

# How much do consumers care about New and Discontinued products? A Case Study of the MillerCoors Merger\*

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November 6, 2023

## Abstract

This paper finds evidence of product variety changes due to a merger and compares the welfare effects of product variety changes would be in relation to the welfare effects of price changes in the context of the MillerCoors merger of 2008. We first test if the merger had any effect on product variety directly. We find the merged firm decreased the number of brands they offered and offset this by increasing product variety in more successful brands. However, under a difference-and-differences framework we find product variety declined relative to other top competitors. We then use a random coefficient nested logit model and estimate demand for the MillerCoors merger in the post-merger period, expanding on work from Miller and Weinberg (2017). In a set of two counterfactuals, we test the value of new products created after the merger and the value of discontinued products lost after the merger. We find the merger increased consumer surplus from changes in product variety: consumer surplus increases by 1.25% from new products created after the merger and decreases by 0.14% from losing discontinued products after the merger. Benchmarking this to the literature, the effect of new product addition and discontinued product removal is approximately 34% and -4% of the consumer welfare effects of coordinated pricing found in prior work, respectively.

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# 1 Introduction

One issue regulators face in merger analysis is how to quantify the non-price effects of a merger and what their relative importance is compared to price effects. In a recent OECD Report summarizing twenty-one Competition Agencies around the world, eighteen explicitly have policy to address the non-price effects of mergers, but the majority do not address these issues unless there are “claims made by merging parties, their customers/consumers, and rivals”.<sup>1</sup> However it is unclear how one such non-price effect, that of product variety, should be weighted in the social optimum, as some agencies consider them second order to price effects, while others consider them of equal importance to price effects. In order to do so, this requires both quantifying the effect of the merger on product variety and quantifying the consumer welfare effect of product variety changes for direct comparison.

Several papers in the literature have provided models to quantify the effects of changing product variety, but make assumptions on which products leave and enter markets. Wollmann (2018) studies what the welfare effects would be of product variety changes in a theoretical setting where a bailout never occurred and bankrupt firms were acquired by competitors. Fan and Yang (2022) examine how to model changes in product variety in multiple markets in a hypothetical where a major brewery acquires smaller craft breweries. Overall, these papers find a loss in consumer welfare from the decline in product variety. Without an appropriate benchmark, it is unclear whether this effect should be a priority by policymakers compared to price effects from a merger.

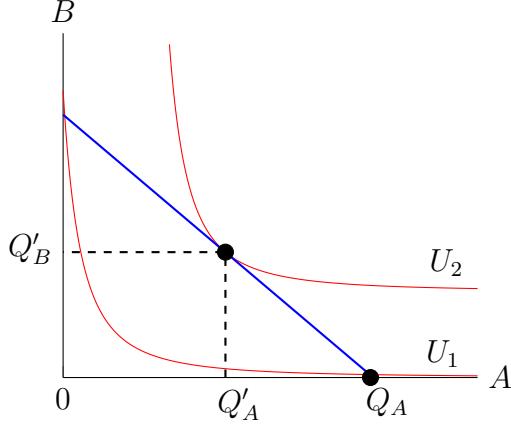
In this paper, we use the setting of the brewery industry after the MillerCoors merger of 2008 to document changes in product variety due to a merger, estimate what the effects of changing product variety are on consumer welfare, and describe how this compares to the consumer welfare effects of price changes measured in the literature. Prior work has not considered how product variety changed and what its potential effects on consumers are within this widely studied merger. We first describe the setting, show how price is limited in this market and discuss how much these product variety effects can be attributed to the merger itself. From here, we estimate a model of consumer demand to measure the effects of this change in product variety for consumer welfare. We find product variety fell relative to competitors, but in terms of consumer welfare, the gain in new product variety far outweighed the loss in discontinued product variety. For comparison, we find the gain in consumer surplus coming from new products and the decline in consumer surplus coming from discontinued products is approximately 34% and -4% of the consumer welfare effects of coordinated pricing found in Miller and Weinberg (2017), respectively.

The intuition behind why consumer surplus changes matter can be motivated through a simple model of consumer choices under a budget constraint. When a product is not available for a consumer, its price can be thought of as infinite. Therefore, a consumer must optimize without purchasing that product, placing them on a lower indifference curve. When the product is made available, i.e., the price is no longer infinite, the consumer can now maximize utility with all the products available. Likewise, when the product is not available, i.e., the

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<sup>1</sup>In these cases, these complaints may be addressed through qualitative evidence in the absence of direct measurement (Capobianco 2018).

price is set to infinite, the inverse happens and the consumer has to maximize utility where one good's quantity is set to zero. This paper attempts to measure how important this change in consumer surplus is relative to price effects.<sup>2</sup> A visual interpretation can be seen in Figure 1.



**Figure 1:** Visual Representation of Product Introduction

The brewing industry is one such industry where heterogeneous products are offered, but products are limited by how much they can change their prices. As described in detail by Miller and Weinberg (2017) and Weinberg, Sheu, and Miller (2019), firms often priced their products very similarly to their competitors, especially for brands owned by Miller, Coors and Anheuser-Busch Inbev. Several reasons were given, such as implicit price collusion, the role of retailers and distributors in price setting and the role of competitors to tamper said implicit collusion through price undercutting. Because of this, firms may decide to cut costs through removing products or capture more profit by introducing new products outside of their flagship brands.

The main data source for this project is the IRI Marketing dataset which provides data on the demand for beer between 2002 to 2012. Using this dataset, we are able to observe at each market which products were removed and which ones were added before and after the MillerCoors merger of 2008. This merger combined the second and third largest brewery companies in the United States, leading to exogenous changes in costs and market structure. As such, product varieties changed after the merger at the market level, leading to both new products after the merger and discontinued products. We additionally supplement this data

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<sup>2</sup>Alternatively, consumer welfare changes can be modeled within a merger setting where the firm's ability to change prices is limited. When two firms decide to merge, they may decide to change prices or change their product offerings. However, this decision must be done with respect to what competitors are doing. For example, prices could rise after the merger due to an increase in market power, but if competition is sufficiently high, this could limit how much prices can increase. In lieu of this, the firm may drop products instead in order to increase market power or reduce costs elsewhere. Alternatively, the converse may occur: firms may increase product variety by creating new products in order to capture profit elsewhere if they cannot change prices. Ultimately, any increase in prices and any loss in product variety can lead to consumer welfare loss, and the converse can lead to consumer welfare gains. This scenario is discussed in detail in the next section.

with the Beverage Marketing Company (BMC) database which has producer and distributor characteristics to provide added context to the market.

We first examine whether product variety, measured as both individual products and a more generalized definition of brands, changed after the merger and whether it can be attributed to the merger itself. Under a basic linear model, we find that while the merger had a minor negative effect on the number of brands provided by both Miller and Coors, it had no effect on the number of products supplied by the merged company. This provides evidence of the phenomenon described in Atalay et al. (2023) towards the merged firm focusing on their core products, rather than new or products on the periphery of their business.

However, when compared to its competitors in a difference-in-differences design, brand variety declines relative to its competitors. We use a difference-in-differences design, comparing brand variety between Miller and Coors and the top firms in market share commonly used by the literature for comparison. Here, we find brand variety for the merged company declined relative to its competitors by 31%. This decline holds when we de-trend the data from time trends occurring before the merger, improving elements of the original difference-in-differences design.

Given this evidence, we design a model of consumer demand to estimate how the measured product variety changes impacted consumers. To make this comparison, we use instruments and the nesting strategy from their paper. We use a random coefficient nested logit model standard in this setting to model how consumers choose beer. Consumers in this setting first choose whether they want to purchase a product from the top three competitors or not, then decide on which specific product within each nest what to purchase. We calibrate the model on the post-merger period only to focus on what short-term effects the merger would have.

After calibrating the model, we estimate the consumer welfare impact of new product through a set of counterfactuals that estimates how consumer welfare changes given changes in product variety after the merger. We consider two sets of counterfactuals: one where products newly created after the merger never existed, and one where products that were discontinued after the merger were never discontinued and remained in their markets. These two counterfactuals estimate the value of losing new products created after the merger and gaining discontinued products after the merger, respectively. This set of counterfactuals differ on assumptions of whether firms change prices based on observed product variety, whether the model is estimated individually at each market, the time dimension the model is estimated at, and whether random coefficients are included or not. We find the value of new products created after the merger ranges from 0.05% to 1.35%, under these different versions of the model. To put these results in perspective, this is approximately 34% of the consumer welfare effect of coordinated pricing found in Miller and Weinberg (2017). Likewise, we find the loss in consumer surplus from the discontinuation of products ranges from -0.14% to -0.175%, which is approximately -4% of the consumer welfare effect of coordinated pricing found in the same paper.

## 1.1 Literature Review

This paper mainly contributes to two strands of literature: the effects of changing product variety and studies on the MillerCoors merger of 2008. We contribute to each by providing a framework on how to model changing product variety, estimating this effect in the merger, and comparing it to the effects of price on consumer welfare.

This paper contributes to the growing literature on product variety changes and how they relate to consumer welfare. As mentioned previously, Wollmann (2018) studies the impact of product variety changes on consumers under an exogenous shock to product variety through bailouts in 2007. Similarly, Fan and Yang (2022) study how firms may reallocate products after an acquisition of a craft brewery. We make two important contributions complimenting their work. The first is the focus on a smaller set of markets, avoiding the curse of dimensionality issue the latter paper addresses. Due to this, we do not need to solve for a large discrete game. This comes with the cost of less specificity on more granular level market information. The second is data. Due to data limitations, they cannot state which breweries or beers form their results. Our data does not have this limitation, albeit at the cost of less markets to study and a shorter time frame. Nevertheless, using this less restricted data allows me to provide readers with more information on firm specifics. By avoiding assumptions on what products leave the market and enter, we provide an empirical test of these model's conclusions. The central exercise and counterfactual of this paper can best be compared to Petrin (2002), who study the value of new products entering the market.

We contribute to the literature on the Coors-Miller merger of 2008 and the implications of beer market changes that occur around this time. O. C. Ashenfelter, Hosken, and Weinberg (2015) examine what the impacts of the merger were on prices and transportation costs for the firm, and whether one outweighs the other. They ultimately find price increases are offset by efficiency gains from the merger, leading to very little change in prices due to the merger itself. As described above, we use this as evidence to justify these companies are limited in how much they can adjust their prices. In other work, Miller and Weinberg (2017) examine the price effects of the merger and find price effects are much higher than predicted with a model that captures the merger's effect of making price coordination easier among top firms. In a follow up paper, Weinberg, Sheu, and Miller (2019) find evidence of tacit pricing coordination after the merger in the brewing industry that can potentially explain these effects. These papers are vital for the model in this paper and comparing the welfare effect of product variety changes on consumers to welfare changes due to price changes.

We use tools from the discrete choice estimation literature, notably the random coefficient nested logit model, to estimate demand in this setting. This model, discussed in greater detail in Grigolon and Verboven (2014), combines the random coefficient model and the nested logit model and allows for more precise estimates than the standard random coefficient model. This model has been used in a number of other works within this industry and in other settings (e.g. Grennan (2013), Ciliberto and Williams (2014), Conlon and Rao (n.d.), Miller and Weinberg (2017)). We additionally estimate the model under a standard nested logit, following other works within this industry (e.g. Fan and Yang (2022), Hellerstein (2008), Goldberg and Hellerstein (2013), Asker (n.d.)).

Our results both validate and provide additional context to results previously seen in the literature. Examining the merger’s effect on product variety, we find results similar to Atalay et al. (2023) who find a slight decline in product variety due to a merger using a large scale event study. They document the phenomenon of brand consolidation: firms cutting back their product variety in certain brand lines to their highest revenue products in other brand lines. In this study we see this phenomenon as well. After the merger, the number of brands falls within each market, but there is no effect of the merger on the number of products offered per market, implying an offsetting effect coming from new products. Likewise, although Fan and Yang (2022) find a decline in consumer surplus with a hypothetical acquisition of smaller breweries, this paper finds a net increase in consumer welfare coming from the welfare gain created by new products compared to discontinued products in a merger between larger firms.<sup>3</sup> Therefore, there may be other conflicting factors such as firm size and product substitution that may lead to differences in product variety outcomes after a merger.

The paper proceeds as follows. In section 2, we describe the setting of the brewing industry, the merger itself, and what in particular makes this merger and setting an ideal setting to test product variety and price changes on welfare. In section 3, we describe the data and provide key summary statistics for each dataset. In section 4, we describe the reduced form models and results to examine what the impact of the merger was on product variety. In section 5, we describe the structural demand models used to estimate the effects of changing product variety on consumer welfare. In section 6, we describe the results of the demand models. In section 7 we describe the main counterfactuals: how does consumer surplus change with changes in product variety after the merger? Finally, in section 8, we conclude.

## 2 Setting

In this section, we expand on the basic intuition between the relationship between product variety and prices and what features of the brewing industry make it an ideal setting to examine this relationship’s effect on consumer welfare. We additionally discuss the MillerCoors merger of 2008, the main exogenous shock to market structure, which is the focal point of this analysis.

### 2.1 A Basic Intuition of the Relationship Between Product Variety and Prices During a Merger

We provide an expanded intuition between the relationship between product variety changes and price changes to illustrate the claim made in this paper: a firm’s trade off between prices and quantities. This model uses a simple monopoly profit comparison, and shows that, depending on how limited firms are in changing prices, products may or may not leave the market. Due to the large size of these firms, this model provides a baseline of what the effects of the merger could be on product variety.

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<sup>3</sup>While this paper does not examine the supply-side changes occurring due to the merger, evidence of firms reallocating resources to more efficient processes can be seen in Demirer and Karaduman (2023).

Suppose we have a market where three firms, denoted  $A$ ,  $B$  and  $C$  operate and sell one good  $i \in \{1, 2, 3\}$ , respectively. Goods are heterogeneous, and prior to the merger, each firm has the following profit condition that determines whether they will provide the product in the market:

$$\pi_A^{pre}(c_A) \geq 0 \quad \& \quad \pi_B^{pre}(c_B) \geq 0$$

Where  $\pi_i$  is the profit for  $i \in \{A, B, C\}$  and  $c_i$  represent their costs of production and distribution, which may differ. If the profit is greater than zero, they provide the product. Firms compete in Bertrand competition.

In this model, a merged firm can change their profits through prices or through costs. Suppose two of the firms merge and can only change prices. For simplicity, suppose the third firm's prices remain constant. Denote this new merged firm as  $AB$ . In the first case, suppose  $AB$  lowers prices. This can occur if the merger affected costs and they can effectively undercut their competitor. Profits would rise if they are able to capture more customers. In the second case, suppose  $AB$  raises price. This can occur through increased market power from the merger, and is more likely if the products are substitutes or one product has a higher cost that is not mitigated by the merger.

Now suppose the merged firm can also adjust product varieties. In the first case, suppose one of the product varieties are dropped. In this setting, this can occur if the products are substitutes and there is some fixed cost of providing the good. Without loss of generality,  $AB$  would drop the product if and only if

$$\underbrace{\pi_A^{\text{two products, after}}(c_A) + \pi_B^{\text{two products, after}}(c_B)}_{\text{Sum of Both Product Profits}} < \underbrace{\pi_A^{\text{Single Product}}(c_A)}_{\text{Single Product Profits only}} \quad (1)$$

However, suppose the firm is limited in adjusting prices. In this case, firms may only be able to adjust through changes in product variety. Note that the existence of the third firm and Bertrand pricing allows for this to naturally occur within the setting. If the third firm has a low enough price (or marginal cost), price changes may not lead to additional sales of the product. This can occur if the third firm has low enough costs such that they are able to lower prices beyond what  $AB$  can do. Another alternative reason for limitations on prices is coordination. If the firms are coordinating on price, the firms may want to capture profit elsewhere by lowering costs by removing low selling products. Therefore, if the firm wants to capture more profit, they could drop products or introduce a new one in a different market.

We can also consider an extension where new products are introduced. After the merger, the firm offers the new product  $AB$  if and only if

$$\underbrace{\pi_A^{\text{three products, after}}(c_A) + \pi_B^{\text{three products, after}}(c_B) + \pi_{AB}^{\text{three products, after}}(c_{AB})}_{\text{Sum of All Product Profits}} < \underbrace{\pi_A^{\text{Single Product}}(c_A)}_{\text{Single Product Profits only}} \quad (2)$$

And

$$\frac{\underbrace{\pi_A^{\text{three products, after}}(c_A) + \pi_B^{\text{three products, after}}(c_B) + \pi_{AB}^{\text{three products, after}}(c_{AB})}_{\text{Sum of All Product Profits}} < \underbrace{\pi_A^{\text{two products, after}}(c_A) + \pi_B^{\text{two products, after}}(c_B)}_{\text{Sum of Both Product Profits}}}{(3)}$$

Note that this would occur with or without limitations in price adjustment, as the main reason this product exists is due to cost changes as a result of the merger.

## 2.2 Implications on consumer surplus

To examine what the impacts of these changes on consumer surplus would be, we add an outside good,  $C$  and a small market to this setting. Suppose there are 9 consumers in this market, with six having preferences on each good as such:  $i > j > k$  for all  $i, j, k \in \{A, B, C\}$ , without replacement, and the last three having preferences only on a good that does not exist prior to the merger,  $AB$ , and the outside good  $C$ .

Depending on the merged firm's choice, we can examine what the final effect on consumer welfare would be given price and product changes. If any product's price rose, for the group of consumers that preferred the product, their consumer welfare would decline, either due to paying a higher price or from shifting from their preferred good to a cheaper, less preferred option. Alternatively a price decline would lead to a consumer welfare increase as consumers shift to a more preferred good or pay less for a preferred good. With the inclusion of product variety changes, any removal of a product would lead to a consumer welfare loss or no change at all. This can also be interpreted as prices set at infinity - consumers can no longer purchase the good, and due to this, they may be forced to substitute to another good. For example, suppose the company that produces  $A$  and  $B$  merge. This merged company can drop  $A$ , and force consumers to substitute to  $B$  or  $C$ . This is a viable strategy if  $B$  or  $C$  are highly substitutable, or if  $B$  or  $C$  have significant costs that the merged company does not want to undertake.

Likewise, the introduction of a new product in the form of  $AB$  can lead to an increase in consumer welfare. When  $AB$  is introduced, the three consumers which previously only purchased the outside good may purchase  $AB$ , depending on prices. If prices for  $AB$  are too high, these consumers will continue purchasing  $C$ , leading to no changes in consumer surplus. However, if  $AB$  has a low enough price, then individuals will purchase  $AB$ , leading to a consumer surplus increase as consumers can now purchase a good they prefer more with a lower price.

While the effects of price individually and quantity individually are clear, the combined effects of both are less clear. For example, suppose prices fell, but product variety also fell. Here, consumer surplus would increase from prices, but fall from the effects of product variety changes. Depending on which effect outweighs the other, the merger's effect would

either have a net positive or net negative increase on product variety. Measuring this requires information on both prices and product variety to accurately measure, or shut down one of these channels in order to estimate consumer welfare's effect on one. For example, if there is an industry where price changes are limited, estimating the change in consumer surplus from new and discontinued products post-merger would tell us the effect of product variety on the merger.

This basic intuition provides the framework behind this project - a merger's effect on consumer surplus can be through prices or quantities, and depending on what the merged company does, this can have different consumer welfare impacts. If a firm is limited on price, one option to capture more profit may be to remove or increase product varieties, affecting consumer surplus in the process. With additional firms and additional products, this intuition still holds as long as price changes are mitigated. The following conclusions can be drawn from this.

1. If a product leaves the market, this would lead to a weakly negative decline in consumer surplus.
2. If a product enters the market, this would lead to a weakly positive increase in consumer surplus.

### 2.3 The U.S. Commercial Beer Industry

The setting is the United States commercial beer industry, a market largely dominated by fifteen firms with large market share which allows for strategic interactions in product variety choices. We choose this industry due to the easily identifiable product differentiation via brands, packaging type and size. Additionally, there is evidence of limited price changes within this market. To help focus on product variety, this industry was largely stable and faced few aggregate shocks to product variety until 2008, where the Miller-Coors merger occurred.

The United States Beer Industry shares many similarities with other branded consumer product industries, however there are some important differences which we use to our advantage in this study. Like other branded consumer product industries, companies compete on prices, and further improve their competitive stance in the industry through quality, product introduction, advertising and sales. The major difference is that distributors are a vital and highly regulated section of the market. By law, brewers first sell to distributors, then distributors sell to stores. This distributor market distributes various types of beverages, such as beers, alcohols, soft drinks and others.<sup>4</sup>. Several states enact additional laws on distribution, and in some cases, restrictions on distribution. For example, each state enacts its own excise tax on beer distributors in their state, ranging from \$ 0.02 per gallon in Wyoming to \$ 1.29 per gallon in Tennessee. Some states, such as New York and New Jersey, also impose their excise tax when manufacturers ship their product to the state.<sup>5</sup>

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<sup>4</sup>See the NWBA website for more information: <https://www.nwba.org/about/what-beer-distributor>

<sup>5</sup>A discussion on 2021 Excise Tax trends can be found here: <https://taxfoundation.org/excise-taxes-excise-tax-trends/#Alcohol>.

These laws provides variation in prices and distribution, which influences beer consumption at the local level.

The presence of the distribution market makes distance and negotiation costs much more pertinent for product variety. Because brewers must first sell to distributors, who then sell to consumer-facing businesses, distribution costs increase final costs, and therefore final product variety. These can take two forms that we focus on in this paper: distance costs and negotiation costs. For distance costs, if brewers are located too far away from distributors distance costs rise, cutting into individual product profits. For negotiation costs, brewery companies must negotiate with brewers on what they must pay to distributors for distributing the brewery's products.<sup>6</sup> As will be described later, both these costs were the main impetus for the merger.

Product variety is also tied closely to individual consumer preferences that are fairly strong in the U.S. Commercial Beer Industry. Typically, consumers have strong preferences towards beer produced within their region. For example, Anheuser-Busch is the market leader in St. Louis, where their central brewery is located. This allows for plausible consumer variation in preferences as well. While firms still have other tools to increase their market share, such as advertising and temporary sales<sup>7</sup>, these are largely stable trends before the merger. Overall mean market shares remain stable around 18% prior to the merger. In each region, market shares remain stable prior to the merger.

Given distributors and these strong consumer preferences, product variety is a vital part of brewery's competitive market. Since 1979, there has been a stark increase in the number of craft beers, with the trend increasing in the mid-2000s (Elzinga, Tremblay, and Tremblay 2015). Several reasons have been proposed for this change, including deregulation in the industry<sup>8</sup> and increasingly friendly local and state policies for craft brewing (Barajas, Boeing, and Wartell 2017). This increase has led to greater local and national variety for consumers on various product dimensions. As such, the craft brewing industry has steadily grown, totaling "\$26.8 billion, and now account for just under 27% of the \$100 billion U.S. beer market." (Association 2022). This changing craft brewery and increasing product variety provides the setting for the Coors and Miller merger of 2008.

Finally, prior to the merger, this market was largely concentrated within fifteen firms. While the IRI dataset contains 852 breweries, the 15 largest breweries fell within the top 5 percentile of total market share.<sup>9</sup> On average, the top 15 firms had a combined market share of 94% prior to the merger, and 92.9% after the merger. Specific to this paper, Miller and Coors made up nearly a third of this market share, with Miller and Coors combined having a

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<sup>6</sup>This can lead to exclusive deals between breweries and distributors, such as the exclusivity bonuses provided by Anheuser-Busch Inc. More information accessible at: <https://www.bizjournals.com/stlouis/stories/2008/03/31/daily73.html>.

<sup>7</sup>See Chandra and Weinberg (2018) for a discussion on the role of advertising in this market and within the Coors/Miller merger.

<sup>8</sup>See "International Beer Day", accessible at: <https://balloon-juice.com/2010/08/05/international-beer-day/>

<sup>9</sup>These include Anheuser-Busch, Inbev, Anheuser-Busch Inbev, SabMiller, Molson Coors, Heineken USA Inc., Grupo Modelo, Boston Beer Co., Cerveceria Costa Rica SA, KPS Partners, Great Lakes Brewing Co., Labatt USA, S&P Company, Constellation Brands Inc., and D.G. Yuengling & Sons Inc.

combined market share of 29.2% prior to the merger and 27.2% after the merger. Their main competitor and the market leader, Anheuser-Busch InBev, had a market share of 39.9% prior to the merger and 35.6% after the merger. This concentrated market, as well as the presence of a strong market leader, contributed to the decision to merge as well as the reason for approval by regulatory agencies.

## 2.4 The Miller-Coors Merger of 2008

The Miller-Coors Merger of 2008 combined Miller, the second largest brewery, and Coors, the third largest brewery, in the United States. The merger's main motivation was to combine the geographically distinct production facilities to reduce costs and prices for consumers (See Martin (2007)). We leverage these distribution costs changes and the lack of aggregate shocks to claim that product variety may be affected as well.

Prior to the merger, it was uncertain whether Coors and Miller's merger would pass regulation due to market power concerns. The merger to MillerCoors was announced in October 2007, with the merger finalized on July 1st, 2008.<sup>10</sup> The merger brought together the second and third largest beer companies in the United States, with an estimate of \$ 500 Million in cost savings from improving economies of scale (Martin 2007).<sup>11</sup>. Initially, the merger seemed it would be unsuccessful in gaining approval by regulators. First, the merger brought together the second and third largest firms in the market, in a fairly concentrated market. Herfindahl-Hirschman Index estimates for the commercial beer market range from 2000 in O. C. Ashenfelter, Hosken, and Weinberg (2015) to 4000 in Tremblay et al. (2005). Using the IRI Dataset, this paper estimates a National HHI over the entire sample of approximately 2100. Second, past mergers in the beer industry often fell under heavy scrutiny. Prior to this merger, sixteen mergers within the beer industry either were denied or told to undergo significant changes. Third, many of the products were close substitutes as these two companies both competed in the four main beer categories. Third, some consulting firms stated there would be issues with the merger. A representative from Bevmark, a beverage consulting firm, stated that the merger would lead to "Less selection and probably higher prices" (Martin 2007).

Regulators decided not to challenge the merger. In the review on the investigation, the Department of Justice came to several conclusions. First, they found the cost savings stated by the company were substantial enough to benefit consumers. The distribution costs, by combining the geographically distinct production facilities, would "be reduced considerably" (Heyer et al. 2009). These transportation cost savings were even the focus of a consulting report prior to the merger, and the Justice department found no issues with this analysis. Secondly, the Justice department found Miller and Coors were less competitors against each other, and moreso competitors against Anheuser-Busch, who held the highest market share

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<sup>10</sup>These two major alcoholic beverage companies existed concurrently until 2020, when the division was later restructured and named the Molson Coors Beverage Company.

<sup>11</sup>In their announcement of the merger, the company estimated \$50 million in savings for the first year, \$ 350 million in the second year, and \$100 million in the third year. See [http://media.corporate-ir.net/media\\_files/irol/10/101929/molson1.pdf](http://media.corporate-ir.net/media_files/irol/10/101929/molson1.pdf)

by a significant margin. Finally, they found the merger was unlikely to increase coordination between firms. Given these reasons, the merger was approved and was formally completed on July 1st, 2008.

However, later research has found that price coordination may have occurred. Miller and Weinberg (2017) find that the price increases post-merger cannot be fully explained by a transition of Nash Equilibria, and relate that to evidence that there was price coordination. In follow up work, Weinberg, Sheu, and Miller (2019) examine the role of implicit price collusion post-merger. They use a price leadership model, where the largest firm announces their price and the rest of the oligopoly sets the price based on this announcement. Here, they find price increases more in-line with the actual price increases after the merger. Notably for this study, this price leadership model holds after the post-merger environment and is easier to accomplish due to the reduction of one competitor.

We focus on product variety within the context of this merger for two reasons. First, the merger led to large variation in distribution costs across markets. This was the main reason the merger occurred. In their announcement concluding the investigation into antitrust behavior, the Department of Justice stated, “In one of the key parts of the investigation, 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.” (Division 2008) These savings largely came from the expansion of Coors and Miller’s production facilities within the United States. Prior to the merger, Coors had two production facilities open: Golden, Colorado; and Elkton, Virginia. Miller had six open throughout the United States, but near large markets such as Irwindale, CA (Near the Los Angeles Metropolitan Area) and Fort Worth, Texas.<sup>12</sup> The combined eight breweries could significantly lower costs for shipping Coors products, which regulators believed could be beneficial to consumers.

The second reason is the two firms had limitation to changing prices for the aforementioned reasons. Due to the coordination on prices as documented by Miller and Weinberg (2017), MillerCoors could not lower prices more than their main competitor, Anheuser-Busch Inbev. Secondly, due to the role of retailers, who may price beers similarly for final purchase, any decision to change prices significantly may be mitigated at this final step. Therefore, firms had limitations on what prices they can offer. With the addition of the distributor market, which further limits upstream prices, firms’ main outlets to affect market share come in the form of new product introduction and advertising.<sup>13</sup>

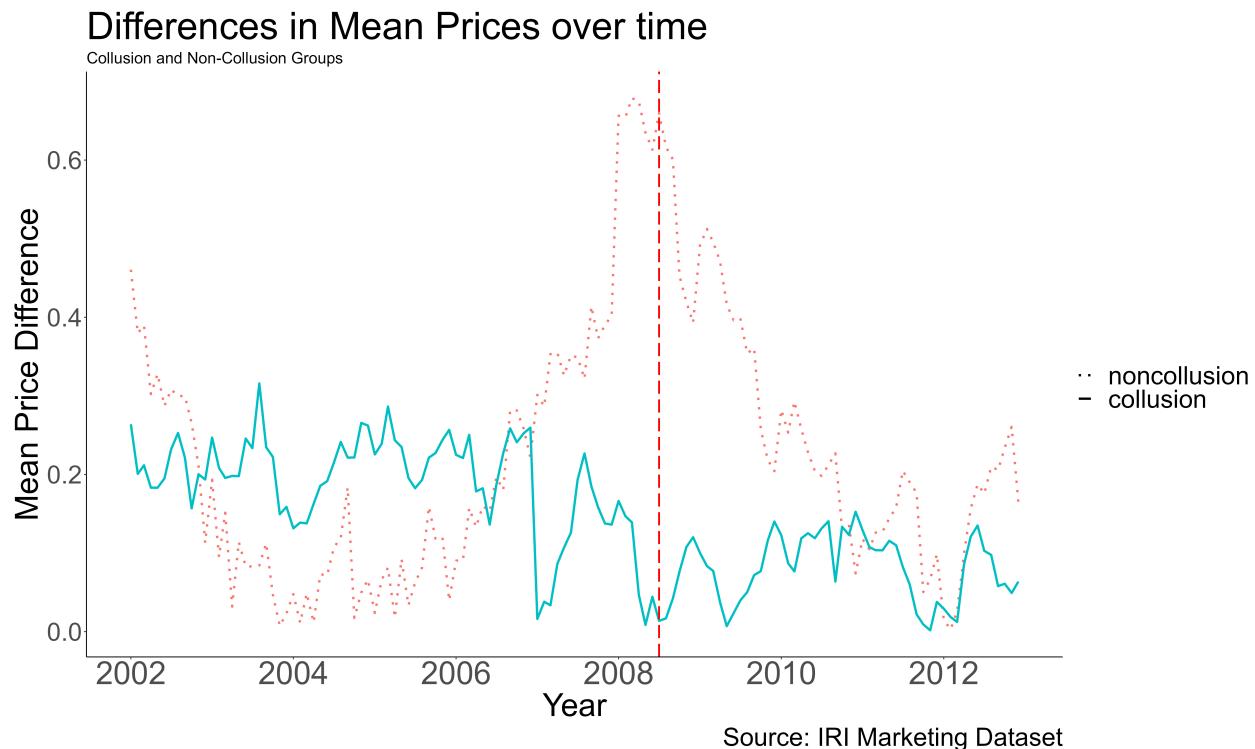
We find evidence of this collusion in prices between 2006 to 2011 in our data as well. Figure 2 shows the differences in mean prices between MillerCoors products and Anheuser-Busch Inbev, and MillerCoors products and all other top-selling firms. Between this period, there is a large diversion between mean prices, peaking at nearly 60 cents in 2008. Despite using a different sample than Miller and Weinberg (2017), we find their trend still holds in this expanded dataset using a per-ounce price.

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<sup>12</sup>A Full list of the breweries can be found on the MolsonCoors blog, <https://www.molsoncoorsblog.com/features/quick-look-our-8-breweries-yes-8>.

<sup>13</sup>While advertising is not the focus of this paper, a discussion of advertising in this merger is discussed further in Chandra and Weinberg (2018).

**Figure 2**



The figure above shows the difference in mean prices between MillerCoors brands and Anheuser-Busch Inbev which underwent implicit collusion on prices according to Miller and Weinberg (2017), and the difference in mean prices between MillerCoors brands and all other firms. The sample is limited to the top 5 percentile of firms in national market share. Data is from the IRI dataset.

## 3 Data

Our main datasets cover the consumer and producer sides of the market, the IRI Dataset and the BMC Dataset, respectively. We then provide some summary statistics to provide a baseline for future sections. These two datasets allow me to examine the entire market, rather than a subsection, and give me information on production factors to further improve the model estimates. Although the majority of the analysis uses the IRI dataset, I provide more information on the BMC dataset in the appendix. More specific information on the datasets, as well as features of products that were discontinued or were newly added after the merger, can be found in the data appendix.

### 3.1 Consumer Level: The IRI Dataset

The IRI Dataset provides information on consumer level demand through scanner data, which shows what products consumers bought at stores. We use monthly data from thirty-nine Metropolitan Statistical Areas from 2002 - 2012, and explain why we use these markets and these years. This allows me to measure product variety at the final good level, as well as observe revenues, market shares and prices.

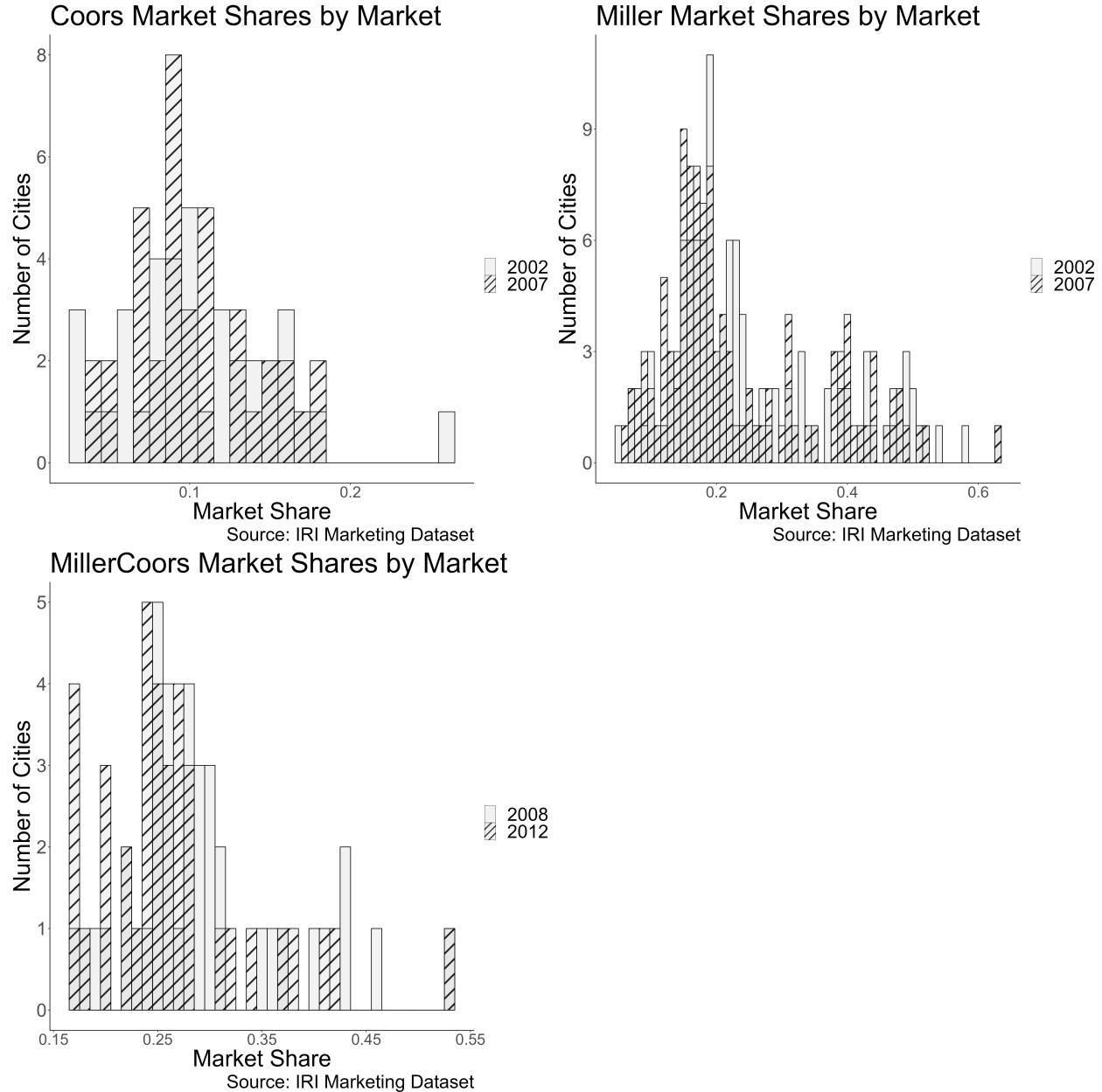
This is a branded consumer product industry, and therefore, varieties, prices and quantities can be measured through supermarket transaction data. The IRI Marketing data set spans from 2001 - 2012 and contains anonymized supermarket transaction data from 51 marketing regions. These marketing regions are typically groups of counties, with some regions crossing state lines. Each observation is an individual sale of a product with a unique UPC identifying a product based on the brand, packaging medium, and the size by ounces.

I make several changes to the raw data for ease of estimation and to remove markets that have unique legislation restricting observations or market definition. First, there were several major store level mergers that occurred in 2001 that affect some store-level controls that will be important for estimation purposes. Therefore, data from the year 2001 are dropped. To better match against state level data, we do not include markets from states that place restrictions on product variety or distribution. These laws include those that place limits on the alcohol content of the beer sold or states where beer is not allowed to be sold in supermarkets. These remove eight markets from the data set. Finally, for estimation purposes and due to unclear definitions of markets, we do not include four markets that consist of entire states. This provides a total of 39 markets in a total of 28 states. For the main demand specification, we additionally subset the brands to the top ten brands in market share. Prior works, such as Miller and Weinberg (2017), Weinberg, Sheu, and Miller (2019), and O. Ashenfelter, Hosken, and Weinberg (2014) focus on these firms as well. This is partially due to computational reasons, but these companies can best be thought of as Miller and Coors' closest competitors than local or craft beer brands.

Overall, market shares vary greatly between markets. Figure 3 shows the mean market share of Miller and Coors prior to the merger, and Miller Coors right after the merger and at the end of the sample. Market shares range from less than 3 percent to nearly 30 percent for

Coors and from less than a percent to over 50 percent for Miller. The combined company reaches market shares similar to Miller, ranging from near 0 to over 50 percent market share.

**Figure 3:** Market Share for Miller and Coors



Note: These histograms depict the market share for each market for Coors and Miller for 2002 and 2007, and the market share for MillerCoors for 2008 and 2012. Each observation is a market's annual market share for the respective company. Data is compiled through the IRI Marketing Dataset.

### 3.2 Producer Level: The BMC Dataset

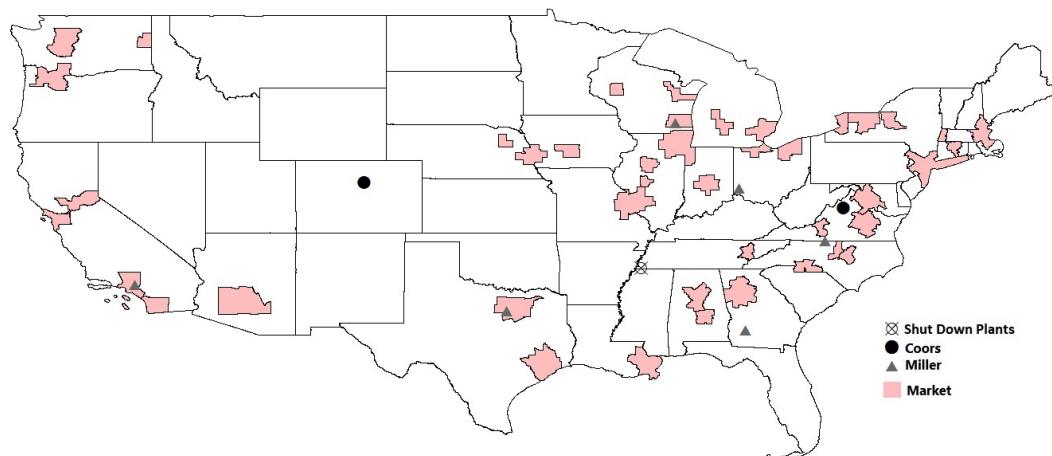
The BMC Dataset provides information on brewery and distributor supplier characteristics between 2006-2010. We use annual data from this source to provide more information on

potential supply-side characteristics that could affect product variety during the merger. The dataset for distributors includes address, type of importer, the parent company of products they distribute, number of employees, number of trucks, total sales in that year, and region they serve. The dataset for brewers includes address, capacity, number of employees, number of lines for canning beverages, number of lines for bottling cold and hot beverages, and region they serve.

These data sources have several key features which improve the quality of this study. First, the IRI dataset ends four years after the merger, allowing for good coverage of the post-merger outcomes trends that will help verify the impacts of the merger. Combining both the BMI and IRI datasets does shrink the post-merger study period to two years, which still allows the study of the short term effects of the merger. Secondly, the “Ounce” and packaging medium data allow me to categorize products at a granular level. Due to this, products are classified at the brand-size-packaging level. Finally, the data contains information on the parent company, vendor, and brand linked together. Therefore, although there are many beer brands, all brands can be identified and tracked through time regardless of parent company or vendor changes. I use this dataset to supplement the existing IRI dataset, and improve the quality of tracking the brands over time.

A map of the markets as of 2022 and where the breweries are located is show in Figure 4. There is some geographic dispersion of both the markets and the breweries, especially for Coors breweries. There are only two Coors breweries, with one being in Golden, CO and the other being in Elkton, VA. The Miller breweries are dispersed across the United States, however, most markets in the data set do not include a brewery within them. There is one brewery that existed during the study period in Tennessee, yet closed prior to the merger in 2006. There is dispersion in the size of these geographic markets, with some containing multiple counties and large population centers within them.

**Figure 4:** Location of Miller and Coors Breweries



Note: This map provides the location of Miller Breweries, denoted by the grey triangles, the location of Coors Breweries, denoted by the black circles, and the markets, denoted by the outlines. Adjacent markets are combined within the data. The Memphis, TN Coors plant was shut down in 2006 prior to the merger and is denoted by a crossed out circle.

### 3.3 Summary Statistics

We provide the summary statistics for each dataset here for the overall market, for Miller, for Coors and for the combined company MillerCoors for 2002-2012. Of these statistics, we emphasize the measures for distance of the nearest brewery to the nearest market, which the company argued was the main impetus of the merger, and product variety. We show the first main results of the paper, the raw change in product and brand variety, and show that

We first define the difference between product variety and brand variety, and examine basic trends to see how the market changed before and after the merger for Miller and Coors. Products in the dataset are defined as a brand  $\times$  size  $\times$  packaging type, while brands are names given to products given in the dataset. We consider both definitions for three reasons. The first is that brands is easily identifiable in the data set and provides a clear distinction between brands. For example, Keystone is a different brand than Keystone Light (a lower calorie version) which is a different brand from Keystone Ice, a version with a higher alcohol by volume. Secondly, brands is the highest level of product identification in the data set prior to the vendor of the product. If consumers have strong preferences over packaging, such as twelve packs versus twenty-four packs, these results would provide an upper bound on consumer impacts and changes in product variety. Finally, this observable heterogeneity allows us to differentiate between product lines and specific products which may be important for litigators.

Table 1 shows summary statistics for key variables such as revenue, concentration measures and prices. Of key importance for this table are the measures of the number of Coors Brands, Miller Brands and the distance to each. Miller had more breweries, leading to the average distance from a Miller brewery to a market being 314 miles. In part potentially due to this increased capacity, the number of Miller brands is much greater than the number of Coors brands. On average, Miller supplies 27 brands to the entire country while Coors only supplies 13 brands. The lack of capacity and distance from markets could potentially affect the cost of producing new products from these sites.

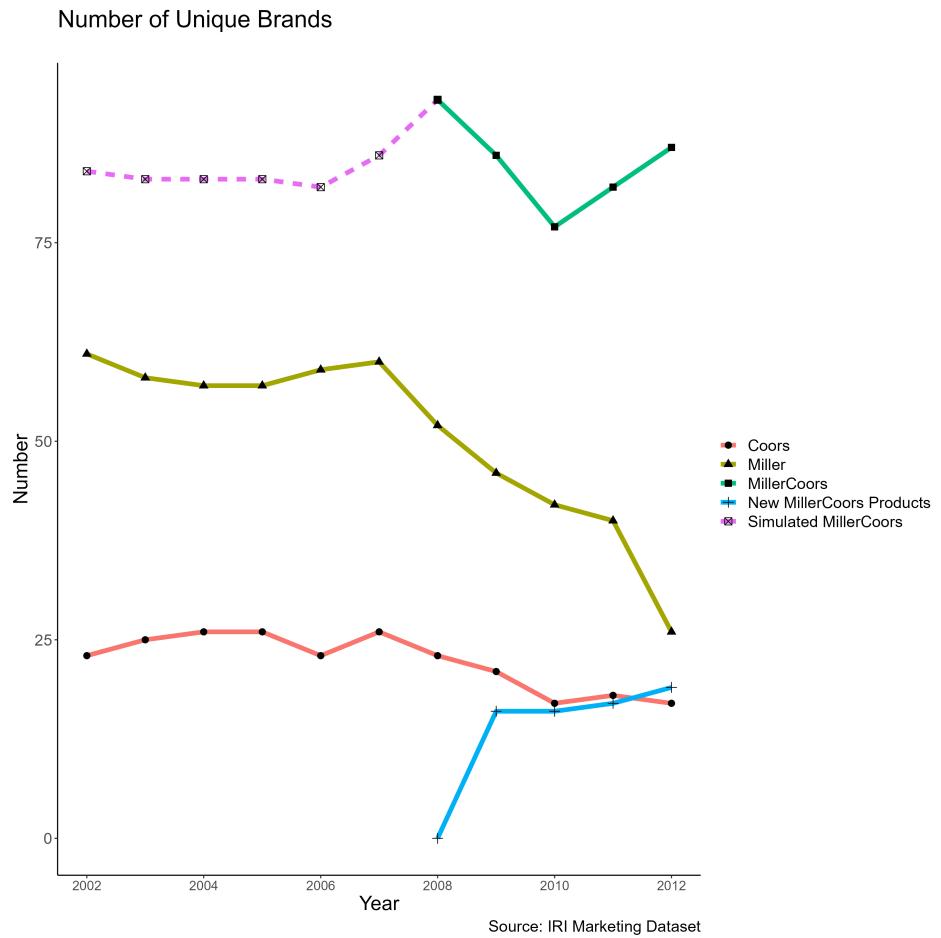
### 3.4 The Merger's Effect on National Brand Variety

We next compare how Miller and Coors brand variety changed after the merger. In Figure 5, we examine the total amount of unique brands offered during each year for Miller, Coors and MillerCoors. We designate whether a brand is a Miller brand or Coors brand based on the parent company of the brand prior to the merger. We find that while brand variety for Miller and Coors declines after the merger, the overall effect of the merger is mitigated by new product introduction from the combined company.

**Table 1:** Summary Statistics

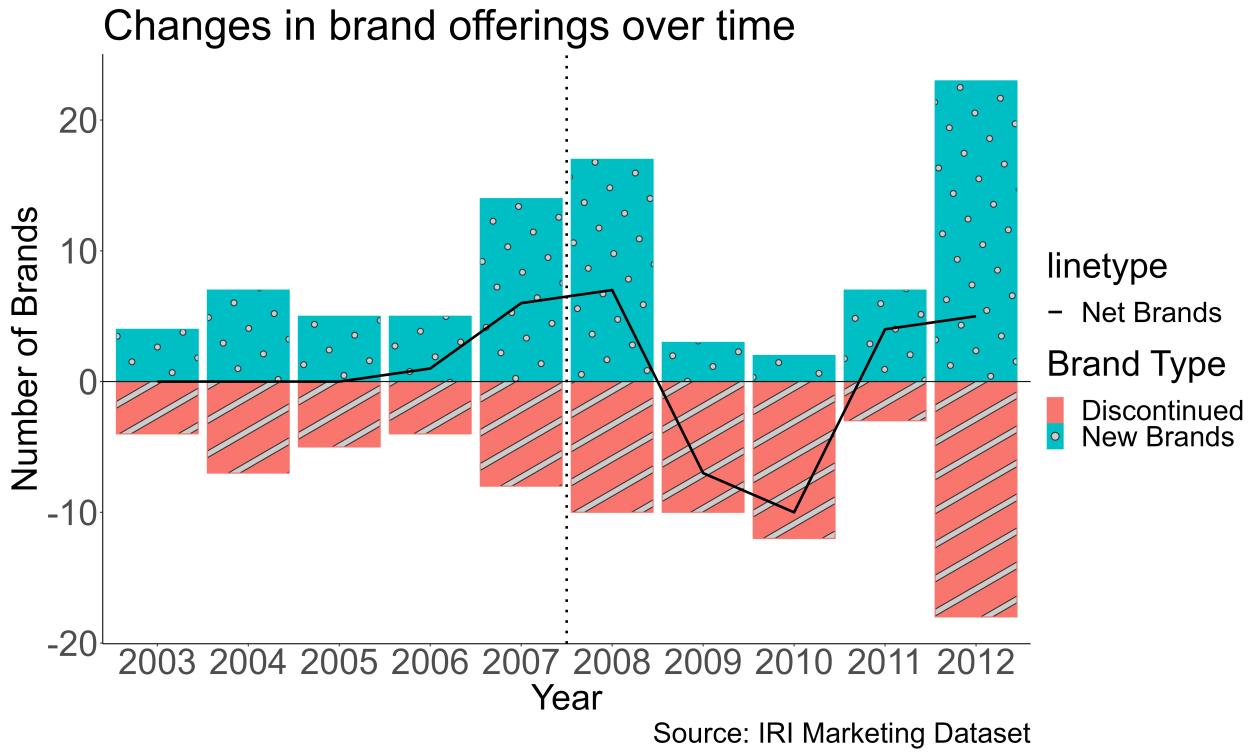
Variables	Mean	Standard Deviation	Min	Max
Price of good per product	8.6431	4.6013	0.01	282.5500
Parent Company National market share	0.1726	0.1474	0.00	0.3977
Industry HHI	2085.7500	146.2158	1864.01	2304.3722
Parent Company Regional Market Share	0.1848	0.1678	0.0000	0.6402
Industry Regional HHI	2438.8231	707.3270	1082.2442	4387.0833
Number of Miller Products, National	92.6220	27.1676	25.0000	177.0000
Number of Coors Products, National	48.2464	12.8936	22.0000	97.0000
Number of MillerCoors Products, National	161.8263	35.4402	61.0000	254.0000
Number of Miller Brands, National	26.6053	6.6754	10.0000	42.0000
Number of Coors Brands, National	12.9904	3.3307	6.0000	23.0000
Number of MillerCoors Brands, National	48.9947	8.8273	22.0000	70.0000
Minimum Distance from a Miller or Coors Brewery, in Miles	271.2110	218.0582	12.5304	949.1906
Distance from a Miller Brewery in Miles	298.5952	238.1581	12.5304	949.1906
Distance from a Coors Brewery in Miles	538.0365	245.8177	77.6465	990.6055
Change in Distance from a Miller Brewery after the Merger in Miles	27.3842	51.1858	0.0000	138.7045
Change in Distance from a Coors Brewery after the Merger in Miles	266.8255	244.9850	0.0000	796.9849

Note: This table provides summary statistics for the IRI Dataset for Miller and Coors Beers and the associated companies between 2002 and 2012. The change in distance is calculated by calculating the linear distance between a brewery and the centroid of the designated market. The average price is calculated over all beers in every market considered in the study.



**Figure 5:** This figure depicts the total number of unique brands offered each year by Miller, Coors and MillerCoors. "MillerCoors" denote all brands within the new merged company, starting in 2008, and "Simulated MillerCoors" denotes the sum of "Miller" and "Coors" brands prior to 2008. "New MillerCoors products" denote all new brands created by MillerCoors. This figure depicts all beer brands.

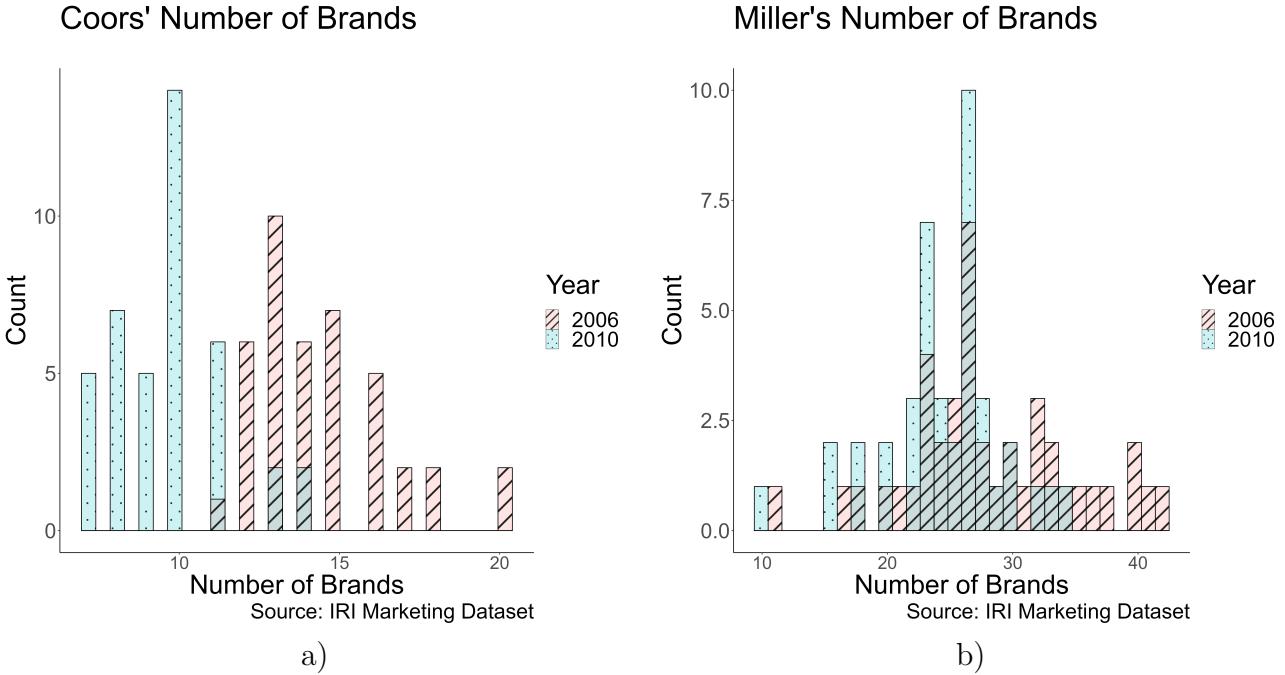
We can further examine what the effects of the merger is by examining the change in new brands over time. Figure 6 depicts this change:



**Figure 6:** This graph shows the change in brands that were added from the prior year. Prior to 2009, "new brands" and "discontinued brands" are the sum of the Coors and Miller new brands and discontinued brands, respectively. From 2009 onward, the "new brands" and "discontinued brands" are for MillerCoors only. 2008 is calculated as the change in brands from Miller and Coors separately to the new merged company. The average total number of Miller and Coors brands prior to the merger is 39, and the average number of MillerCoors brands after the merger is 48.

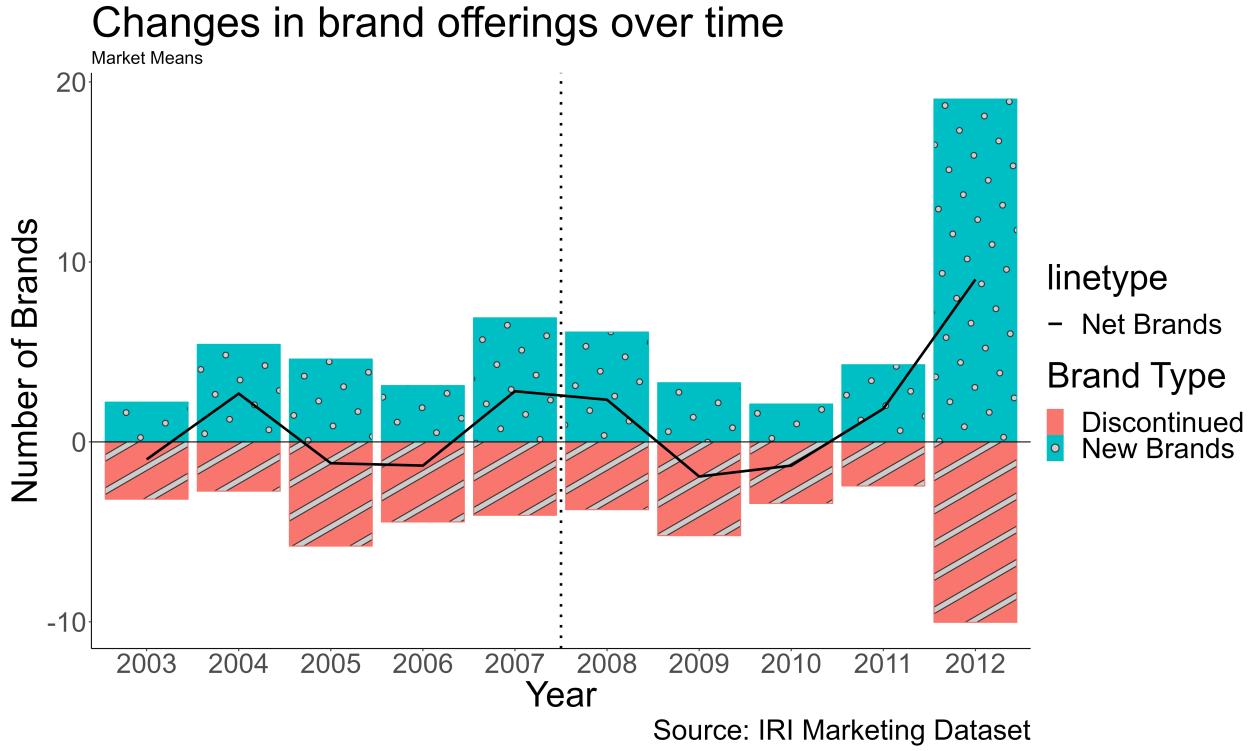
Here, new brand offerings declined in the first few years after the merger before increasing again. Prior to the merger, brand offerings remain stable until 2007, when there was a slight increase. Starting in 2009, less new brands are created. This effect disappears by 2011 and 2012 with a large increase in the number of new brands.

The decline in the number of new brands does not appear to be driven by a small group of markets, as shown by Figure 7. The histograms suggest a decline in brand offerings across all markets after the merger. Prior to the merger, for the entire market, with the exception of one market, Coors offered at least 10 brands while offering at anywhere from 4-11 brands in the twelve pack market. For Miller, for the entire market, there were 17-27 brands offered. For Coors brands, after the merger most cities range between 7 - 12 brands for the entire market. For Miller brands, after the merger most cities range between 15 - 20 brands for the entire market. The decline seems to be stronger for Miller brands, as noted before.



**Figure 7:** This histogram shows the number of brands sold at each market that are designated as sold by Miller or Coors (Miller or Coors brands, respectively) at 2006 and 2010. This does not include brands created by MillerCoors after the date of the merger.

Figure 8 shows the average new brands over markets, and shows no increase until 2012. Here, it appears that the merger had no immediate effect, or at best, a lagged effect that did not occur until the end of the sample.



**Figure 8:** This graph shows the change in brands that were added from the prior year. Prior to 2009, "new brands" and "discontinued brands" are the sum of the Coors and Miller new brands and discontinued brands, respectively. From 2009 onward, the "new brands" and "discontinued brands" are for MillerCoors only. 2008 is calculated as the change in brands from Miller and Coors separately to the new merged company. The average total number of Miller and Coors brands prior to the merger is 39, and the average number of MillerCoors brands after the merger is 48.

These results show there was some brand variety changes after the merger. In the context of the basic intuition, it is possible that some brands were dropped due to high costs or increased similarities to other existing brands, while brands were introduced to capture new markets or had sufficiently low costs. Since there is enough heterogeneity in brand changes, it is possible to estimate what these baseline effects are.

## 4 Reduced Form Model

While the summary statistics suggest that the merger's effect on brand variety is positive across all markets, it is less clear if any particular underlying time or market-level trends affecting these results, as well as what these changes would imply for products. We first control for potential confounding factors regarding the relationship between the merger and brand variety. We explain this basic linear model, justify the assumptions and show the results of the model: a decline in brand variety but a null effect on product variety, implying brand consolidation and production of new products in existing brands. We next describe the second model used to control for potential confounding factors regarding the relationship between the merger and brand variety: a difference-in-differences model akin to O. C.

Ashenfelter, Hosken, and Weinberg (2015). We explain why this model, justify the assumptions and show the results of the model: a large decline in brand variety relative to other top competitors. We finally correct for some issues of these models using several robustness checks.

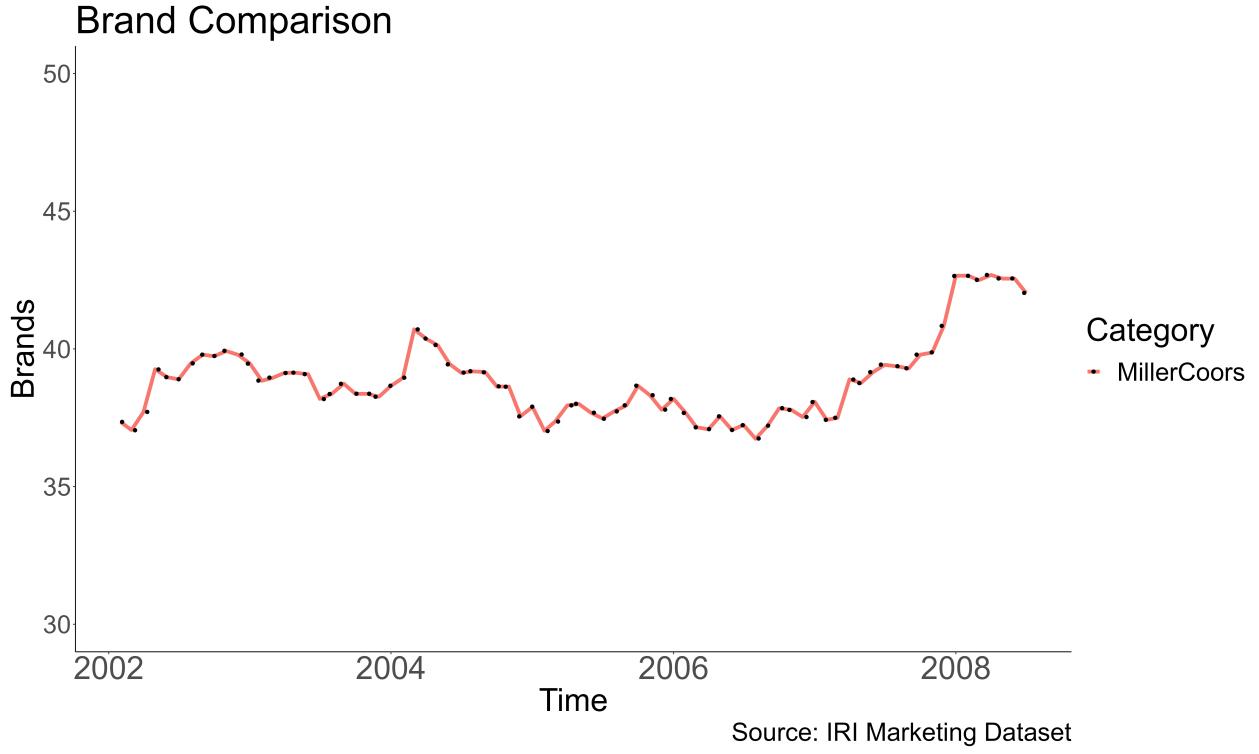
## 4.1 Model Description

Although the changes in brand variety described in previous sections suggest some changes in brands after the merger, it is possible that this could be related to changes over time or specific market characteristics. To better control for this, we estimate the following linear model by market  $m$  and month  $t$ :

$$\log(\text{Number of Brands}_{mt}) = \alpha_{mt} + \beta_1(\text{Post Merger}_t) + \epsilon_{mt} \quad (4)$$

$\alpha_{mt}$  are state-time fixed effects,  $\text{Post Merger}_t$  is a dummy for whether the observation is at or after July 1, 2008, denoted as the post-merger period, and  $\epsilon_{mt}$  is a term representing unobserved market-specific heterogeneity at the market-month-year level. This basic model tests what percentage change of the number of brands is affected by the merger, controlling for observed heterogeneity. Another variant of the model that we also test includes separate dummies on each year to see if there are any notable changes per year and to better match the pattern seen in the summary statistics.

To precisely estimate the coefficients of the model, we implicitly assumes no changes to the underlying market happen before and after the merger. Examining brand variety prior to the merger provides evidence justifying this assumption. Figure 9 shows the average brand variety prior to the merger in 2008. Up until the start of 2008, the graph is mostly flat save for some increases in 2004 and prior to the merger. Even then, any changes are fairly small - approximately a change of 3-5 brands at most.



**Figure 9:** Note: This graph measures the average monthly brand variety for Miller and Coors from January 2002 to May 2007. Brand variety is measured by the number of unique brands each company has.

## 4.2 Linear Model Results

We first estimate the effect of the merger on brand variety before and after the merger. Table 2 shows the results of the linear model.

These results are mixed but ultimately show evidence against the positive effect found in the summary statistics. The effect decreases from a gain of 9.7% to a loss of 2.2%, implying market and time effects play a large role in explaining brand variety changes after the merger. To put this latter term in perspective with a back of the envelope calculation, after the merger markets lost on average 2.2% of brands post merger or about a brand.

We next test whether these results hold under a finer definitions for products. Rather than use brands, we use products, which is a combination of brand, product packaging, and ounce size. The implication of these results is that while brands may have changed, there may have been an increase in other products. Table 3 shows the model under this finer definition.

The ultimately null results of the merger's effect on product variety combined with the results on brand variety above provide some evidence of product consolidation. With no controls, the effect is positive and implies a five percent increase in product variety due to the merger. However, under the introduction of year fixed effects, the point estimate of the effect of the merger on product variety is 0.1%, but this effect is indistinguishable from zero. Taken with the brand results, this implies that the firm may have dropped a brand in order to create

**Table 2**

<i>Dependent variable:</i>					
	log(Number of Brands)				
	(1)	(2)	(3)	(4)	(5)
Post Merger	0.097*** (0.005)	0.096*** (0.005)	0.096*** (0.003)	-0.009 (0.008)	-0.022*** (0.008)
Constant	3.647*** (0.003)	3.649*** (0.009)	3.568*** (0.009)	3.571*** (0.008)	3.567*** (0.009)
State FE	No	No	Yes	Yes	Yes
Month FE	No	Yes	Yes	No	Yes
Year FE	No	No	No	Yes	Yes
Observations	4,978	4,978	4,978	4,978	4,978
R <sup>2</sup>	0.069	0.071	0.706	0.741	0.744
Adjusted R <sup>2</sup>	0.069	0.068	0.704	0.739	0.742

*Note:*

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Note: Observations are at the market/month/year level. ‘Post Merger’ indicates after July 2008, the start of the merged company’s operation. ‘Number of Brands’ indicates the total number of brands produced by Miller and Coors from 2002 to 2012. These results include all non-statewide markets and all brands produced by Miller and Coors. HC1 robust standard errors used.

**Table 3**

<i>Dependent variable:</i>					
	log(Number of Products)				
	(1)	(2)	(3)	(4)	(5)
Post Merger	0.067*** (0.007)	0.067*** (0.007)	0.067*** (0.003)	0.017* (0.009)	0.011 (0.010)
Constant	4.820*** (0.004)	4.819*** (0.012)	4.764*** (0.008)	4.780*** (0.008)	4.777*** (0.010)
State FE	No	No	Yes	Yes	Yes
Month FE	No	Yes	Yes	No	Yes
Year FE	No	No	No	Yes	Yes
Observations	4,978	4,978	4,978	4,978	4,978
R <sup>2</sup>	0.021	0.022	0.738	0.745	0.746
Adjusted R <sup>2</sup>	0.021	0.020	0.736	0.743	0.744

*Note:*

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Note: Observations are at the market/month/year level. ‘Post Merger’ indicates after July 2008, the start of the merged company’s operation. ‘Number of Products’ indicates the total number of brands produced by Miller and Coors from 2002 to 2012. These results include all non-statewide markets and all products. HC1 robust standard errors used.

more products within their main brands. These results indicate the decline in brands was offset by an increase in products, leading to an ultimately null result.

Overall, these results imply a slight decline in the number of brands offered by Miller and Coors offset by potential increases in products. However, there are shortcomings of this basic model. First, there are no controls for competitive effects. There could have been industry-specific effects from this merger which could influence these results, and a comparison examining only the firms involved ignores this. Secondly, there could be other changes that happen around the merger that the linear model would not capture well. For example, the recession occurred during the sample period. If it had an effect on demand for alcohol during this time compared to prior to the merger, this could bias the results upwards. Therefore, another model is needed to better control for these industry-wide effects.

### 4.3 Difference-in-Differences Model

We describe the difference-in-differences model here, which uses a subset of the firm's data alongside the Miller and Coors data to estimate how MillerCoors brand offerings compare in regards to competitors. This model is used for comparing what brand variety effects are in relation to competitors, and may be important for policymakers. We describe the variables and estimation strategy here, as well as what groups we use for comparison.

We use the model below to estimate the impact of the merger on the number of brands of each firm  $i$ , in each market  $m$  at each period  $t$ :

$$\log(\text{num brands})_{imt} = \alpha_{imt} + \beta_1(\text{Post Merger}_t) + \beta_2(\text{Miller}_i + \text{Coors}_i) + \beta_3(\text{MillerCoors}_i) + \epsilon_{imt}$$

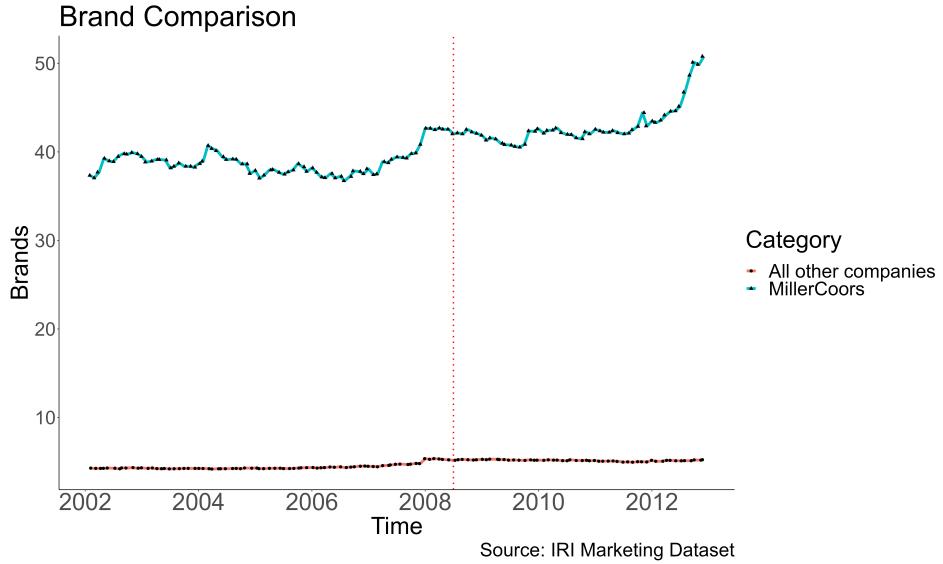
Where  $\alpha_{imt}$  represents market, firm and time fixed effects,  $(\text{Post Merger}_t)$  is an indicator for whether the observation is after the completion of the merger,  $\text{Miller}_i + \text{Coors}_i$  is a sum of the indicators for Miller and Coors brand, and  $\text{MillerCoors}_i$  is an indicator for whether the brand is a MillerCoors brand. The last coefficient acts as a difference-in-differences coefficient of interest, as it measures the additional impact of the number of brands after the merger and under the merged company, compared to the control group.

We employ two different control groups to compare the effects on the merger on brand variety. One important distinction is that firms may act differently with brand variety depending on their size. Craft Breweries, which are typically small in overall market share, only have so much capacity to not only provide variety but to ship it to every market in the United States. Therefore these breweries are typically local. To deal with this issue, we examine two groups: all firms in the data set and firms in the top 5 quintile of market share, which is the set of firms used in O. C. Ashenfelter, Hosken, and Weinberg (2015).

The difference-in-differences model implicitly assumes both Miller and Coors and their competitors were similar prior to the merger. We provide evidence that the difference-in-differences assumption is valid when using the top 5% of firms in the market. We first examine how MillerCoors compares between all firms. However, this may not be an appropriate comparison. Many firms are small and produce only a few brands, such as regional

brands and craft brewing companies. First, we plot the average MillerCoors brand variety across markets versus the average brand variety across all firms and all markets. Figure 10 displays the comparison of Miller and Coors brand variety versus all firms.

**Figure 10**



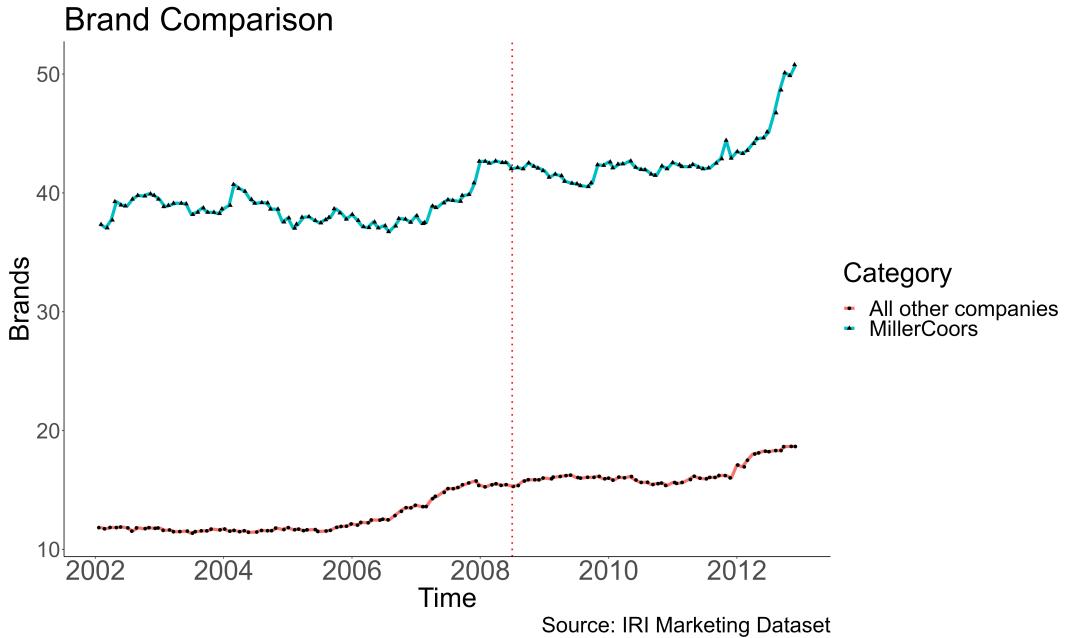
Note: Observations are at the month/year level. This graph plots the average of the number of brands offered over all markets. Miller and Coors are combined as one company prior to their merger. The Red dashed line denotes the date the Miller Coors merger was finalized.

As seen in this figure, this comparison group greatly differs by levels, and may not be an appropriate group for comparison. Much of this comes from smaller firms in the data set, such as craft breweries.

We next examine how MillerCoors compares between firms in the top 5% market share quartile, analogous to the comparison group used in O. C. Ashenfelter, Hosken, and Weinberg (2015). We focus on the top 5% as it may be a better comparison group to Miller and Coors, who were the second and third largest breweries in the country prior to the merger. This comparison group has been used by other works in the literature (Miller and Weinberg (2017)). First, we plot the average MillerCoors brand variety across markets versus the average brand variety across all firms in the top 5% market share quartile and all markets. Figure 11 displays the comparison of Miller and Coors brand variety versus all firms.

With the exception of an increase prior to the merger, driven by rapid growth by Anheuser-Busch in 2007, the graphs are far closer on levels than the previous figures. While the inclusion of Anheuser-Busch is a concern due to their rapid growth prior to the merger, removing it from the group does not change the sign of the results below.

**Figure 11**



Source: IRI Marketing Dataset

Note: Observations are at the month/year level. This graph plots the average of the number of brands offered over all markets. Miller and Coors are combined as one company prior to their merger. The Red dashed line denotes the date the Miller Coors merger was finalized.

#### 4.4 Difference-in-differences Model Results

The impact of the merger when compared to the first group may not represent the true outcome, as seen in Table 4.

Similar to the brand variety change results in the linear model, there is no significant effect of the merger on brand variety, and much of the effect is on the firm itself. The point estimates for the difference-in-difference coefficient, MillerCoors, is 0.01, which would imply a 1 percent change in the amount of brands offered after the merger for MillerCoors, compared to all competitors of the market. However, this coefficient is not significant, regardless of state, month and year fixed effects.

However, the effect of the merger on brand variety changes when we directly compare MillerCoors brand variety changes to the other top competitors in the beer industry. Table 5 shows the results for the difference in differences model when compared to the AHW group:

Here, we find a large and significant decline in brand variety for MillerCoors compared to its competitors. The point estimates for the difference in difference coefficient, MillerCoors, is -0.32, which would imply a 32 percent decline in the amount of brands offered after the merger for MillerCoors, compared to all other competitors in the AHW group. This effect remains significant with year, month and state fixed effects.

Finally, to verify how these results can compare against the linear model, we examine the impact over time for just the top quartile results. This is to see if the positive effect is driven by brand increases in the later years or at the start of the merger. We use the model below,

**Table 4**

<i>Dependent variable:</i>					
	log(Number of brands)				
	(1)	(2)	(3)	(4)	(5)
Post Merger	0.077 (0.047)	0.078 (0.048)	0.073 (0.047)	-0.010 (0.011)	-0.012 (0.011)
Miller or Coors	2.637*** (0.088)	2.637*** (0.088)	2.638*** (0.091)	2.640*** (0.091)	2.640*** (0.091)
MillerCoors	0.012 (0.047)	0.012 (0.047)	0.017 (0.047)	0.014 (0.048)	0.014 (0.048)
Constant	1.001*** (0.088)	1.012*** (0.088)	0.985*** (0.097)	1.054*** (0.086)	1.063*** (0.085)
State FE	No	No	Yes	Yes	Yes
Month FE	No	Yes	Yes	No	Yes
Year FE	No	No	No	Yes	Yes
Observations	297,105	297,105	297,105	297,105	297,105
Adjusted R <sup>2</sup>	0.098	0.098	0.101	0.102	0.102

*Note:*

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Note: Observations are at the firm/market/month/year level.'Post Merger' indicates after July 2008, the start of the merged company's operation.

**Table 5**

<i>Dependent variable:</i>					
	log(Number of brands)				
	(1)	(2)	(3)	(4)	(5)
Post Merger	0.419*** (0.152)	0.421*** (0.152)	0.421*** (0.152)	0.033 (0.048)	0.023 (0.045)
Miller or Coors	1.402*** (0.269)	1.402*** (0.269)	1.402*** (0.269)	1.391*** (0.266)	1.391*** (0.266)
MillerCoors	-0.322** (0.152)	-0.322** (0.152)	-0.322** (0.152)	-0.311** (0.144)	-0.311** (0.144)
Constant	2.245*** (0.269)	2.247*** (0.270)	2.151*** (0.287)	2.578*** (0.325)	2.573*** (0.328)
State FE	No	No	Yes	Yes	Yes
Month FE	No	Yes	Yes	No	Yes
Year FE	No	No	No	Yes	Yes
Observations	38,749	38,749	38,749	38,749	38,749
Adjusted R <sup>2</sup>	0.296	0.296	0.312	0.333	0.333

*Note:*

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Note: Observations are at the firm/market/month/year level.'Post Merger' indicates after July 2008, the start of the merged company's operation.

with observations for firm  $i$  at time  $t$  in market  $m$ :

$$\begin{aligned} \log(\text{Number of Brands}_{imt}) = & \alpha_{mt} + \beta_0(\text{Miller}_i + \text{Coors}_i) + \\ & (\text{Year\_1\_After\_Merger}_t)\beta_1 + (\text{Year\_1\_After\_Merger}_t * \text{MillerCoors}_i)\beta_2 + \\ & (\text{Year\_2\_After\_Merger}_t)\beta_3 + (\text{Year\_2\_After\_Merger}_t * \text{MillerCoors}_i)\beta_4 + \\ & (\text{Year\_3\_After\_Merger}_t)\beta_5 + (\text{Year\_3\_After\_Merger}_t * \text{MillerCoors}_i)\beta_6 + \\ & (\text{Year\_4\_and\_Above\_After\_Merger}_t)\beta_7 + \\ & (\text{Year\_4\_and\_Above\_After\_Merger}_t * \text{MillerCoors}_i)\beta_8 + \epsilon_{imt} \end{aligned} \quad (5)$$

The main difference between this model and the previous one is that here, we interact each year after the merger with the MillerCoors dummy variable. After the fourth year, we group all observations together. The results for this model adding month and state fixed effects are in Table 6.

These results grow increasingly negative over time. Under month and year fixed effects, the difference-in-differences coefficient interacted by years after the merger grows from -0.42 to -0.49. This implies the effect of the merger grew over time, with the effect at its largest towards the end of the sample. In percentage terms and as a back of the envelope calculation using the mean number of MillerCoors brands per market, these coefficients imply a decline of 24 brands, compared to competitors.

## 4.5 Variants on Control Groups

While the results above show how the number of brands compare against firms that are not part of the merger (the control group), there are concerns about the control group used and if the results would still hold under corrections to the control group. In this section, we explain these issues and the two techniques we use to deal with these issues.

### 4.5.1 Key issues with the merger and comparisons

There are two main issues with the comparison group, of which the following two techniques attempt to deal with. Both issues are related to the parallel trends assumption, mainly how the control group compares with levels and with pre-trends. First, the majority of companies produce less brands than Miller, Coors and Anheuser-Busch, the top three firms in market share. Figure 12 shows the average number of brands for the top firms in market share during the 2002-2012 period. As such, comparisons on levels may be difficult. While reducing the data to the firms with the top five percentile of market share does alleviate this issue, and allow better comparisons between large, similar firms, this leads to a second issue regarding parallel trends.

The second issue is the pre-trend the control group has prior to 2008. The majority of the increase prior to the merger occurs due to an increase in Anheuser-Busch's brand variety in 2006. Additionally, Anheuser-Busch and InBev did merge in 2007, however InBev is

**Table 6**

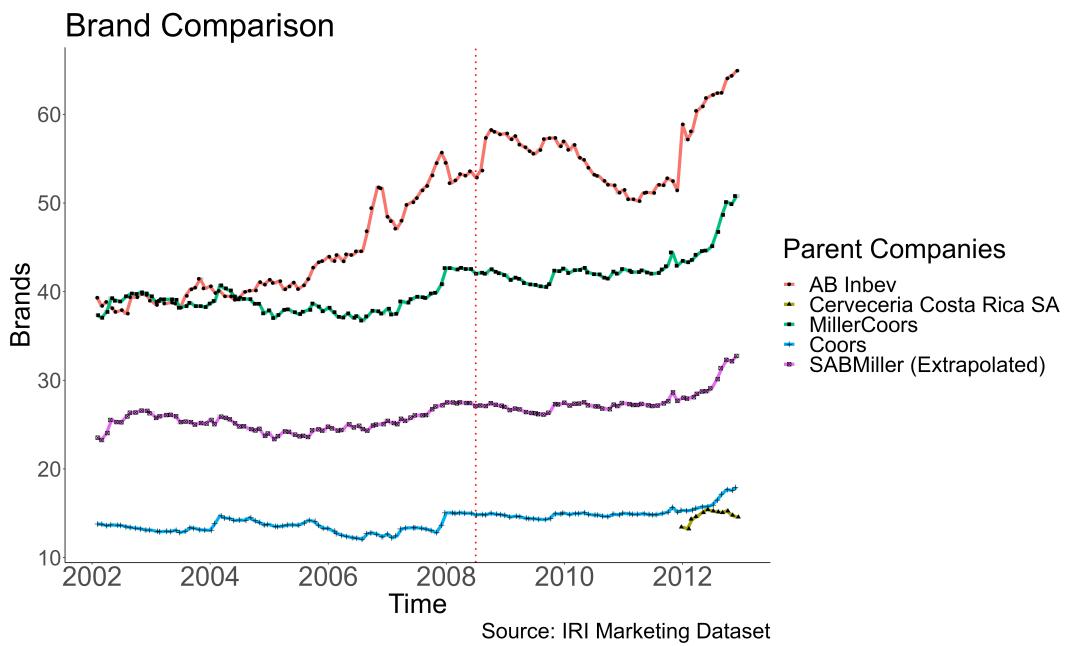
<i>Dependent variable:</i>				
	log(Number of brands)			
	(1)	(2)	(3)	(4)
Year 1	0.484*** (0.155)	0.486*** (0.154)	0.485*** (0.155)	0.487*** (0.154)
Year 1 *MillerCoors	-0.422*** (0.155)	-0.423*** (0.154)	-0.422*** (0.155)	-0.423*** (0.154)
Year 2	0.518*** (0.160)	0.519*** (0.160)	0.519*** (0.160)	0.520*** (0.160)
Year 2 *MillerCoors	-0.451*** (0.160)	-0.453*** (0.160)	-0.451*** (0.160)	-0.452*** (0.160)
Year 3	0.526*** (0.162)	0.527*** (0.162)	0.527*** (0.163)	0.528*** (0.162)
Year 3 *MillerCoors	-0.457*** (0.162)	-0.458*** (0.162)	-0.457*** (0.162)	-0.458*** (0.162)
Year 4+	0.628*** (0.168)	0.629*** (0.167)	0.634*** (0.169)	0.635*** (0.168)
Year 4+ *MillerCoors	-0.492*** (0.168)	-0.493*** (0.167)	-0.492*** (0.168)	-0.493*** (0.167)
State FE	No	Yes	No	Yes
Month FE	No	No	Yes	Yes
Observations	27,669	27,669	27,669	27,669
Adjusted R <sup>2</sup>	0.294	0.304	0.294	0.304

*Note:*

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Note: Observations are at the firm/market/month/year level. The year variables indicate after July 2008, the start of the merged company's operation. Only the ten largest firms by national revenue shares prior to 2007 are included in this regression.

**Figure 12**



Note: This graph plots the average of the number of brands offered over all markets. Miller and Coors and Anheuser-Busch and Inbev are combined as one company prior to their merger. Miller and Coors number of brands are added to this graph for comparison. Observations are at the monthly level. The Red dashed line denotes the date the MillerCoors merger was finalized. The lines in grey are firms where the minimum number of brands they produced at any time is less than ten.

an Belgian company with no breweries located in the United States prior to the merger.<sup>14</sup> While removing these companies from the data could help, Anheuser-Busch InBev is the top competitor and has the largest number of brands, and this causes issues with using comparable levels and companies as described previously. Therefore, removing Anheuser-Busch and Inbev is not preferable. In the following sections and in the Appendix, we explain how we correct this by removing the time trend from the data using a strategy from Goodman-Bacon (2021) and synthetic control methods from Abadie and Gardeazabal (2003).

#### 4.5.2 Detrending the data

One method to create a better control group is to remove the time trend from the data. This method comes from Goodman-Bacon (2021), and involves the following two-step process. In the first stage, we estimate linear trends in the number of brands for the control group and the treatment group using only the pre-treatment period. Next, we subtract the predicted time trend from the number of brands from the entire period. This method is designed to remove any trends from the groups that may not be accounted for by year fixed effects, such as the increase in Anheuser-Busch's brand variety.

Figure 13 displays the de-trended data for the top five percentile comparison group, which does match the pre-trend prior to the merger better on levels, but has more fluctuations in the earlier part of the sample. Although this method helps better match the pre-trend more, and based on the figure MillerCoors still undergoes a large increase in brand variety after the merger, this earlier data causes some issue.

Using this detrended data, we estimate a version of the model that accounts for negative brand values that has the detrended number of brands as the dependent variable. The difference-in-difference coefficient, MillerCoors, now represents the number of brands lost after the merger caused by the merger and by being part of the MillerCoors company. The results are in Table ??:

The effect on the detrended data is negative and larger than the baseline results. After the merger, the number of brands offered by MillerCoors compared to its competitors ranges from about -6 to -5.9, and remains significant under standard fixed effects. Net of this time trend, the effect is smaller but still negative.

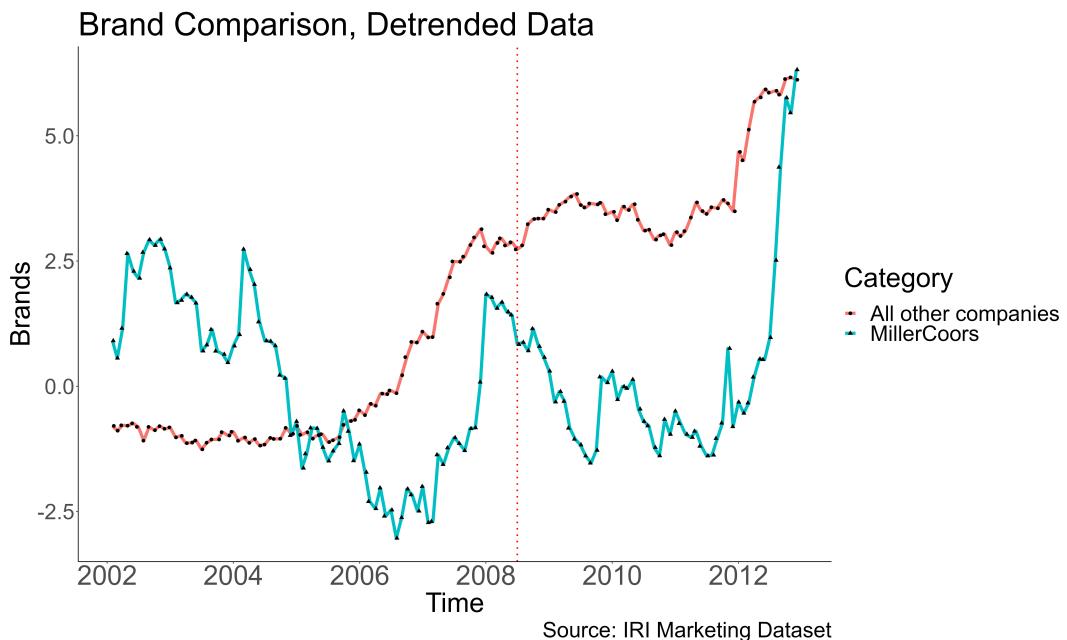
## 4.6 Summary of the two models

Several conclusions can be drawn from these these two classes of models. The linear model shows that Miller and Coors experienced a decrease in brand variety per market after the merger, compared to their brand variety prior to the merger. However, there is no decline in product variety, indicating some products within established brands were created after the merger to offset the loss of certain brands. This corroborates a finding with prior work that merging firms coalesce product lines to core competencies.

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<sup>14</sup>Since the focus of this paper is on a large domestic merger with cost synergies, this merger is not discussed here. See NY Times, “Anheuser-Busch Agrees to Be Sold to InBev”

**Figure 13**



Note: This graph plots the average of the number of brands offered over all markets. Miller and Coors are combined as one company prior to their merger. Miller and Coors are kept separate for comparison. Observations are at the monthly level. The Red dashed line denotes the date the MillerCoors merger was finalized. The detrending procedure is as follows: in the first stage, we estimate linear trends in the number of brands for the control group and the treatment group using only the pre-treatment period. Next, we subtract the predicted time trend from the number of brands from the entire period.

**Table 7**

<i>Dependent variable:</i>					
	Detrended Number of Brands				
	(1)	(2)	(3)	(4)	(5)
Post Merger	6.069** (2.650)	6.088** (2.653)	6.092** (2.650)	0.922 (0.967)	0.668 (0.863)
Miller + Coors	-0.635 (4.967)	-0.635 (4.966)	-0.632 (4.962)	-0.757 (4.978)	-0.759 (4.978)
MillerCoors	-5.993** (2.650)	-5.992** (2.651)	-5.997** (2.648)	-5.869** (2.551)	-5.867** (2.550)
Constant	0.689 (4.967)	0.725 (5.041)	-0.102 (5.600)	6.693 (7.508)	6.744 (7.646)
State FE	No	No	Yes	Yes	Yes
Month FE	No	Yes	Yes	No	Yes
Year FE	No	No	No	Yes	Yes
Observations	38,749	38,749	38,749	38,749	38,749
Adjusted R <sup>2</sup>	0.042	0.041	0.055	0.068	0.067

*Note:*

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Note: Observations are at the firm/market/month/year level. The ‘Post Merger’ variable indicates after July 2008, the start of the merged company’s operation. Only the ten largest firms by national revenue shares prior to 2007 are included in this regression.

However, the linear alone may not be sufficient for understanding overall product variety changes after the merger. We therefore create a difference in difference model to control for competitor effect. We find a decrease in brand variety compared to the top competitors, but no decrease in brand variety when compared to all brands on the market. Which effect seems plausible is heavily reliant on market definition, which this paper takes no stance on but provides multiple results to address this.

A model is needed to explain how significant this change truly is for consumers. While the data appendix does show the majority of discontinued brands were low revenue, low sales brands, consumer welfare may depend more on the overall products currently offered, and consumers may substitute to existing products in the market. Alternatively, consumers may not care about MillerCoors products, and the gain in product variety from that brand alone may lead to little consumer welfare changes. Therefore, we need a consumer welfare model to see which of these two reduced form models aligns best with final consumer outcomes. With this in mind, we return to the product level for the structural model.

## 5 Structural Model

To fully estimate the effects of changing product variety on consumer welfare, we estimate a model of consumer demand during the merger period. By estimating this model, we can incorporate a flexible system of consumer demand to get precise consumer welfare results. Additionally, we can use this model to complete our main counterfactual - what would consumer surplus and total surplus be had changes in product variety not occurred?

### 5.1 The Demand Model

Following the literature, we use the random coefficient nested logit (RCNL) model to estimate consumer demand for beer. This model and models analogous to it has been used in a variety of works studying this industry and others. This model is our preferred consumer demand model, as it allows us to flexibly estimate consumer preferences for specific types of beer and may better match shopping behavior. We use the notation from Miller and Weinberg (2017) to describe the model below.

The model is illustrated as follows. Suppose there are  $m = 1, \dots, M$  markets observed during  $t = 1, \dots, T$  time periods. Per market and per time, there are  $i = 1, \dots, N_{mt}$  consumers in each period. Each consumer decides whether to purchase no good (the outside good), or two types of beer: an Ale or a Lager (defined as a non-Ale in the data). Once decided on the type of good, they then choose a specific good in that category. The products observed are represented as  $j = 1, \dots, J_{mt}$ , with the outside good represented as  $j = 0$ . Products are defined by a combination of brand, the type of good they are, the packaging type, and the total size of the product in ounces. Prices are standardized at price per OZ. The conditional indirect utility that consumer  $i$  receives from a product  $j$  is represented by the following:

$$U_{ijmt} = \sigma_1 + (\alpha_1 + \sigma_2 y_i) p_{jmt} + (\alpha_2 + \sigma_3 \nu_1) \mathbb{1}\{\text{Import}\} + (\alpha_3 + \sigma_4 \nu_2) \mathbb{1}\{\text{Light}\} + FE_t + FE_j + \xi_{jmt} + \epsilon_{ijmt}^{NL}(\rho) \quad (6)$$

Where  $y_i$  is the average income in the market,  $p_{jmt}$  is the price of the product,  $\nu_k$  for  $k \in \{1, 2, 3, 4\}$  is the unobserved household shock for the household and the product attributes,  $FE_t$  is the year fixed effects,  $FE_j$  for product fixed effects,  $\mathbb{1}\{\text{Light}\}$  indicates whether it is a Light beer,  $\mathbb{1}\{\text{Import}\}$  indicates whether it is a Import beer,  $\xi_{jmt}$  is the product by market by time demand shock, and  $\epsilon_{ijmt}^{NL}(\rho)$  is the error term, as a function of which type of product was purchased. We normalize the outside good's mean utility to 0, so buyers only receive  $\epsilon_{ijmt}^{NL}(\rho)$ . Buyers can purchase any lager or ale beer within the dataset, with any beers not in the dataset being part of the outside good.

Under the assumption of a nested logit, we assume the following specification for the error term, given two groups  $g \in \{0, 1\}$ , where group 1 defines the ales, and group 2 defines the lagers. Then:

$$\epsilon_{ijmt}^{NL}(\rho) = \Xi_{igmt} + (1 - \rho)\epsilon_{ijmt} \quad (7)$$

Where  $\epsilon_{ijmt}$  represents the I.I.D. extreme value draw,  $\Xi_{igmt}$  is a draw from a unique distribution such that  $\epsilon_{ijmt}^{NL}(\rho)$  is extreme value, and  $\rho$  is a nesting parameter between 0 and 1. Larger  $\rho$  correspond to greater correlation for products within the same nest, and less substitutions between products not in the nest. We also normalize the indirect utility of the outside good such that  $U_{i0mt} = \epsilon_{i0mt}$ , and assume the market sizes are the number of unit sales within each region. The outside good contains any beers sold by companies not within the top ten beers of market share, any malt beverages, any other alcohol products such as wine, and beer sold outside of supermarkets. This implicitly assumes these outside good group firms do not price strategically with respect to the firms in this model.

From this specification, we can derive logit choice probabilities for market  $m$  and brand  $j$  at time  $t$  seen in Berry, Levinsohn, and Pakes (1995). Multiplying these logit choice probabilities by the market size, we can derive demand as a function of product characteristics, prices, competitor's product characteristics and consumer characteristics. Market shares can then be represented as

$$s_{jmt} = \frac{1}{N_{mt}} \sum_{i=1}^{N_{mt}} \frac{\exp(u_{ijmt} - \Xi_{igmt} + (1 - \rho)\epsilon_{ijmt})/(1 - \rho)}{\exp(I_{igmt}/(1 - \rho))} \frac{\exp I_{igmt}}{\exp I_{imt}} \quad (8)$$

Where  $I_{igmt}$  and  $I_{imt}$  are the Mcfadden (1977) inclusive values to normalize the shares. This allows the normalization on the mean indirect utility of the outside good to be  $I_{i0mt} = 0$ , the inclusive value of the inside products is  $I_{igmt} = (1 - \rho) \log \sum_{j=1}^{J_{mt}} \exp(u_{ijmt} - \Xi_{igmt} + (1 - \rho)\epsilon_{ijmt})/(1 - \rho)$  for good type  $g \in \{1, 2\}$ . Finally the inclusive value for all products is  $I_{imt} = \log(1 + \exp I_{igmt})$ .

Under the assumption that all  $\nu_k = 0$ , this model reduces to the standard nested logit model, which we use for comparison purposes later. In this case, the utility is linear in parameters:

$$U_{ijmt} = \alpha_1 p_{jmt} + \alpha_2 \mathbb{1}\{\text{Import}\} + \alpha_3 \mathbb{1}\{\text{Light}\} + FE_t + FE_j + \xi_{jmt} + \epsilon_{ijmt}^{NL}(\rho) \quad (9)$$

and therefore the difference in log market shares relative to the mean market share is

$$\log(s_{jmt}) - \log(s_{0mt}) = \alpha_1 p_{jmt} + \alpha_2 \mathbb{1}\{\text{Import}\} + \alpha_3 \mathbb{1}\{\text{Light}\} + FE_t + \rho \log(s_{jmt|g}^{NL}) \xi_{jmt} \quad (10)$$

Where  $s_{jmt|g}^{NL} = s_{jmt} / \sum_{j=1}^{J_{mt}} s_{jmt}$  is the conditional share of product  $j$  among products within each nest.

Although this model is used for comparison, we prefer using the full RCNL for two reasons. First, the nesting parameter allows for flexibility in substitution patterns among similar types of alcohols. Additionally, other papers have adopted the full RCNL model for alcohol related markets, including the paper we want to directly compare results with. Secondly, parameters on taste preferences such as lite beer and international brands cannot be fully estimated without random coefficients, and this may be important given a heterogeneous customer base. We provide both the RCNL and the nested logit for comparison.

## 6 Results

In this section we describe the key results of the paper. The estimation details and instruments, which follow from Miller and Weinberg (2017), can be found in the Appendix. We find sensible coefficients under the demand model, and find new and discontinued products had higher diversion ratios and were more elastic. We then use this model to estimate the two counterfactuals of the paper: what would occur if new products were never created after the merger, and what would occur if discontinued products remained in markets after the merger. We find the loss in consumer welfare from removing new products far outweighs the gain from including discontinued products.

### 6.1 Demand Model Estimation

To estimate the value of the new and discontinued product, we estimate the demand model after the merger, from 2008-2010. We first estimate a standard nested logit for this period of time, for monthly and quarterly data. The results are in Table 8:

Overall, the aggregate models provide more sensible results than the market-level models. Price coefficients are -0.38 and -0.48 in the monthly and quarterly models, respectively, which denote that for every dollar increase in the price of a twenty-four pack, the probability of purchase falls by 38% and 48%, respectively. Meanwhile, the indicators on imported, ale and lite beers are all positive, indicating the probability of purchase for these products is

**Table 8**

	Monthly		Quarterly	
	Aggregate Model	Average of Market Models	Aggregate Model	Average of Market Models
	(a)	(b)	(c)	(d)
Price	-0.3813 (0.0200)	-0.01086 (0.0036)	-0.4837 (0.0492)	-0.0098 (0.0061)
Imported	0.4020 (0.0794)		0.63157 (0.0199)	
Ale	0.86153 (0.0613)		0.9140 (0.0136)	
Lite	0.4495 (0.0263)		0.3675 (0.0638)	
Nested Logit Term	0.0208 (0.0189)	0.9515 (0.0150)	0.01987 (0.0445)	0.9602 (0.0232)
Observations	155253	155253	65306	65306
<i>Other Statistics:</i>				
All Products:				
Median Own Price Elasticity	-4.5726	-2.6397	-5.9153	-3.0426
Median Outside Good Diversion Ratio	0.5076	0.0109	0.4917	0.0066
New Products Only:				
Median Own Price Elasticity	-5.4251	-2.4356	-6.8314	-3.0259
Median Outside Good Diversion Ratio	0.7741	0.1175	0.5096	0.1306

Note: This table shows the results of the Nested Logit Model for the period 2008-2010. The model includes the above variables and the following fixed effects: month, year and indicators on which firm provided the product. For the aggregate model, which calculates demand across all markets and contains all data from 2008 - 2010, we include market fixed effects. For the market level models, which is an estimate of demand for 2008 - 2010 for each of the 39 markets, we exclude the characteristic indicators for computational reasons. Only firms included in the original MW study are included. The 'pyblp' package was used for the estimation of this model.

higher than their counterparts. For the market-level models, these are all the same sign, yet much smaller potentially due to the smaller sample size for each individual model. When examining the elasticities and diversion ratios, we find that the median for the aggregate models is around 4-5 while the market level models ranges from 2-3. These are much smaller, and imply a less elastic good. Again, this could be due to the lack of data when estimating these models as there is only a few years of data.

Notably in both models, the diversion ratio for new products is above all products, and the elasticities for new products are near or above the elasticities for all products. This result shows that new products are not only more sensitive to price changes, but are more easily substitutable with the outside good. This makes sense, as new products are likely not established enough for consumers to have a strong preference towards them. This also shows that any results of the counterfactual may be low - if these products are more easily replaceable, losing them may not decrease consumer welfare as much.

After calibrating the model under a nested logit, we now add complexity to the model and calibrate it under a random coefficient nested logit. We find the following parameters for the random coefficient nested logit in Table 9:

Overall, the RCNL's results match closely with the nested logit model. While the non-random coefficients are similar to the nested logit model, the random coefficients are all insignificant. Notably, the nested logit terms are also insignificant like the prior model. Both price elasticities and outside good diversion ratios are consistent with prior results.

## 7 Counterfactuals

We next examine the following two counterfactuals to examine the value of new products and discontinued products after the merger: what would consumer surplus be if the products newly created after the merger were never made, and what would consumer surplus be if products discontinued after the merger continued to exist? From these two counterfactuals, we can compare consumer surplus from the observed baseline and compare the change in consumer surplus, giving an estimate of the value of these goods. Both of these use the model above, calibrated to the post-merger period, to calculate what these hypothetical consumer surplus changes would be. The benefit here is that the products dropped and added after the merger are known, so no assumptions about which products should be considered in these counterfactuals are needed. The underlying assumption is that every new product was created due to the merger and every discontinued product was dropped due to the merger. If this does not hold, these results provide an upper bound on the value of new products, and a lower bound on the value of discontinued products, respectively.

An important caveat in these counterfactuals is what happens with prices after any market changes. For this, we consider two cases. In the first case, we keep prices constant. This is to consider a case where other firms do not respond to any product variety changes. In the second case, we recalculate prices after products are removed from the markets. This is to allow competitors to readjust after seeing competitor's product variety changes. These prices are calculated through finding the Bertrand price equilibrium after the products have

**Table 9**

	Monthly	Quarterly
	(a)	(b)
Price	-0.3813 (0.0217)	-0.5580 (0.0560)
Price Random Coefficient	0.0000 (0.2765)	0.0239 (0.0734)
Ale	0.8615 (0.0677)	1.0911 (0.2723)
Ale Random Coefficient	0.0000 (14.2829)	0.0000 (13.1826)
Imported	0.4019 (0.1216)	0.8515 (0.3815)
Imported Random Coefficient	0.0117 (6.7652)	-0.0269 (16.3632)
Lite	0.4496 (0.0352)	0.3369 (0.0789)
Lite Random Coefficient	0.0000 (10.7582)	0.0000 (10.3504)
Nesting Term	0.0021 (0.0024)	0.0027 (0.0651)
Random Coefficient Constant	0.0000 (4.9327)	0.5036 (5.2577)
Observations	155253	65306
		Quarterly
		MW Firms Only    Top 5% Firms
		(a)                  (b)
<i>Other Statistics:</i>		
All Products:		
Median Own Price Elasticity	-4.5724	-6.6626
Median Outside Good Diversion Ratio	0.5076	0.4654
New Products Only:		
Median Own Price Elasticity	-5.4248	-7.6794
Median Outside Good Diversion Ratio	0.5478	0.4796

Note: This table shows the results of the Random Coefficient Nested Logit Model for the period 2008-2010.

The model includes the above variables and the following fixed effects: month, year and indicators on which firm provided the product. For the aggregate model, which calculates demand across all markets and contains all data from 2008 - 2010, we include market fixed effects. Only firms included in the original MW study are included. The 'pyblp' package was used for the estimation of this model.

left the market. In order to estimate these new prices, we assume that the products that will be dropped have a marginal cost equal to 125% of the highest marginal cost estimated in the model. This is to guarantee these products will have a large enough cost such that they will not be made.

To provide an appropriate baseline for these results, we replicate as close as possible the data cleaning done in Miller and Weinberg (2017). Since these consumer surplus results ultimately rely on a specification of demand, a market definition and what data is used to estimate the model, to provide correct relative estimates of consumer surplus changes we limit the data as closely to their results as possible. This leads to several major changes regarding discontinued and new products. First, Miller and Weinberg (2017) use three size types for their study: 72 ounces (6 packs), 144 ounces (12 packs), and 288 ounce products (24 packs). Secondly, they include products that do not drop out of markets throughout the sample. To replicate this, we consider products that were in at least ten markets in each period throughout the sample. Notably, this effects the discontinued product results more, as typically products are discontinued to a few markets before being removed completely. These changes limits the number of new brands studied between 2008 and 2010 and discontinued products studied from 2008 and 2009 from 28 to 10 and 21 to 4, respectively.

## 7.1 The Value of New Products

In order to estimate the value of new products, we drop a subset of products that were created after the merger in the period after the merger instead. We consider two subsets: one where the only new products are ones which were added to any market nationally, and one where for each market, we consider which products were newly added for each after the merger. After dropping these products, we re-estimate consumer surplus and estimate the change in consumer surplus under this regime compared to the baseline of the post-merger period. The final calculation to find the value of new products is the difference between the baseline consumer surplus and the consumer surplus under the scenario without the new products, divided by the baseline consumer surplus. We consider two settings where prices do not change and prices readjust as described above. Table 10 shows the change in consumer welfare under these four cases, for the nested logit.

The results for the counterfactual are consistent across the aggregate models for both the nested logit and RCNL model. In the aggregate models, the value of new products coming from the change in consumer surplus ranges from 1.12% to 1.31%, depending on the time dimension the model is estimated at and whether the model allows prices to readjust after the change in product variety. Compared to the results of Miller and Weinberg (2017) which estimate a -3.7% decline in consumer surplus due to both the effects of the merger and the coordinated effects of pricing, the effect estimated in the paper is approximately 34% of that effect. Using Miller and Weinberg's estimate for unilateral effects only, this model's estimated effect is nearly 60% of that. Under the market level models, this effect is much smaller, ranging from at most 0.08% to 0.05%. However, it is still positive, showing that the loss of these new products would still have a negative effect on consumers.

**Table 10:** Change in Consumer Surplus estimating the Value of New Products

		Time	$\Delta CS$ , Prices Fixed	$\Delta CS$ , Prices Adjust
Brands Added to any market	Nested Logit	Monthly	1.2503 %	1.1208 %
		Quarterly	1.3511 %	1.2060 %
	RCNL	Monthly	1.2503 %	1.1208 %
		Quarterly	1.3127 %	1.1844 %
New brand allocation for each market				
	Nested Logit	Monthly	0.0659%	0.0838%
		Quarterly	0.0508%	0.0585%

## 7.2 The Value of Discontinued Products

In order to estimate the value of discontinued products, we add a subset of products that were discontinued after the merger in the period after the merger instead. Due to the decline in the number of brands, and therefore, products studied, we only examine what happens if discontinued products were added to their respective markets nationally, rather than at a per-market basis. Additionally, due to the data cleaning, we are only considering products that were discontinued at the end of 2008. The remaining products either did not exist in at least ten markets prior to being discontinued or were not sold in either six packs, twelve packs or twenty-four packs.

Two assumptions need to be made regarding what the prices and shares would be if the discontinued products existed after 2008. Since these products do not exist in the after-merger period, there is no price or sense of what the shares would have been. We assume that the prices of the discontinued products follow the same pattern as 2008, the last full year the products were available. To calculate the new shares, we start by obtaining the expenditures of these products during 2008 and add them to the total expenditures of all products sold in the market. The shares of the discontinued products from 2008 onward are the expenditures divided by this new total expenditure, and the remaining shares of products in these markets are the expenditures of each product divided by this new total expenditure. The implicit assumption here is that the discontinued products prices only changed with respect to inflation over time, and that with the removal of these products, consumers bought the outside good rather than any products supplied by the companies. This assumption upward biases the results, as it is possible that consumers may substitute to other products owned by the same company, rather than leave the market entirely.

To do this estimation, we first re-calibrate my demand model with data including this new set of discontinued products. The results under this augmented model can be found on Table 11. Overall, results are mostly the same, save for the coefficients on the nested logit parameter being estimated at zero in this model. Since the coefficients in the original model were within two standard deviations of zero in the first nested logit model, this does not seem unusual.

**Table 11**

	Monthly	Quarterly
	(a)	(b)
Price	-0.3925 (0.0188)	-0.4973 (0.0351)
Imported	0.4263 (0.0745)	0.7929 (0.1413)
Ale	0.7322 (0.0559)	0.4908 (0.0794)
Lite	0.4244 (0.0211)	0.3633 (0.0391)
Nested Logit Term	0.0000 (0.0198)	0.0000 (0.0294)
Observations	166005	76474
<i>Other Statistics:</i>		
All Products:		
Median Own Price Elasticity	-4.6990	-6.2912
Median Outside		
Good Diversion Ratio	0.4923	0.4506
Discontinued Products Only:		
Median Own Price Elasticity	-4.9273	-6.6808
Median Outside		
Good Diversion Ratio	NA	NA

Note: This table shows the results of the Nested Logit Model for the period 2008-2010 with products that were previously discontinued. The model includes the above variables and the following fixed effects: month, year and indicators on which firm provided the product. For the aggregate model, which calculates demand across all markets and contains all data from 2008 - 2010, we include market fixed effects. Only firms included in the original MW study are included. The 'pyblp' package was used for the estimation of this model.

**Table 12:** Change in Consumer Surplus estimating the Value of Discontinued Products

		Time	$\Delta CS$ , Prices Fixed	$\Delta CS$ , Prices Adjust
Brands re-added to all markets originally discontinued in, then removed				
	Nested Logit	Monthly	-0.1412 %	-0.1543 %
		Quarterly	-0.1523 %	-0.1732 %
	RCNL	Monthly	-0.1412 %	-0.1543 %
		Quarterly	-0.1468%	-0.1750%

After dropping these products, we re-estimate consumer surplus and estimate the change in consumer surplus under the baseline regime compared to the hypothetical situation of keeping the discontinued products in the post-merger period. Here, the counterfactual where prices remain fixed is identical to the outcome seen in the data, where the products were dropped and prices were adjusted by the firms accordingly. The second scenario is if prices were to adjust further after the removal of the products. For example, suppose a supply-side issue in the counterfactual where these products existed prevented firms from choosing optimal prices. The final calculation to find the value of discontinued products is the difference between the baseline consumer surplus and the consumer surplus under the scenario with the discontinued products, divided by the baseline consumer surplus. Table 12 shows the change in consumer welfare under these four cases, for the nested logit.

The results for this counterfactual are again consistent across the aggregate models for both the nested logit and RCNL model. In the aggregate models, the change in consumer surplus when discontinued products are retained in their markets ranges from -0.175% to -0.141%, depending on the time dimension the model is estimated at and whether the model allows prices to readjust after the change in product variety. Compared to the results of Miller and Weinberg, which estimate a -3.7% decline in consumer surplus due to both the effects of the merger and the coordinated effects of pricing, the effect estimated in the paper is approximately 4% of that effect. Using Miller and Weinberg's estimate for unilateral effects only, this model's estimated effect is 6% of that.

### 7.3 Summarizing the two counterfactuals

These counterfactuals jointly show evidence that the gains from retaining discontinued products are far outweighed by the loss in new product variety after a merger. These results come with several important caveats which are important for later extensions on this topic. For one, these models do not include a supply side and therefore are partial equilibrium results. Secondly, these are benchmarked to the Miller and Weinberg (2017) work, and these results should only be considered in the context of their model. Finally, these results provide an upper bound and lower bound on the value of new products and discontinued products, respectively. The underlying assumption is that all products were discontinued or created due to the merger, which may not necessarily hold. These counterfactuals focus on the most extreme case to provide bounds on what these results could be.

These results are still informative, as they show product variety changes do matter for

consumer surplus effects. New product variety in particular leads to a large gain in consumer surplus. The removal of new product varieties can be considered at a lesser magnitude than price coordination, but 34% of the effect may still important for policymakers. In other industries where product or location variety may be more vital to consumers, such as the drug industry or the supermarket industry, this effect could be significant.

## 8 Conclusion

In this paper, we examine how a merger may affect changes in product variety offered to consumers, and what the effects of product variety changes after the merger may be for consumers. We first motivate this through a simple model of how the reduction in product variety can weakly negatively affect consumers, and then establish the main setting for this project: the Beer Industry and the Miller and Coors merger of 2008. This setting contains a well-established market with a large set of competitors, the merger of two large firms within it, and well-defined product variety that is mapped easily to the main data source for this project, the IRI Marketing Database. After providing evidence of national product varieties decreasing, then increasing late in the sample, we apply two sets of reduced form models to see how this change compares at the market level for the two companies by themselves, and how this change compares against similar competitors in the market. We then answer the second question of what the effects of product variety changes are for consumers by formulating and estimating a model of consumer demand. In the tradition of the Empirical IO literature, the model is a random coefficient nested logit model which incorporates product characteristics with the additional flexibility of product nests and idiosyncratic shocks to consumer's preferences on product characteristics. We align the model closely to Miller and Weinberg's 2018 work, another paper studying this merger that uses a similar model and the same data. Using this model, we consider a counterfactual of what would occur if the new products created after the merger were to not exist and a counterfactual of what would occur if the discontinued products were to be retained after the merger.

This paper finds that at the market level, product variety does change after a merger, and this change is significant for consumers. After the merger, we find that while the number of MillerCoors brands per market falls, the number of products remains constant, implying a streamlining of product choices at the firm level. However, compared to competitors in the market, MillerCoors brand variety falls by 31%. This negative result is robust to removing the time trend. Finally, in the last section of the paper, we find that the loss of new products created after the merger would be detrimental to consumers. The change in consumer surplus coming from the value of new products would be about 1.25%, or benchmarked to the Miller and Weinberg findings, about 34% of the change in consumer surplus occurring due to price changes and coordination. Likewise, we find the loss in consumer surplus from discontinued products would be about -0.14%, or benchmarked to the Miller and Weinberg findings, about 4% of the change in consumer surplus occurring due to price changes and coordination. Combining the two we find the value added from new products outweighs the value lost from discontinued products.

Future work would incorporate a supply-side model to find a general equilibrium and incor-

porate more dynamics of how product variety can change on the producer side. Work such as Wollmann (2018) would provide a baseline for how to incorporate how the firm changes product variety based on the fixed costs of the product. Ultimately, this project also serves as a guideline for how product variety changes should be studied for mergers. Work such as Atalay et al. (2023) emphasize the increasing importance of these effects, and policymakers could use this study's framework to model how they study changes in product variety for a merger.

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