effects to vary freely by brewer and adds two potential confounders that vary over time within a market and may predict advertising spending: local unemployment rates and (log) earnings. The point estimate is essentially unchanged, indicating that the potential confounders are conditionally uncorrelated with market concentration. Column 3 adds census region/date fixed-effects. Doing so leads the positive relationship between product market concentration and advertising spending to remain stable, while the magnitude of the point estimates becomes larger and the estimates become slightly more precise. This implies that the region/date effects explain some of the variation in advertising spending.

While our estimates of equation 1 are fairly stable across specifications, each set of estimates may be biased because of reverse causality or because of correlation between within-market changes in concentration and omitted determinants of advertising. For this reason, we now move on to estimates of the effect of concentration on advertising that use only the variation in concentration resulting from the Miller/Coors merger, which was motivated for reasons plausibly exogenous to unobservable determinants of advertising spending. Before presenting these results, we first verify a strong relationship between how the merger was anticipated to increase concentration across markets and how concentration actually changed; *i.e.* the “first-stage”. We next present direct estimates of the effect of the merger on advertising; *i.e.* the “reduced form”. We then combine the first-stage relationship between the merger and concentration, and the direct effect of the merger on advertising, to construct instrumental variables estimates of the effect of concentration on advertising.

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<sup>17</sup>We attempted to add a separate time trend for each local media market in our data, but there was not enough independent variation in our variables of interest to obtain precise estimates.

Table 2: OLS Estimates of Advertising on Concentration

	(1)	(2)	(3)
HHI	68.50 <sup>c</sup> (38.67)	72.86 <sup>c</sup> (38.25)	87.11 <sup>b</sup> (37.13)
Firm*Market Effects	No	Yes	Yes
Firm*Date Effects	No	Yes	Yes
Covariates	No	Yes	Yes
Census Region*Date Effects	No	No	Yes
R <sup>2</sup>	0.302	0.641	0.662
Obs	13800	13800	13800

Notes: <sup>c</sup>  $p < 0.1$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$ . All regressions contain market and year\*month fixed effects. Standard errors clustered by market are in parentheses.

## 5.2 The Effect of the Miller-Coors Merger on Concentration

Nationally, Miller and Coors were the second and third largest firms in the United States prior to their joint venture. While both firms' products were sold essentially everywhere in the United States, there were substantial differences in the firms' pre-merger market shares across the 46 advertising regions in our data. This variation is important for our identification strategy, as it allows us to control for any firm-specific unobservable factors that had a common effect on per-capita advertising across local markets. Our framework implicitly does this by comparing changes in a firm's per-capita advertising across markets that were differentially affected by the merger.

In this subsection we document the extent to which concentration increased just after the merger across local markets, and the ability of pre-merger market shares to explain any increases in local market concentration that happened with the merger.<sup>18</sup> Following [Dafny et al. \(2015\)](#) and [Ashenfelter et al. \(2014b\)](#), for each market  $m$  in the data we calculate the simulated increase in concentration,  $sim\Delta HHI_m$ , as the increase in concentration that would have been predicted using market shares calculated just before the merger.<sup>19</sup> Specifically,

$$sim\Delta HHI_m = 2 * PreMergerMillerShare_m * PreMergerCoorsShare_m$$

We use the interaction of  $sim\Delta HHI_m$  and a post-merger dummy as an instrumental variable for  $HHI_{mt}$  in equation 1. We provide evidence of the ability of the merger to predict

<sup>18</sup>These results confirm the strength of the relationship between predicted and actual changes in concentration documented in [Ashenfelter et al. \(2014b\)](#) on a slightly different set of geographic markets.

<sup>19</sup>We calculate pre-merger shares using sales data from the 5 months immediately preceding the merger's approval date.

actual changes in market concentration by fitting the following equation to the data using OLS:

$$HHI_{nt} = \sum_{\tau=2}^{\tau=60} \beta_{\tau} \text{sim}\Delta HHI_m * 1(t = \tau) + \alpha_{jn} + \gamma_{jt} + \epsilon_{jnt} \quad (2)$$

where  $\text{sim}\Delta HHI_m$  is interacted with a set of dummies for each time period in the dataset (except January of 2007, the omitted category) and the other variables are defined as before. We produce an event-study graph, in Figure 3, by plotting the estimated coefficients  $\beta_{\tau}$  with respect to calendar dates. The graph allows us to explore whether there were pre-existing trends in market concentration that were correlated with how the merger was predicted to impact local markets, which would be evidence against the exogeneity of the merger. We estimate the extent to which pre-merger concentration growth was systematically related to  $\text{sim}\Delta HHI$  by regressing the coefficients  $\beta_{\tau}$  from periods prior to the merger on a linear trend. The slope coefficient in this regression is the implied pre-trend, which is presented along with its standard error in the event-study figure.<sup>20</sup> The graph also allows us to determine whether any increase in concentration was persistent through our sample period, which could in principle help us determine the relevant time period in which the merger may have influenced advertising.<sup>21</sup>

Three key facts stand out about Figure 3. First, there is no evidence of a relationship between local concentration growth and how the merger affected local markets *prior* to the merger. This gives us confidence that the merger itself was not a response to underlying factors that were creating changes in concentration within the designated market areas in our sample. Second, the merger had a large impact on concentration just after it was consummated, exactly as would be expected. Third, the impact of the merger on concentration was persistent—entry or diversion of sales to rival firms’ brands did not reduce the combined Miller/Coors market share significantly over the two and a half years following the merger.

We next estimate a more parsimonious version of equation 2 that includes a single indicator for the post-merger time period interacted with the predicted increase in concentration. The post-merger indicator is coded as zero prior to the date the Department of Justice approved the merger—June of 2008—and as one afterwards.<sup>22</sup> The results are pre-

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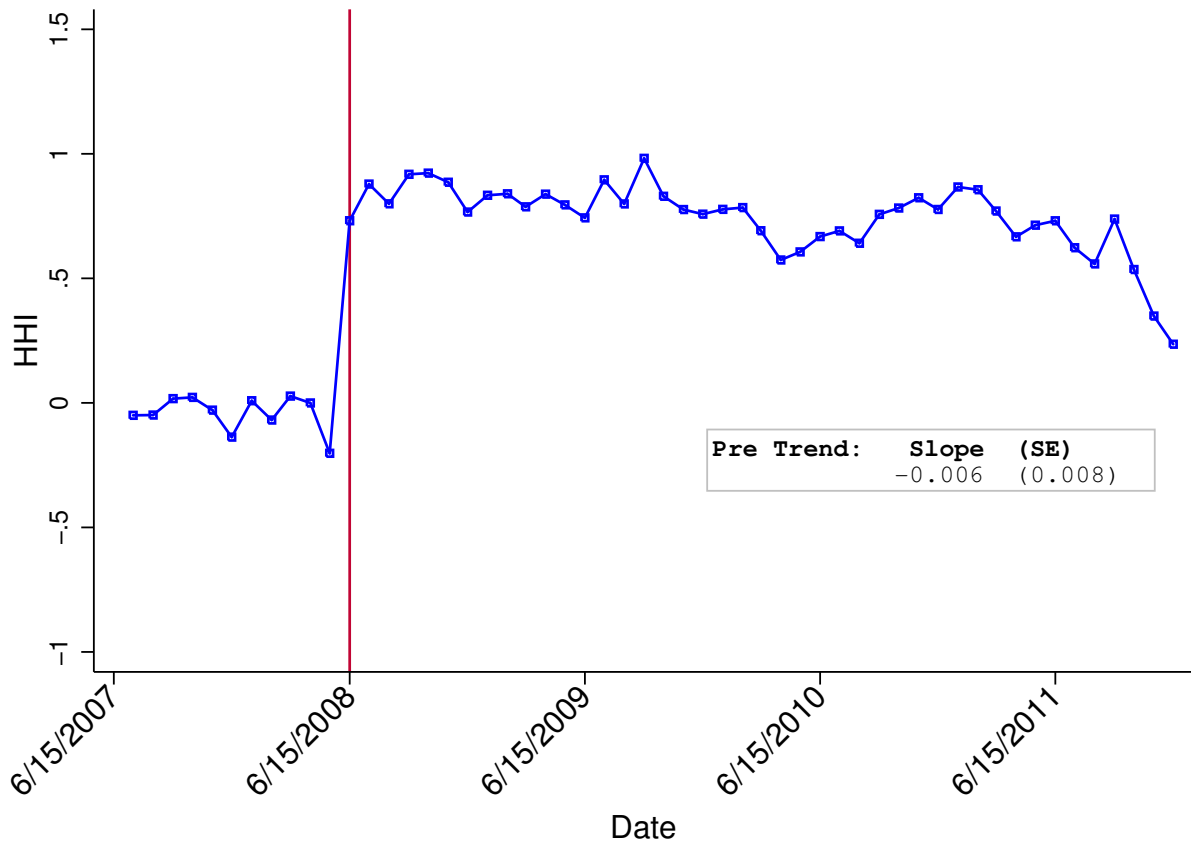
<sup>20</sup>The standard error accounts for the fact that the dependent variable in this regression is itself an estimate. We calculated the standard error by applying the delta method to the OLS estimate of the slope parameter from the regression of the event dummies on the time trend.

<sup>21</sup>Even though our main regressors vary only by region and time, we estimated equation 2 on firm/market/monthly data so that constrained versions of it can be interpreted as a first-stage for our IV regressions that estimate the effect of concentration on advertising.

<sup>22</sup>The merger was approved by the Department of Justice on June 30, so we code the post-merger indicator as zero for that month. All results in the paper were robust to dropping a window of data spanning two months before and two months after the month the merger was approved.



Figure 3: Estimated Coefficients from Regression of HHI on Simulated Change in HHI



Notes: HHI was regressed on year-month effects, region-firm effects, and interactions between  $sim\Delta HHI$  and year-month dummies. The figure plots estimated coefficients on the interactions between  $sim\Delta HHI$  and year-month dummies.

Table 3: Effect of Merger on Market Concentration

	(1)	(2)	(3)
<i>sim</i> $\Delta$ <i>HHI</i> * <i>Post</i>	0.77 <sup>a</sup> (0.12)	0.78 <sup>a</sup> (0.12)	1.02 <sup>a</sup> (0.09)
Firm*Market Effects	No	Yes	Yes
Firm*Date Effects	No	Yes	Yes
Covariates	No	Yes	Yes
Census Region*Date Effects	No	No	Yes
R <sup>2</sup>	0.980	0.981	0.987
Obs	13800	13800	13800

Notes: <sup>c</sup>  $p < 0.1$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$ . All regressions contain market and year\*month fixed effects. Standard errors clustered by market are in parentheses.

sented in Table 3. We start by including only market effects and time effects, in Column 1. A one-point predicted increase in concentration leads to a 0.77 point increase in actual concentration. Column 2 shows that results are unchanged when we allow the market and time effects to vary by firm, and add local unemployment rates and log earnings. Column 3 shows that the coefficient approaches 1 when we add census-region/date fixed-effects, which also supports adding these to our main regression specification. Across specifications, the effect of the merger on concentration is statistically significant at the .01 level.

### 5.3 The Effect of the Miller-Coors Merger on Advertising

We estimate the effect of increases in concentration caused by the Miller-Coors merger on advertising by fitting the following equation to the data using OLS:

$$Y_{jnt} = \beta_1 \text{sim}\Delta\text{HHI}_m * \text{Post}_t + \alpha_{jn} + \gamma_{jt} + \theta_{nt} + \epsilon_{jnt} \quad (3)$$

Table 4 presents the results of estimating equation 3 for the same specifications considered in the first stage regressions described in the preceding subsection. Column 1 presents our baseline specification. While the point estimate implies a positive relationship between how the Miller/Coors merger was anticipated to increase local market concentration and advertising spending per capita, the result is insignificant at conventional significance levels. In the average market, the merger was anticipated to raise concentration by 0.036 points (where the HHI is scaled to be between zero and one). This translates into a \$2.9 (.036\*81.25) increase in monthly advertising spending per thousand capita. Relative to the average pre-merger value of monthly advertising spending, this is a 12% increase in advertising spending

Table 4: Effect of Merger on Advertising

	(1)	(2)	(3)
$sim\Delta HHI * Post$	81.25 (59.72)	85.02 (66.11)	192.95 <sup>b</sup> (84.66)
Firm*Market Effects	No	Yes	Yes
Firm*Date Effects	No	Yes	Yes
Covariates	No	Yes	Yes
Census Region*Date Effects	No	No	Yes
R <sup>2</sup>	0.302	0.641	0.662
Obs	13800	13800	13800

Notes: <sup>c</sup>  $p < 0.1$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$ . All regressions contain market and year\*month fixed effects. Standard errors clustered by market are in parentheses.

per capita.

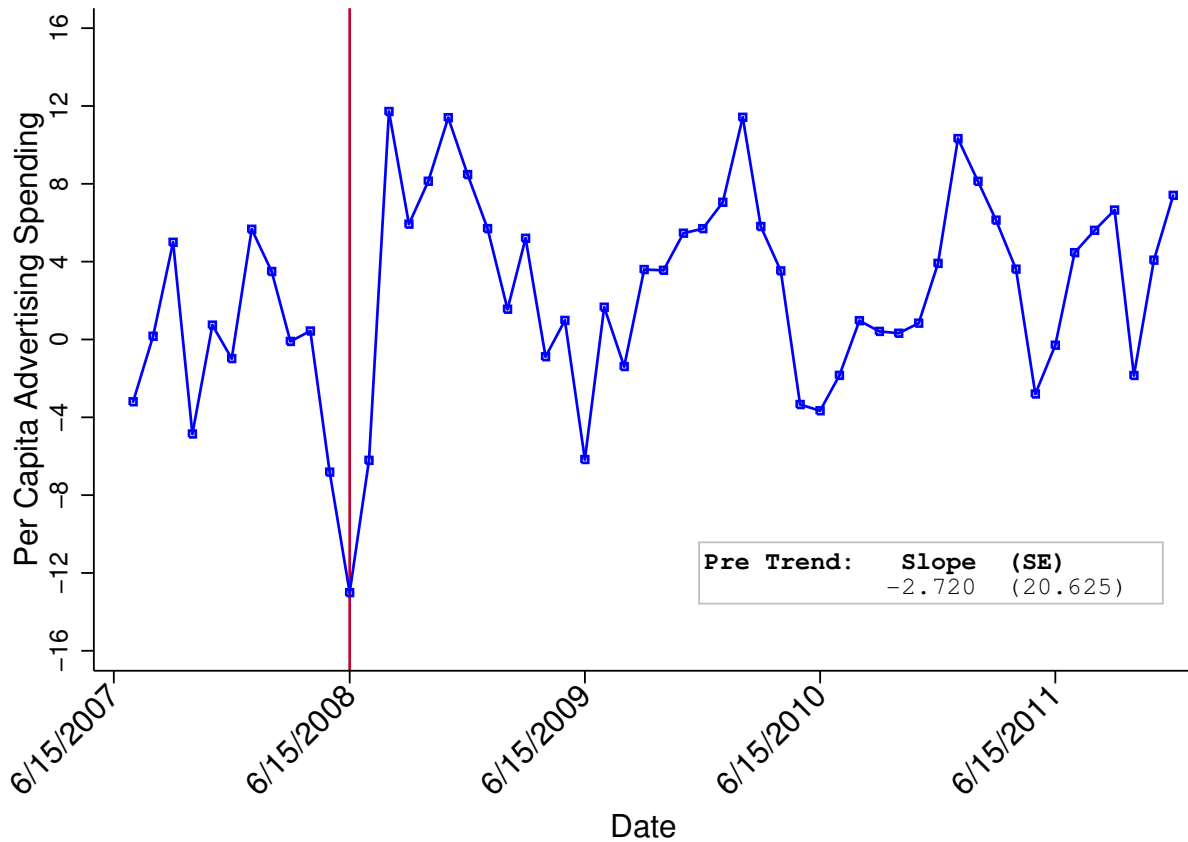
The key threat to our research design is the presence of any unobservable determinants of advertising that vary over time within a market and are correlated with how the merger was anticipated to raise concentration. For example, the recent recession had a greater impact on some regions than on others, and this could bias our results if there is somehow a systematic relationship between how the merger increased concentration and changes in advertising related to local economic conditions. Column 2 of Table 4 includes local unemployment rates and (log) earnings, which are meant to capture time varying local economic conditions. Here, the results are stable because there turns out to be no meaningful correlation between the change in concentration caused by the merger and these covariates. In contrast, column 3 shows that adding census region/date effects increases the main coefficient of interest substantially and also makes it significant at the .05 level. This is likely due to the fact that the importance of seasonality on beer consumption, and thus on advertising, varies across regions in the United States.

The pattern of estimates in Table 4 suggests that our estimates of how the merger increased advertising is due to the sharp increase in concentration caused by the Miller/Coors joint venture and how it impacted advertising. Furthermore, there is no evidence of underlying regional trends in concentration related to how the merger was expected to increase concentration. However, we examine the timing of when the merger changed advertising spending more directly and conduct a second event-study by estimating a more flexible version of equation 3, analogous to the specification in Equation 2. Specifically, we use the same set of independent variables as in equation 2 while using per-capita advertising spending as

the dependent variable.<sup>23</sup>

The results are in figure 4. While there is some volatility in the event study graph—likely related to the underlying volatility in advertising that we discussed in Section 3—there is no clear evidence of any underlying, pre-existing regional trends in advertising that would call into question our identification strategy. Further, the increase in advertising related to the increase in concentration is persistent and visually apparent in the event study.

Figure 4: Estimated Coefficients from Regression of Per Capita Advertising on Simulated Change in HHI



Notes: Per capita advertising spending was regressed on firm-year-month effects, market-firm effects, and interactions between  $sim\Delta HHI$  and year-month dummies. The figure plots estimated coefficients on the interactions between  $sim\Delta HHI$  and year-month dummies times the average increase in concentration across all geographic markets (0.036).

<sup>23</sup>These variables include year-month effects that are allowed to vary by firm that control for (firm-specific) seasonality common to all markets, market-firm effects, and interactions between year/month dummies and the predicted increase in concentration.

Table 5: The Impact of Local Market Concentration on Advertising Spending

	Dep Var=HHI	Dep Var=Ad Spending per Capita		
	First Stage	Reduced Form	2SLS	OLS
	(1)	(2)	(3)	(4)
<i>sim</i> $\Delta$ <i>HHI</i> * <i>Post</i>	1.02 <sup>a</sup> (0.09)	192.95 <sup>b</sup> (84.66)		
HHI			188.46 <sup>b</sup> (87.53)	87.11 <sup>b</sup> (37.13)
R <sup>2</sup>	0.987	0.662	-	0.662
Obs	13800	13800	13800	13800

Notes: <sup>c</sup>  $p < 0.1$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$ . All regressions contain region\*manufacturer and year\*month\*manufacturer fixed-effects, and other covariates. Standard errors clustered by market are in parentheses.

## 5.4 The Effect of Market Concentration on Advertising Spending: IV Estimates

Table 5 presents the first stage, reduced form, and two-stage least squares instrumental variable results. We also present the OLS estimates of the effect of concentration on advertising for comparison. Each specification includes census region/date fixed-effects, local unemployment rates and log earnings. The coefficient on concentration from the specification estimated by 2SLS is 188.46. Because we have one endogenous regressor ( $HHI_{nt}$ ) and one instrument ( $Post_t * sim\Delta HHI_n$ ), the two-stage least squares estimate is simply the ratio of the reduced form and first-stage estimates.<sup>24</sup>

The point estimates from the IV specification indicate a stronger relationship between market concentration and advertising than the simple OLS results, but the 95% confidence interval is wide and overlaps with the confidence interval for the OLS estimates. That said, we believe the IV results are consistent, for two reasons. First, we have supported the assumption that the merger is an exogenous shifter of local market concentration by showing, in Figure 3, that the variation in concentration caused by the Miller/Coors merger was not systematically related to pre-existing trends in local market concentration. Second, we showed, in Figure 4, that pre-existing trends in advertising were unrelated to the change in local market concentration caused by the merger.

<sup>24</sup>While not reported in the text, two stage least squares estimates for the specifications without various sets of covariates can be computed by taking the ratio of the reduced form estimate and the first stage estimates for a particular specification in tables 3 and 4.

Table 6: Effect of Concentration on Advertising: IV Results Estimated Separately For Three Largest Firms

	Molson Coors	SAB Miller	Anheuser Busch	Heineken	Other
HHI	221.46 <sup>b</sup> (112.68)	233.53 <sup>a</sup> (86.67)	130.02 (94.40)	217.92 (159.31)	139.40 <sup>c</sup> (82.58)
Obs	2760	2760	2760	2760	2760

Notes: <sup>c</sup>  $p < 0.1$ , <sup>b</sup>  $p < 0.05$ , <sup>a</sup>  $p < 0.01$ . All regressions contain region\*manufacturer and year\*month\*manufacturer fixed-effects, and other covariates. Standard errors clustered by market are in parentheses.

We next estimated the model separately for each of the five manufacturer groups. The results are in Table 6. The results are clear: the point estimates of the effect of concentration on advertising are substantially larger for Miller and Coors than for their largest and closest rival, Anheuser-Busch/Inbev. The estimates for Miller and Coors are also the only ones that are statistically significant at the .05 level. This suggests that the biggest effects of the merger on advertising behaviour for the merging firms themselves, and less so for their rivals.

The point estimate from the IV specification in Table 5 implies that a 100-point increase in the HHI increases advertising by around 6% from its average value.<sup>25</sup> However, the merger itself increased the HHI by 360 points in the average market, implying that the total increase in advertising from the merger was around 20%. This is a large number, but is primarily driven by the size of the merger itself, which raised concentration substantially in a number of markets. As we will discuss in the next Section, this number does not appear large when compared with the best available estimate thus far of how much advertising would rise under complete coordination by rival firms.

## 6 Interpretation and Discussion

We have shown that beer advertising spending per capita increases with market concentration within regional advertising markets, that the merger between Miller and Coors substantially increased market concentration largely as anticipated, and that changes in concentration induced by the merger lead to increases in advertising. In this section we explore the ability of different theories to explain precisely how the merger changed advertising incentives. Specifically, we focus on two theories. First, we explore whether advertising is associated with

<sup>25</sup>This refers to the conventional 0 to 10,000 point scale used by antitrust agencies. We obtain this number by noting that a one percentage point increase in the HHI raises advertising by \$1.9 per thousand capita, which is about 6% of the average advertising spending for a manufacturer-month of \$29,300.

“spillovers” onto rivals’ sales. If advertising spillovers are at play, after a merger firms can more fully internalize advertising externalities and will thus increase advertising spending. Second, we test the Dorfman-Steiner hypothesis that firms will advertise higher margin products more heavily.

We directly explored whether advertising spillovers are at play by regressing sales of firm  $i$  in market  $n$  during time period  $t$  on firm/market effects that allow firms’ sales to vary freely across geographic markets, firm specific time effects, census-region/date effects, the firm’s own advertising spending, and the sum of rivals’ advertising spending. The estimated model was:

$$\log Sales_{int} = \underset{(0.0013)}{0.0024} * \log Advertising_{int} + \underset{(0.0017)}{0.0024} * \log \sum_{j \neq i} Advertising_{jnt}$$

where standard errors clustered by market are in parentheses. We expressed the advertising variables in logs so that the coefficients would have a direct elasticity interpretation.

The results indicate that advertising has a positive and statistically significant effect on the sales of a manufacturer’s own brands, which is as expected, although the elasticity is small, at around 0.002. Perhaps more surprising is that the coefficient on rival advertising is also positive, with the same magnitude as a firm’s own advertising, although less precisely estimated. While these results are not conclusive, they do provide suggestive evidence that rival advertising can have a small positive—or at least non-negative—effect on sales, which is consistent with the notion of positive spillovers.

We next used how the merger shifted costs differently across local markets to test the Dorfman-Steiner hypothesis that firms will advertise higher margin products more heavily. As stated earlier, the Miller/Coors merger was approved because of Coors’s unusually high distribution costs. Coors products were only brewed in two plants prior to the merger—a very large plant in Golden, Colorado and a smaller facility in Elkton, Virginia. In contrast, Miller was brewed in six plants spread out across the United States. By merging, the combined firm could economize on shipping costs by rationalizing production across plants and reducing shipping distances, primarily by moving the production of Coors beer into the Miller plants. The Department of Justice approved the merger because of these shipping costs and, in related research it has been shown that reductions in shipping costs reduced prices, all else equal ([Ashenfelter et al., 2014b](#)).

We estimated the extent to which reductions in shipping costs increased advertising by estimating our basic reduced-form specification given in equation 3 for Coors brands after adding an additional regressor—the reduction in driving miles to the nearest brewery interacted with a post-merger dummy. Distance is measured in hundreds of driving miles,

so the interpretation of the coefficient is the impact of reducing shipping distances by one hundred miles on advertising per thousand capita. We found no direct evidence in support of the Dorfman-Steiner hypothesis. The point estimate implies that a one hundred mile reduction in shipping distances for Coors brand beers was associated with a small and very imprecisely estimated \$0.16 reduction in advertising spending per thousand capita, with an associated p-value of 0.81.

Thus, our results are not consistent with the Dorfman-Steiner model, but are consistent with the notion of positive spillovers. This also fits well with recent empirical research. Three recent studies provide compelling evidence, using large randomized trials, that advertising can have positive externalities on rivals, rather than pure business stealing effects. [Anderson and Simester \(2013\)](#) run a controlled experiment at a private label retailer in three product categories, and show that consumers exposed to rivals' advertising purchase 5% more items from the retailer. [Sahni \(2014\)](#) conducts a similar controlled experiment on the set of ads shown to visitors at a restaurant search website, and shows that there are positive spillovers among rival restaurants that serve the advertising restaurant's cuisine, although only when advertising intensity is relatively low. Finally, [Lewis and Nguyen \(2015\)](#) randomize advertising to millions of visitors to Yahoo! and establish that, while display ads increase searches for the advertised brands by 30–45%, they also increase searches for rival brands by 23%.

In addition, [Shapiro \(2013\)](#) finds evidence of positive spillovers from television advertising for antidepressant drugs. The identification relies on discontinuities created by the borders of media markets, rather than the controlled experiments described above. Shapiro comes closest to the question we investigate in this paper, as he then explores the predictions of these spillovers on advertiser behaviour, showing that if firms were to internalize the positive externalities that their advertising creates for rivals, aggregate advertising would be almost six times as high as in a competitive equilibrium. Thus, the large effects that we estimate in our study are entirely consistent with the simulations in [Shapiro \(2013\)](#).

We note that, while our results are most consistent with a theory of positive spillovers in advertising, such spillovers may not necessarily exist in all contexts, and may well depend on the specific definition of product categories. As discussed above, [Sahni \(2014\)](#) shows that these spillovers only exist for rival firms that produce a close substitute. Similarly, [Shapiro \(2013\)](#) restricts his sample to a set of narrowly defined drugs that are likely to be good substitutes for each other. In our context, the majority of beer sales are driven by light beer brands, which are likely to be seen as very close substitutes for one another in the eyes of their target audience. By contrast, it is less likely that we would have found positive spillovers between these light beers and more expensive products such as imported



or domestic craft beers.<sup>26</sup>

## 7 Conclusion

In this paper we empirically examined the effect of market structure changes on the propensity of firms to advertise. By exploiting a large change in market structure, brought about by the 2008 merger of Miller and Coors in the U.S. brewing industry, we can identify the causal effect of concentration on advertising. This is an especially important and useful context for such a study, given the strategic importance of advertising in the brewing industry, as well as the nature of local preferences over beer brands, which lead to considerable variation in the effects of the merger across markets.

Our findings have three important implications. First, we are able to help resolve long-standing debates, and conflicting results, surrounding the relationship between concentration and advertising. Various theories—dating back to at least [Dorfman and Steiner \(1954\)](#) and [Telser \(1964\)](#)—suggest that this relationship can be either positive or negative since each variable will affect the other. Accordingly, empirical studies of this issue will be affected by endogeneity, but previous studies have not fully accounted for this endogeneity. By establishing the causal effect of concentration on advertising, within a single industry with clear identification, we help to resolve earlier theoretical debates and to understand the direction of bias in previous empirical studies.

Second, our results complement the finding that advertising has positive spillovers for the industry, which has been shown in recent empirical research including [Anderson and Simester \(2013\)](#), [Lewis and Nguyen \(2010\)](#), [Sahni \(2014\)](#) and [Shapiro \(2013\)](#). An implication of this research is that firms in competitive markets will under-invest in advertising. Our study supports this conclusion by establishing a positive relationship between the degree of concentration in an industry and the advertising expenditures of firms. Thus, our paper suggests that advertising firms are aware of positive spillovers, and behave accordingly when the competitive environment changes.

Third, this paper contributes to the large literature on the effects of mergers. Past work in this area has heavily emphasized the price effects of mergers. However, in a number of industries, non-price effects can be an equally important aspect of competition. The brewing industry is, in fact, an excellent example of such a setting, given the high advertising expenditures by firms. Our results indicate that increased concentration—brought about by a

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<sup>26</sup>We are unable to directly test this hypothesis because, as noted above, the three major brewers are the only ones to have significant advertising expenditures. Most other brewers, especially craft brewers, simply do not show up in the Kantar data.

merger between two large firms—caused the industry to sharply increase advertising spending per capita. Indeed, the increase in advertising was considerably more than the concurrent rise in prices (Ashenfelter et al. (2014b)). This indicates that mergers can have substantial non-price effects, and therefore that the existing emphasis in Industrial Organization on price effects may be missing an important non-price dimension.

In summary, our findings suggest that, to the extent that advertising has positive spillovers, this phenomenon is understood by advertisers, who allocate their expenditures accordingly. We believe that this is an especially important finding given the nature of research into advertising. Past work in this area has strongly emphasized the way in which advertising relates to *consumers*. This is apparent in the debates about informative versus persuasive advertising, and how advertising affects consumer choice and therefore industry outcomes such as profitability and market structure. By contrast, there is comparatively little research on advertising choices by *firms*, and the circumstances under which they choose to strategically deploy this tool. By showing that firms increase advertising in markets that are more concentrated, we provide a valuable insight into the decisions that firms make regarding their advertising budgets, and what this implies about their thinking regarding this important instrument of competition.

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