How much do consumers care about new and discontinued products? A case study of the MillerCoors merger*

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Abstract

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

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1 Introduction

One issue that regulators face in merger analysis is how to quantify the nonprice effects of a merger and what their importance is relative to price effects. According to a recent OECD report summarizing the policies of twenty-one competition agencies around the world, eighteen explicitly have policies addressing nonprice effects of mergers, but the majority do not address these issues unless there are "claims made by merging parties, their customers/consumers, and rivals".[1] However, it is unclear how one such nonprice effect, that on 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. Resolving this issue requires quantifying both the effect of the merger on product variety and 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 welfare effects from product variety changes in a theoretical setting where a bailout never occurs and bankrupt firms are 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. However, without an appropriate benchmark, it is unclear whether this effect should be a priority for policymakers relative to price effects from a merger.

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

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 her 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. This paper attempts to measure how important this

[1] In such cases, the complaints may be addressed through qualitative evidence in the absence of direct measurement (Capobianco 2018).

change in consumer surplus is relative to price effects.[2] A visual interpretation can be seen in Figure 1.

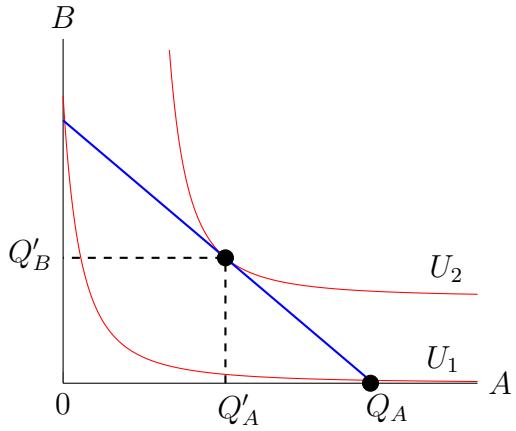


Figure 1: Visual Representation of Product Introduction

The brewing industry is one such industry where heterogeneous products are offered but products are limited by how much their prices can be changed. As described in detail by Miller and Weinberg (2017) and Weinberg, Sheu, and Miller (2019), brewing firms often priced their products very similarly to their competitors', especially for brands owned by Miller, Coors and Anheuser-Busch Inbev. Several reasons for this similarity were given, such as implicit price collusion, the role of retailers and distributors in price setting and the role of competitors in hampering such 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, I am able to observe in each market which products were removed and which 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. Thus, product varieties changed at the market level, with both product additions and discontinuations after the merger. I additionally supplement these data with the Beverage Marketing Company (BMC) database, which has producer and distributor characteristics, to provide added context on the market.

[2]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 their product offerings. However, this decision must be made 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 the face of such price constraints, the firm may drop products to increase market power or reduce costs elsewhere. Alternatively, firms may increase product variety by creating new products 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.

I first examine whether product variety, measured in terms of both individual products and brands more generally defined, changed after the merger and whether this can be attributed to the merger itself. Under a basic linear model, I 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) of the merged firm focusing on core products rather than new products or products at the periphery of its business.

However, brand variety in the merged firm declined relative to that of its competitors. I use a difference-in-differences design, comparing brand variety between Miller and Coors and the top firms in terms of the market share measure commonly used in the literature, and find that brand variety at the merged company declined relative to its competitors' by 22%. This decline holds when I detrend the data of premerger time trends, improving elements of the original difference-in-differences design.

Given this evidence, I design a model of consumer demand to estimate how the measured product variety changes impacted consumers. To make this comparison, I use instruments and the nesting strategy from their paper. I use a random coefficient nested logit model, which is standard in this setting, to model how consumers choose beer: consumers first choose whether they want to purchase a product from the top three competitors and then decide on which specific product to purchase within each nest. I calibrate the model only on the postmerger period to focus on the merger's short-term effects.

After calibration, I estimate the consumer welfare impact of new product additions through a set of counterfactuals. I consider two sets of counterfactuals: one where products newly created after the merger never exist, and one where products discontinued after the merger are never discontinued and remain 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. The counterfactuals differ in the assumptions on whether firms change prices based on observed product variety, whether the model is estimated individually in each market, the time dimension of model estimation, and whether random coefficients are included. I find that the value of new products created after the merger ranges from 0.05% to 1.35% under these different versions of the model; this is approximately 34% of the consumer welfare effect of coordinated pricing found in Miller and Weinberg (2017). Likewise, I find that the loss in consumer surplus from product discontinuation ranges from -0.14% to -0.175%—approximately -4% of the consumer welfare effect of coordinated pricing found in the same paper.

1.1 Literature Review

This paper contributes to two main strands of literature: the stream on the effects of changing product variety and that on the MillerCoors merger of 2008. I contribute to each by providing a framework for how to model changing product variety, estimating this effect for 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. I make two important contributions complimenting their work. The first is that I focus on a smaller set of markets, avoiding the curse of dimensionality issue that the latter paper addresses. For this reason, I do not need to solve for a large discrete game. This comes at the cost of less granularity of market information. The second contribution is my use of different data. Due to data limitations, the authors of the aforementioned works cannot identify which breweries or beers drive their results. My data are not subject to this limitation, although they cover fewer markets and a shorter time frame. Nevertheless, using these less restricted data allows me to provide more information on firm specifics. By avoiding assumptions on what products leave the market and enter, I provide an empirical test of the conclusions from these authors' models. The central exercise and counterfactual of this paper can best be compared to the work of Petrin (2002), who studies the value of new products entering the market.

In addition, I contribute to the literature on the Coors–Miller merger of 2008 and the implications of the changes in the beer market occurring around this time. Ashenfelter, Hosken, and Weinberg (2015) examine the impacts of the merger on prices and transportation costs for the firm and their relative importance. They ultimately find that the price increases were offset by efficiency gains from the merger, leading to very little change in prices attributable to the merger itself. As described above, I use this as evidence that the 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 that they are much higher than predicted by a model capturing the merger's effect in facilitating price coordination 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 potentially explains these effects. These papers are vital for the model in this paper and my comparison of the consumer welfare effects from product variety changes and price changes.

I 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 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)). I additionally estimate the model under a standard nested logit, following other works focused on 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, I find results similar to those of Atalay et al. (2023), who find, using a large-scale event study, a slight decline in product variety from a merger. They document the phenomenon of brand consolidation: firms cutting back their product variety in certain brand lines to focus on their highest-revenue products in other brand lines. I observe this phenomenon in my study, 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 hypothetical acquisition of smaller breweries, this paper finds a net increase in consumer welfare from the from the addition of new products and discontinuation of old ones in a merger between larger firms.[3] Therefore, there may be other conflicting factors such as firm size and product substitution that lead to differences in product variety outcomes after a merger.

The paper proceeds as follows. In section 2, I describe the setting of the brewing industry, the merger itself, and the suitability of this merger and setting for testing the welfare effects of product variety and price changes. In section 3, I describe the data and provide key summary statistics for each dataset. In section 4, I describe the reduced-form models and results to examine the merger's impact on product variety. In section 5, I describe the structural demand models used to estimate the effects of changing product variety on consumer welfare. In section 6, I describe the results of the demand models. In section 7, I describe the main counterfactuals analyzing how consumer surplus changes with changes in product variety postmerger. Finally, in section 8, I conclude.

2 Setting

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

2.1 Basic Intuition on Relationship Between Product Variety and Prices under a Merger

Here, I provide an expanded intuition on the relationship between product variety changes and price changes to illustrate the claim made in this paper: that firms trade off prices and quantities. My model uses a simple monopoly profit comparison and shows that, depending on how constrained firms are in changing prices, products may or may not disappear from the market. Due to the large size of the firms considered here, the model provides a baseline for the product variety effects of the merger.

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

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

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

where π_i is the profit for $i \in \{\text{A,B,C}\}$ and c_i represents the costs of production and distribution, which may differ. If profit is greater than zero, the firm provides the product. Firms compete in Bertrand competition.

In this model, a merged firm can change its profits through prices or through costs. Suppose that two of the firms merge and can change only prices. For simplicity, suppose that the third firm's prices remain constant. Denote this new merged firm AB. In the first case, suppose that AB lowers prices. This can occur if the merger affected costs and allowed the merged firm to effectively undercut its competitor. Profits would rise if it is able to capture more customers. In the second case, suppose that 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 not reduced by the merger.

Now, suppose that the merged firm can also adjust product varieties. In the first case, suppose that one of the product varieties is 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

$$\underbrace{\pi_A^{\text{two products, after}}(c_A) + \pi_B^{\text{two products, after}}(c_B)}_{\text{sum of both product profits}} < \underbrace{\pi_A^{\text{single product}}(c_A)}_{\text{single product profits only}} \tag{1}$$

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

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

$$\underbrace{\pi_A^{\text{three products, after}}(c_A) + \pi_B^{\text{three products, after}}(c_B) + \pi_{AB}^{\text{three products, after}}(c_{AB})}_{\text{sum of all product profits}} < \underbrace{\pi_A^{\text{single product}}(c_A)}_{\text{single product profits only}} \tag{2}$$

and

$$\underbrace{\pi_A^{\text{three products, after}}(c_A) + \pi_B^{\text{three products, after}}(c_B) + \pi_{AB}^{\text{three products, after}}(c_{AB})}_{\text{sum of all product profits}} < \underbrace{\pi_A^{\text{two products, after}}(c_A) + \pi_B^{\text{two products, after}}(c_B)}_{\text{sum of both product profits}} \tag{3}$$

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

2.2 Implications for Consumer Surplus

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

I can examine what the final effect on consumer welfare would be given price and product changes depending on the merged firm's choice. If any product's price rises, the consumer welfare of the group of consumers who prefer the product would decline either from their paying a higher price or from their shifting consumption 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 withdrawal of a product would lead to a consumer welfare loss or no change at all. This can also be interpreted as prices' being set to infinity—consumers can no longer purchase the good, and for this reason, they may be forced to substitute to another good. For example, suppose that the companies producing 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 is highly substitutable or if B or C has 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 who previously purchased only 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 that they prefer more at a lower price.

While the effects of price and quantity individually are clear, the combined effects of both are less clear. For example, suppose that prices fall but product variety also falls. Here, consumer surplus would increase from prices but fall from the effects of the product variety changes. Depending on which effect prevails, the merger's effect on product variety would be either net positive or net negative. Evaluating this outcome requires information on both prices and product variety to accurately measure and shut down each channel individually to estimate the consumer welfare effect for each one. For example, in an industry where price changes are constrained, estimating the change in consumer surplus from new and discontinued products postmerger would inform us about the product variety effect of the merger.

This basic intuition underpins the framework of this project—a merger's effect on consumer surplus can run through prices or through quantities, and this can have different consumer welfare impacts depending on the merged company's actions. If a firm is constrained in changing price, one option to capture more profit may be to remove or increase product varieties, affecting consumer surplus in the process. This intuition holds with additional firms and additional products as long as price changes are restricted. The following conclusions

can be drawn from this observation:

1. If a product is withdrawn from the market, it leads to a weakly negative decline in consumer surplus.

2. If a product enters the market, this leads to a weakly positive increase in consumer surplus.

2.3 The U.S. Commercial Beer Industry

My research setting is the United States commercial beer industry, a market dominated by fifteen firms with large market share, which allows strategic interactions among them in product variety choices. I choose this industry because it is characterized by easily identifiable product differentiation via brands, packaging type and size. Additionally, there is evidence of limited price changes within this market. This industry was largely stable and faced few aggregate shocks to product variety until 2008, when the Miller-Coors merger occurred; this quasi-experimental setting lets me focus on product variety.

The United States beer industry shares many similarities with other branded consumer product industries; however, there are some important differences that I use to my advantage in this study. Similarly to firms in other branded consumer product industries, beer 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, and distributors then sell to stores. Distributors market various types of beverages, such as beers, alcohols, soft drinks and others.[4] Several states have enacted additional laws and, in some cases, restrictions on distribution. For example, each state imposes its own excise tax on beer distributors in the 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 an excise tax when manufacturers ship products to the state.[5] These laws provide 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 in this than in other industries. Because brewers must first sell to distributors, who then sell to consumer-facing businesses, distribution costs increase final costs and therefore final product variety. Distribution costs can take two forms that I focus on in this paper: distance costs and negotiation costs. For the former, costs rise with brewers' distance from distributors, cutting into individual product profits. For the latter, brewery companies must negotiate what they pay distributors for distributing brewery products.[6]

[4]See the National Beer Wholesalers Association (NBWA) website for more information: https://www.nbwa.org/about/what-beer-distributor.

[5]A discussion on 2021 excise tax trends can be found here: https://taxfoundation.org/excise-taxes-excise-tax-trends/#Alcohol.

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

As will be described later, these two types of costs were the main impetus for the merger between Miller and Coors.

Product variety is also tied closely to individual consumer preferences, which are fairly strong in the U.S. commercial beer industry. Typically, consumers have strong preferences for beer produced within their region. For example, Anheuser-Busch is the market leader in St. Louis, where its central brewery is located. This market feature allows plausible consumer variation in preferences as well. While firms still have other tools to increase their market share, such as advertising and temporary sales,[7] trends in these components were largely stable before the merger. Overall mean market shares remained stable around 18% prior to the merger, and market shares in each region also held steady prior to the merger.

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

Finally, prior to the merger, this market was highly concentrated among fifteen firms. While the IRI dataset contains 852 breweries, the 15 largest breweries fell within the top 5 percentile of total market share.[9] On average, the top 15 firms had a combined market share of 94% prior to the merger and 92.9% after the merger. Miller and Coors accounted for nearly a third of this market share, with the two combined having a market share of 29.2% prior to 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 and 35.6% after the merger. This concentrated market, as well as the presence of a strong market leader, contributed to Miller and Coors's decision to merge and the rationale for the merger approval by regulatory agencies.

2.4 The Miller–Coors Merger of 2008

The Miller and Coors merger of 2008 combined the United States' second and third largest breweries, respectively. The merger's main motivation was to integrate the geographically distinct production facilities to reduce costs and prices for consumers (see Martin (2007)). I leverage the associated distribution costs changes and the lack of aggregate shocks to argue that the merger could have affected product variety as well.

[7] See Chandra and Weinberg (2018) for a discussion on the role of advertising in this market and within the MillerCoors merger.

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

[9] These include Anheuser-Busch, InBev, Anheuser-Busch InBev, SabMiller, Molson Coors, Heineken USA Inc., Groupo 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.

The MillerCoors merger was announced in October 2007 and finalized on July 1st, 2008.[10] It generated an estimated $ 500 million in cost savings from improving economies of scale (Martin 2007).[11] It was uncertain ex ante whether the merger would pass regulatory scrutiny given market power concerns. First, the merger context was a fairly concentrated market, with Herfindahl–Hirschman index (HHI) estimates for the commercial beer market ranging from 2000 (Ashenfelter, Hosken, and Weinberg (2015)) to 4000 (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 had been denied or had seen the merging firms subjected to significant behavioral requirements. Third, many of the products were close substitutes, as Miller and Coors both competed in the four main beer categories. Third, some consulting firms predicted that there would be issues with the merger, with one representative from beverage consultancy Bevmark arguing that the merger would lead to "less selection and probably higher prices" (Martin 2007).

Ultimately, however, regulators decided not to challenge the merger. In the review of its investigation, the Department of Justice came to several conclusions. First, it found that the cost savings stated by the company were substantial enough to benefit consumers. Through the integration of geographically distinct production facilities, distribution costs would "be reduced considerably" (Heyer et al. 2009). Transportation cost savings had been the focus of a consulting report prior to the merger, and the Justice Department found no issues with this analysis. Second, the Justice Department found that Miller and Coors competed with each other less than with Anheuser-Busch, which held the highest market share by a significant margin. Finally, it found that the merger was unlikely to increase coordination between firms. For these reasons, the merger was approved and was formally completed on July 1, 2008.

However, later research has found that price coordination may have occurred. Miller and Weinberg (2017) find that the price increases postmerger cannot be fully explained by a transition of Nash equilibriums, and they relate this to evidence that there was price coordination. In follow-up work, Weinberg, Sheu, and Miller (2019) examine the role of implicit price collusion postmerger. They use a price leadership model, where the largest firm announces its 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 continues to characterize the postmerger environment, and price leadership is in fact easier to implement with the disappearance of one competitor.

I 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, indeed, the main reason for the merger's occurrence. In its announcement concluding its antitrust investigation, the Department of Justice stated, "In one of the key parts of the investigation, the Division

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

[11]In its merger announcement, the company declared the merger would result in an 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/

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: one in Golden, Colorado, and one in Elkton, Virginia. Miller had six, all near large markets such as Irwindale, California (near the Los Angeles metropolitain area), and Fort Worth, Texas.[12] The combined eight breweries would have significantly lower costs of shipping Coors products, which regulators believed could be beneficial to consumers.

The second reason for my product variety focus is that the two firms were constrained in 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 its main competitor, Anheuser-Busch InBev. Second, because of the role of retailers, which may price beers similarly for final purchase, any decision to change prices significantly could backfire at this final step. Therefore, firms are restricted in what prices they can offer. With the addition of the distributor market, which further limits price changes upstream, firms' main outlets to affect market share come in the form of new product releases and advertising.[13]

I find evidence of this collusion in prices between 2006 to 2011 in my data, as well. Figure 2 shows the differences in mean prices between MillerCoors and Anheuser-Busch InBev products and between MillerCoors products and those of all other top-selling firms. In this period, there was a large divergence in mean prices, peaking at nearly 60 cents in 2008. Despite using a different sample from Miller and Weinberg's (2017), I find that their trend still holds in this expanded dataset in terms of the per-ounce price.

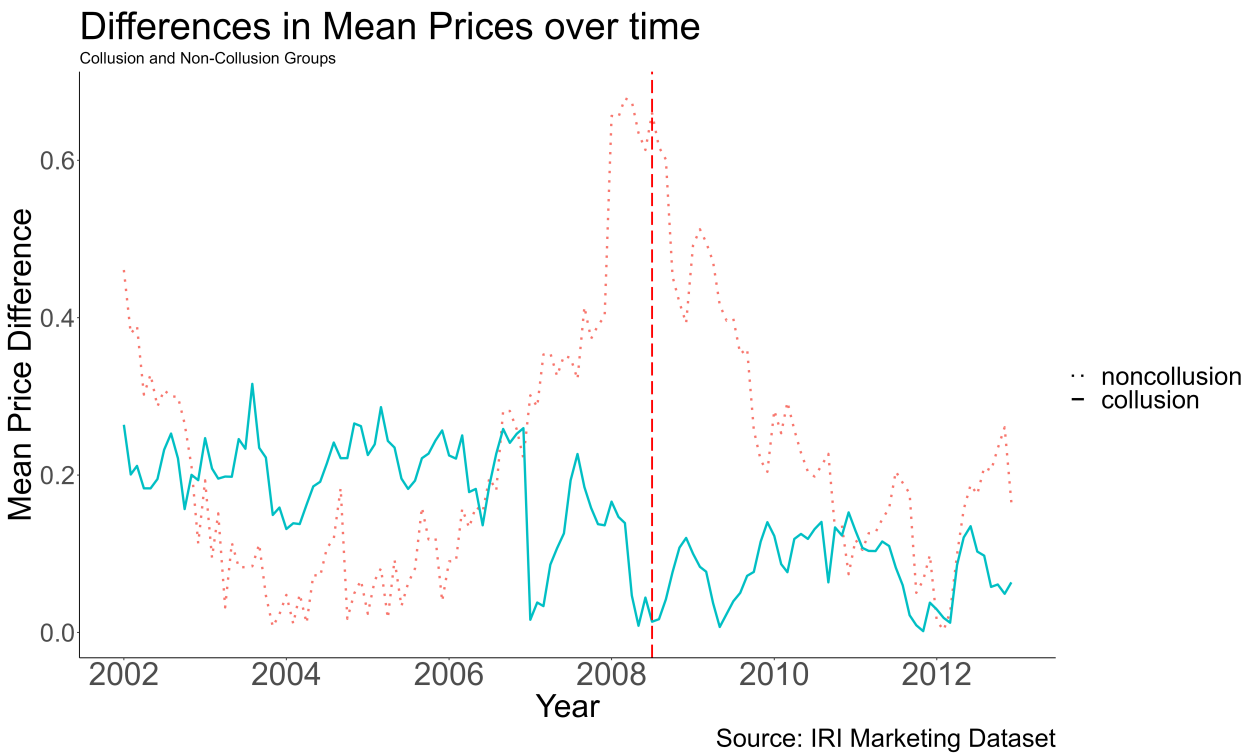
3 Data

Our main datasets, the IRI and BMC datasets, cover the consumer and producer sides of the market, respectively. I now present 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 and features of products discontinued or newly added after the merger can be found in the data appendix.

[12] A full list of the breweries can be found on the MolsonCoors blog: https://www.molsoncoorsblog.com/features/quick-look-my-8-breweries-yes-8.

[13] While advertising is not the focus of this paper, a discussion of advertising in this merger appears in Chandra and Weinberg (2018).

Figure 2



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

3.1 Consumer Level: IRI Dataset

The IRI dataset provides information on consumer-level demand through scanner data, which show what products consumers buy in stores. I use monthly data from thirty-nine metropolitan statistical areas (MSAs) from 2002 to 2012, which allow me to measure product variety at the final good level and observe revenues, market shares and prices.

The beer industry is a branded consumer product industry, and therefore, varieties, prices and quantities can be measured through supermarket transaction data. The IRI marketing dataset spans 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 size in ounces.

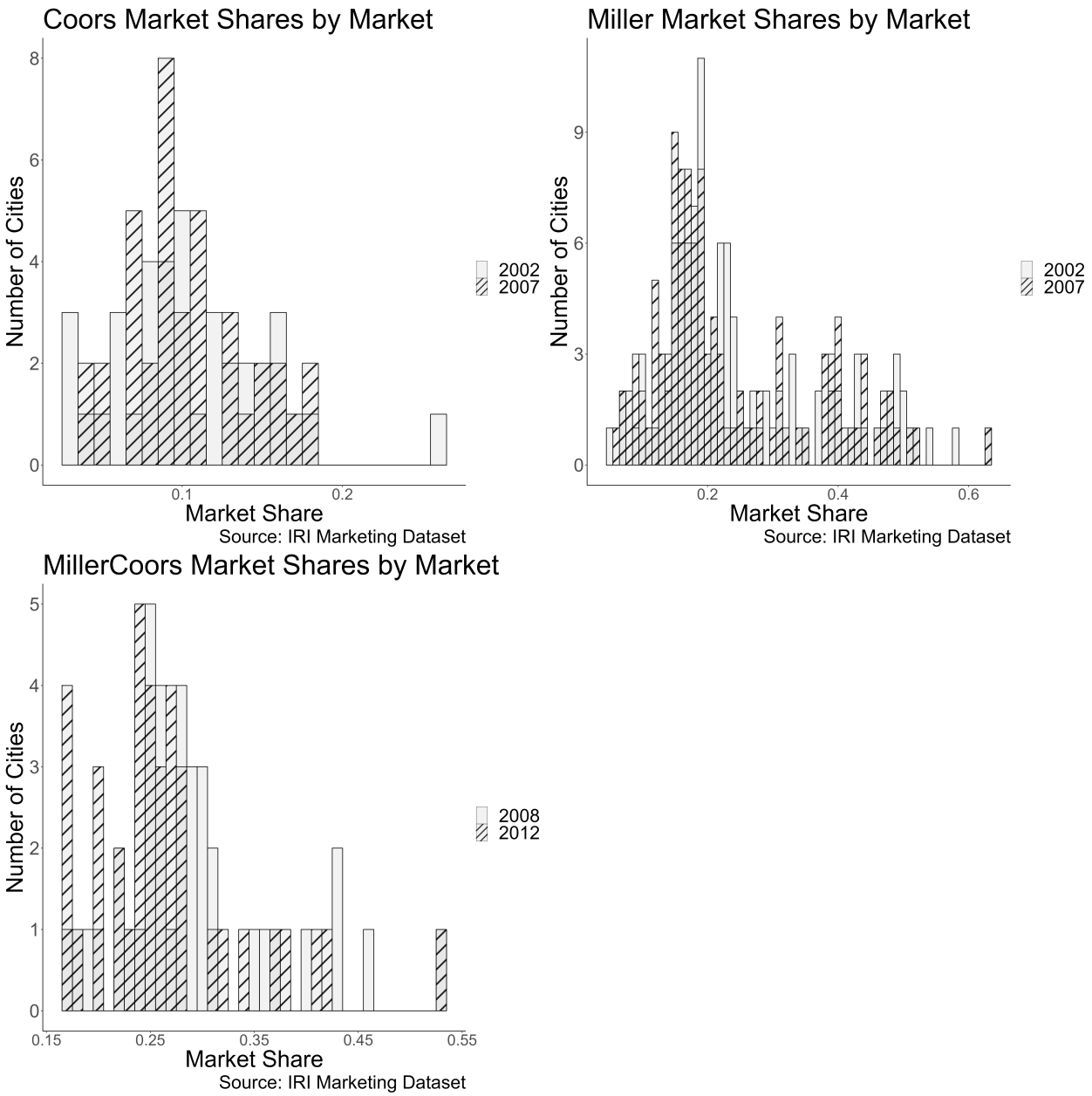
I make several changes to the raw data to facilitate estimation and remove markets with unique legislation restricting the representativeness of observations or impeding my ability to define a market. First, there were several major store-level mergers that occurred in 2001 that affect some of the store-level controls that will prove important for estimation purposes. Therefore, data from the year 2001 are dropped. To better match against state-level data, I do not include data on markets in states that place restrictions on product variety or distribution. Such laws include those limiting the alcohol content of beer sold or prohibiting sales of beer in supermarkets. This criterion leads me to remove eight markets from the dataset. Finally, for estimation purposes and because of unclear definitions of markets, I 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, I additionally subset the brands into the top ten brands by market share. Prior works, such as Miller and Weinberg (2017), Weinberg, Sheu, and Miller (2019), and Ashenfelter, Hosken, and Weinberg (2014), focus on these firms as well. This is partially for computational reasons, but these companies can better be thought of as Miller's and Coors's closest competitors than can local or craft beer brands.

Overall, market shares vary greatly between markets. Figure 3 shows the mean market shares of Miller and Coors prior to the merger and of MillerCoors right after the merger and at the end of the sample period. The shares range from less than 3% to nearly 30% for Coors and from less than 1% to over 50% for Miller. The merged company reaches market shares similar to Miller's, ranging from near 0 to over 50% market share.

3.2 Producer Level: BMC Dataset

The BMC dataset provides information on brewery and distributor supplier characteristics between 2006 and 2010. I 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, parent company of products distributed, number of employees, number of trucks, total sales in that year, and region served. The dataset for brewers includes address, capacity, number of employees, number

Figure 3: Market Shares for Miller and Coors



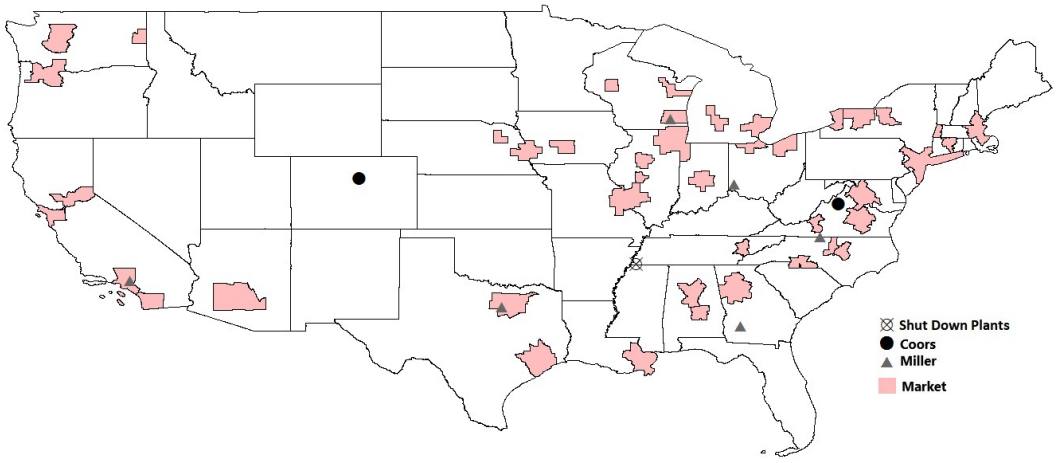
Note: These histograms depict the market share for each market for Coors and Miller for 2002 and 2007 and the market share for MillerCoors for 2008 and 2012. Each observation is a market's annual share for the respective company. Data are compiled through the IRI marketing dataset.

of lines of canned beverages, number of lines of bottled cold and hot beverages, and region served.

These data sources have several key features that improve the quality of this study. First, the IRI dataset ends four years after the merger, allowing good coverage of the postmerger outcome trends that helps me verify the impacts of the merger. Combining both the BMI and IRI datasets does shrink the postmerger study period to two years, although this still allows me to study the short-term effects of the merger. Second, the ounce-size 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 contain 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 of 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: one in Golden, Colorado, and the other in Elkton, Virginia. 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 but 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 locations of Miller breweries, denoted by the gray 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, Tennessee, Coors plant was shut down in 2006, prior to the merger, and is denoted by a crossed-out circle.

3.3 Summary Statistics

I 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, I emphasize the measures of distance of the nearest brewery to the nearest market, which the company argued was the main impetus for the merger, and product variety. I show the first main results of the paper, the raw change in product and brand variety, and show that

I 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. I consider both definitions for three reasons. First, brands are easily identifiable and clear distinguished in the dataset. For example, Keystone is a different brand from Keystone Light (a lower-calorie version), which is a different brand from Keystone Ice (a version with a higher alcohol by volume). Second, the brand is the highest level of product identification in the dataset beneath the product vendor. If consumers have strong preferences over packaging, such as for twelve packs over twenty-four packs, these results would provide an upper bound on consumer impacts and changes in product variety. Finally, this observable heterogeneity allows me 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 distance to the breweries for each. Miller had more breweries, leading to an average distance from a Miller brewery to a market of 314 miles. Potentially due in part 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 supplies only 13 brands. The lack of capacity and distance from markets could potentially affect the cost of producing new products from these sites.

3.4 Merger's Effect on National Brand Variety

I next compare how Miller and Coors brand variety changed after the merger. In Figure 5, I examine the total number of unique brands offered each year for Miller, Coors and MillerCoors. I designate whether a brand is a Miller or Coors brand based on the parent company of the brand prior to the merger. I find that, while brand variety for Miller and Coors declined after the merger, the overall negative effect of the merger was mitigated by new product introductions by 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 merger, in Miles	27.3842	51.1858	0.0000	138.7045
Change in distance from a Coors brewery after 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 based on 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.

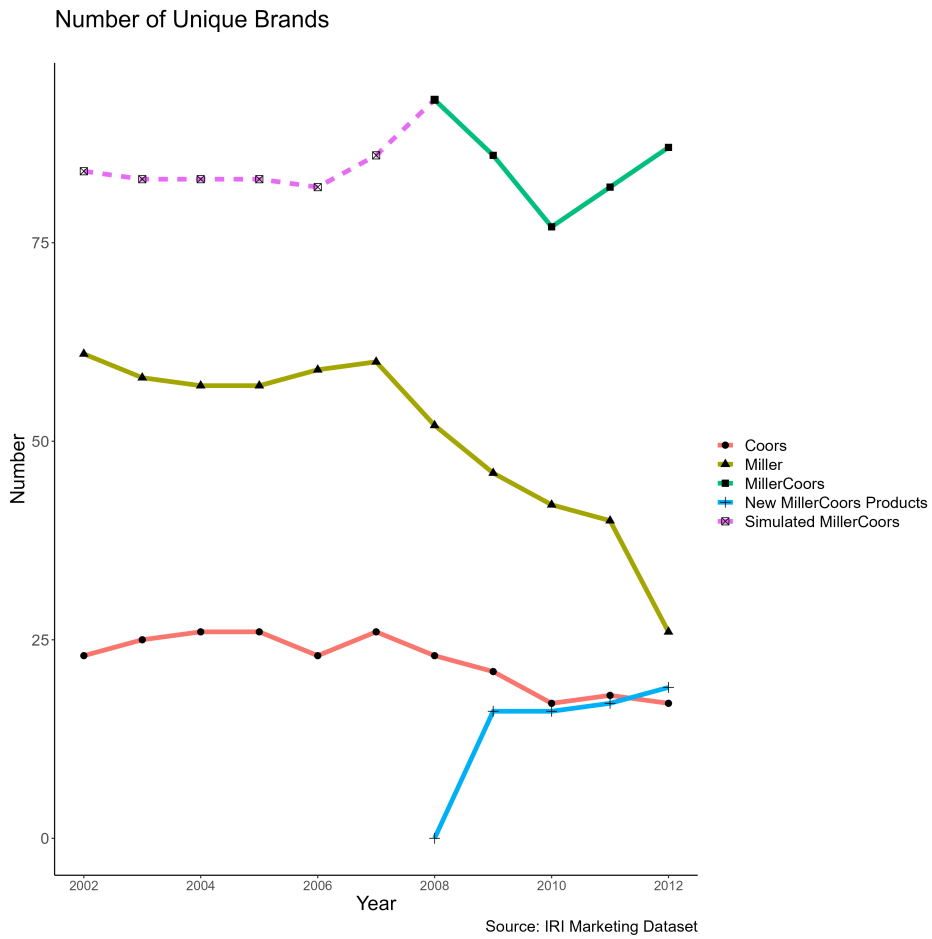


Figure 5: This figure depicts the total number of unique brands offered each year by Miller, Coors and MillerCoors. "MillerCoors" denotes all brands within the new merged company, starting in 2008, and "Simulated MillerCoors" denotes the sum of "Miller" and "Coors" brands prior to 2008. "New MillerCoors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

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

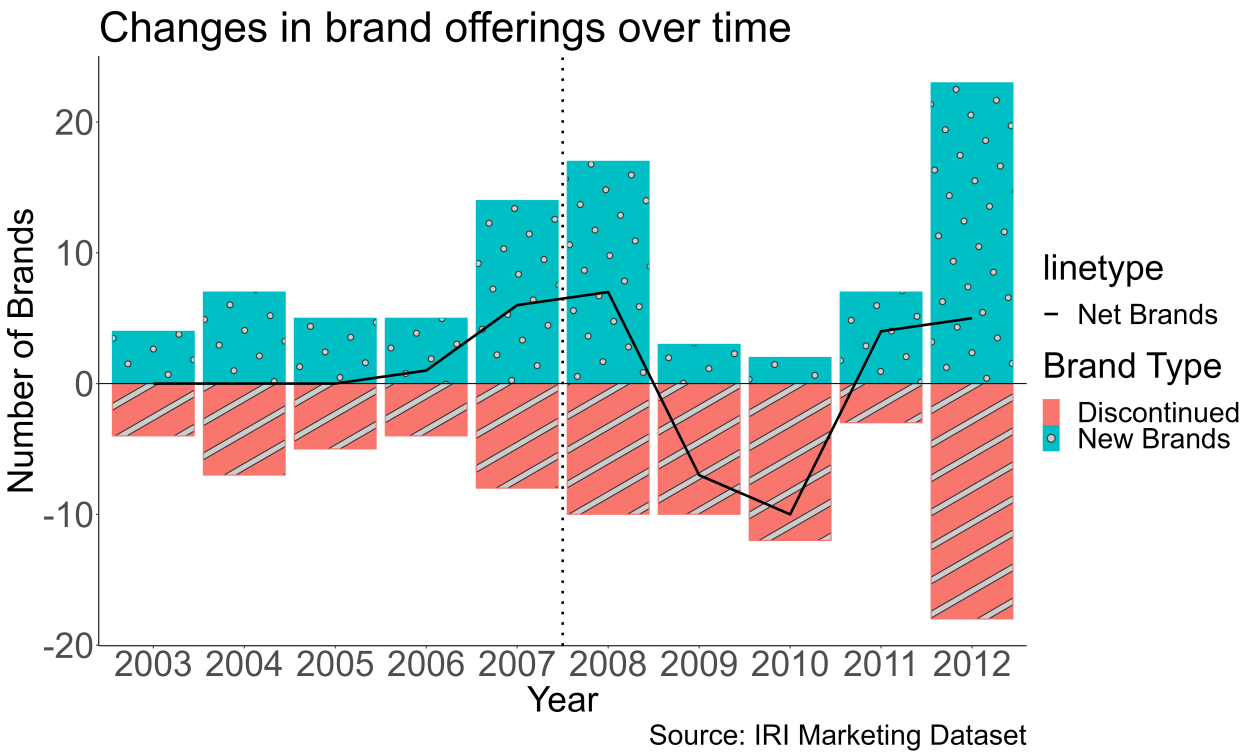
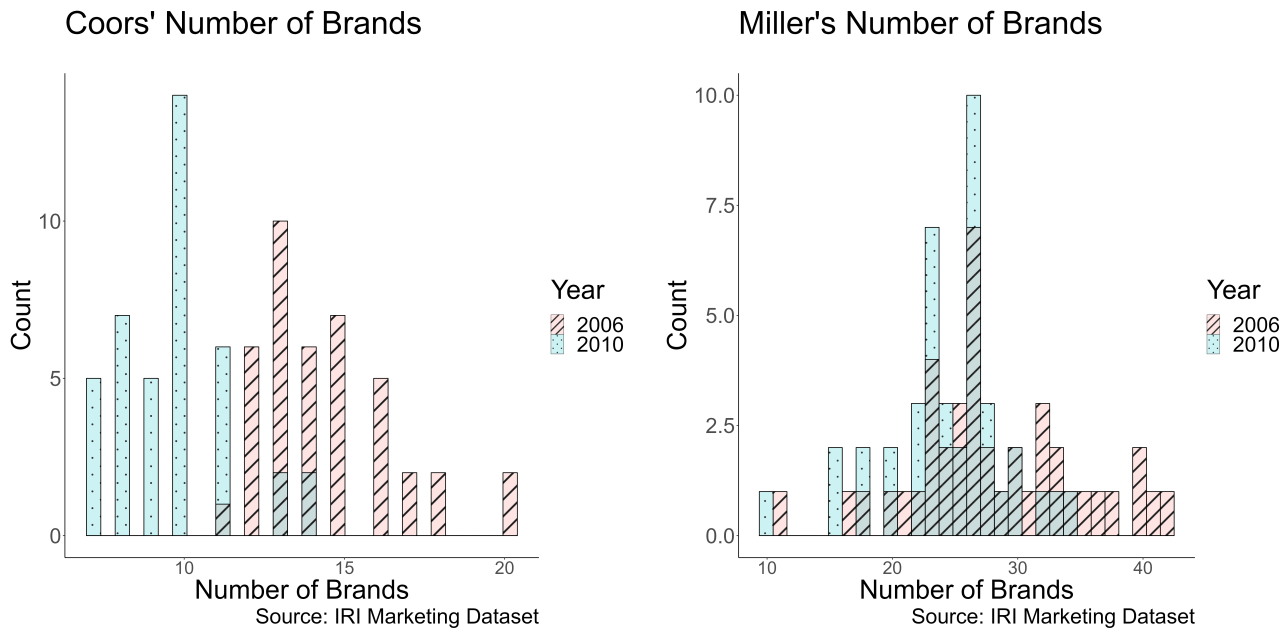


Figure 6: This graph shows the change in number of brands from the prior year. For years prior to 2009, "new brands" and "discontinued brands" are the sum of the Coors and Miller new brands and discontinued brands, respectively. For years from 2009 onward, "new brands" and "discontinued brands" are for MillerCoors only. The figure for 2008 is calculated as the difference in number of brands of Miller and Coors separately and the number in 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 remained stable until 2007, when there was a slight increase. Starting in 2009, fewer new brands are created. This effect disappeared 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 anywhere from 4 to 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 had between 7 and 12 brands for the entire market. For Miller brands, after the merger, most cities had between 15 and 20 brands for the entire market. The decline seems to be stronger for Miller brands, as noted before.



a) b)

Figure 7: This histogram shows the number of brands sold in each market that are designated as sold by Miller or Coors (Miller or Coors brands, respectively) in 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, had a lagged effect that did not occur until the end of the sample.

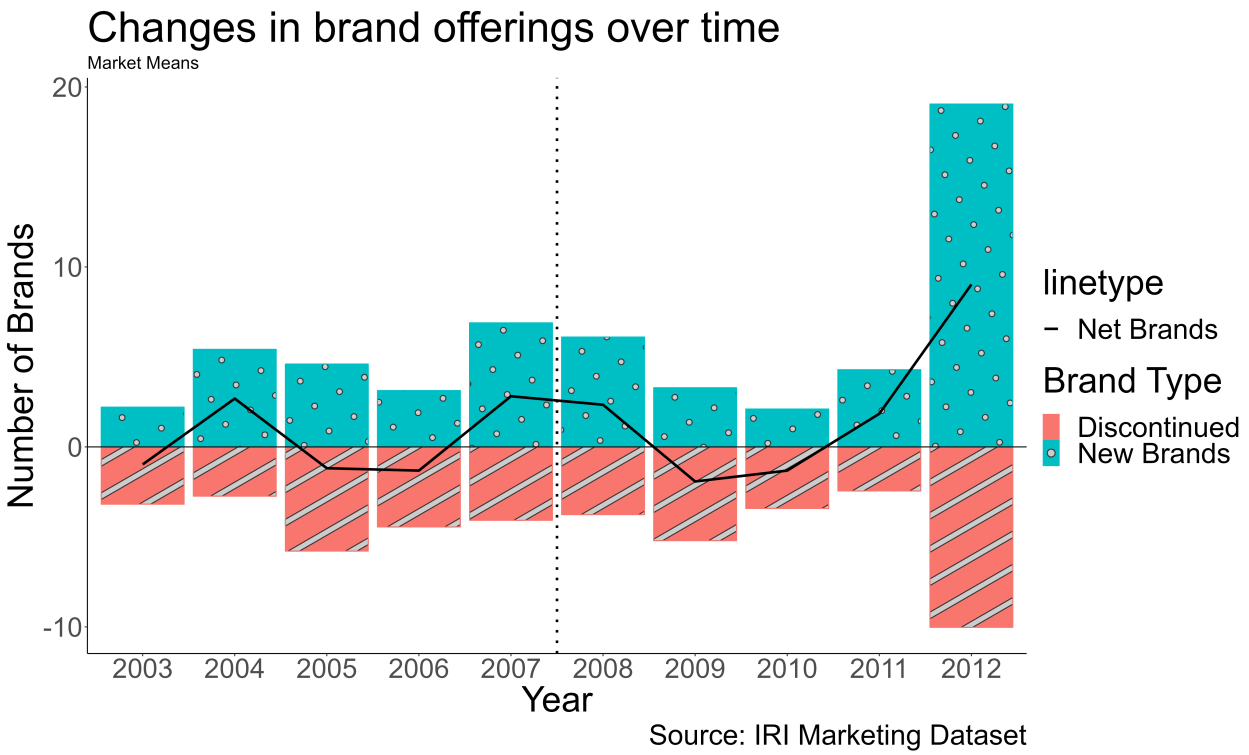


Figure 8: This graph shows the change in brands from the prior year. Prior to 2009, "new brands" and "discontinued brands" are the sum of the Coors and Miller new and discontinued brands, respectively. From 2009 onward, "new brands" and "discontinued brands" are for MillerCoors only. The figure for 2008 is calculated as the difference in the number of brands for Miller and Coors separately and the number for 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 that there were 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 with other existing brands while brands were introduced to capture new markets or had sufficiently low costs. Since there is enough heterogeneity in the 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 whether any particular underlying time- or market-level trends affect these results and what these changes imply for products. We first control for potential confounding factors regarding the relationship between the merger and brand variety. I explain this basic linear model, justify the assumptions and show the results of the model: namely, a decline in brand variety but a null effect on product variety, implying brand consolidation and production of new products in existing brands. I 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 the model in Ashenfelter, Hosken, and Weinberg (2015). I then explain this model, justify the assumptions and show the results: specifically, a large decline in brand variety relative to that of other top competitors. I finally correct for some issues with these models in 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, this could be related to changes over time or specific market characteristics. To better control for this possibility, I estimate the following linear model by market m and month t:

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

where α_{mt} is state–time fixed effects, Post Merger$_t$ is a dummy for whether the observation falls at or after July 1, 2008 (denoted the postmerger period), and ϵ_{mt} is a term representing unobserved market-specific heterogeneity at the market–month–year level. This basic model tests what percentage change in the number of brands is affected by the merger, controlling for observed heterogeneity. Another variant of the model that I also test includes separate dummies on each year to see whether 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, I implicitly assume no changes to the underlying market happening 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, except for some increases in 2004 and prior to the merger. Even then, any changes are fairly small—of approximately 3–5 brands at most.

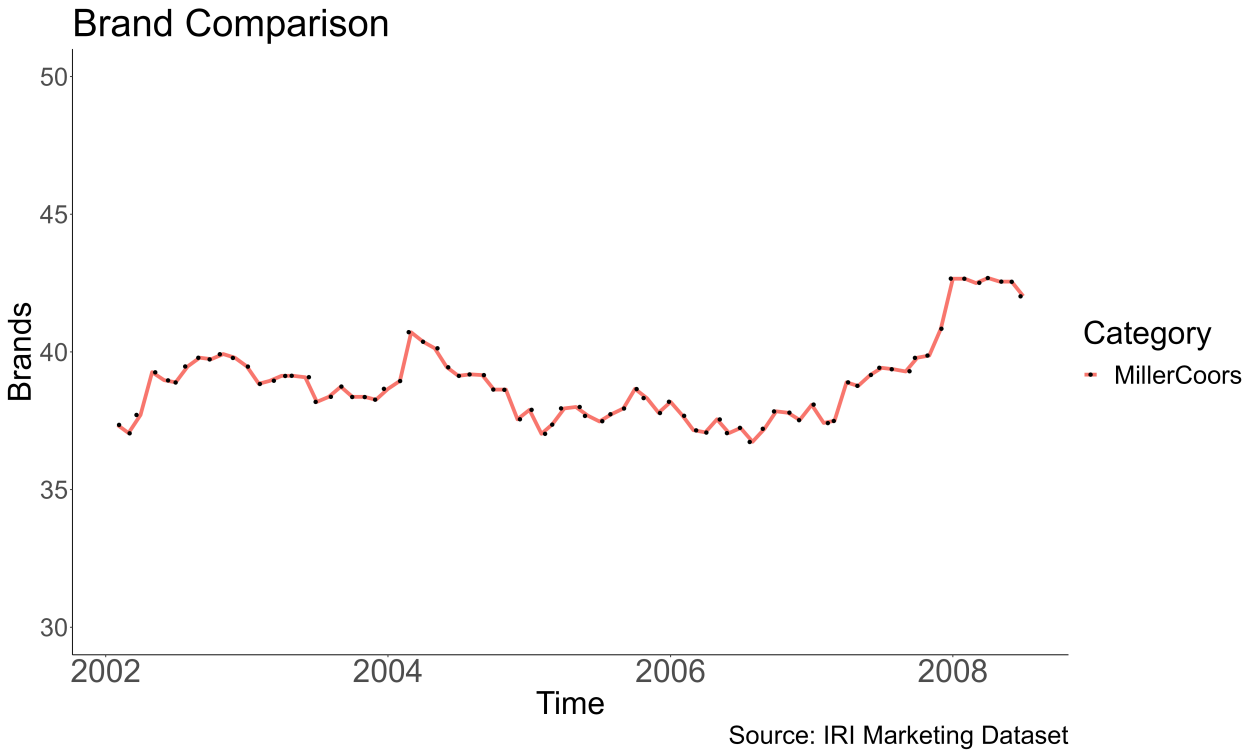


Figure 9: Note: This graph measures the average monthly brand variety for Miller and Coors from January 2002 to May 2007. Brand variety is measured by the number of unique brands that each company has.

4.2 Linear Model Results

I 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 that market and time effects play a large role in explaining the 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 postmerger or approximately one brand.

I next test whether these results hold under a finer definition of products. Rather than use brands, I use the data on products, which combine brand, product packaging, and ounce-size information. 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 5% increase in product variety due to the merger. However, with the introduction of year fixed effects, the point estimate of the effect of the merger

Table 2

	Dependent variable:				
	log(Number of Brands)				
	(1)	(2)	(3)	(4)	(5)
Postmerger	0.097^{***}	0.096^{***}	0.096^{***}	-0.009	-0.022^{***}
	(0.005)	(0.005)	(0.003)	(0.008)	(0.008)
Constant	3.647^{***}	3.649^{***}	3.568^{***}	3.571^{***}	3.567^{***}
	(0.003)	(0.009)	(0.009)	(0.008)	(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^2	0.069	0.071	0.706	0.741	0.744
Adjusted R^2	0.069	0.068	0.704	0.739	0.742

Note: *p<0.1; **p<0.05; ***p<0.01

Note: Observations are at the market–month–year level."Postmerger" indicates the period 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 nonstatewide markets and all brands produced by Miller and Coors. HC1 robust standard errors used.

Table 3

	Dependent variable:				
	log(Number of Products)				
	(1)	(2)	(3)	(4)	(5)
Postmerger	0.067***	0.067***	0.067***	0.017*	0.011
	(0.007)	(0.007)	(0.003)	(0.009)	(0.010)
Constant	4.820***	4.819***	4.764***	4.780***	4.777***
	(0.004)	(0.012)	(0.008)	(0.008)	(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^2	0.021	0.022	0.738	0.745	0.746
Adjusted R^2	0.021	0.020	0.736	0.743	0.744

Note: *p<0.1; **p<0.05; ***p<0.01

Note: Observations are at the market–month–year level."Postmerger" indicates the period 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 nonstatewide markets and all products. HC1 robust standard errors used.

on product variety is 0.1% and indistinguishable from zero. Taken with the brand results, this implies that the firm may have dropped a brand to create more products within its main brands. These results indicate that the decline in brands was offset by an increase in products, leading to the 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 be industry-specific effects from the merger that influence the results, and a comparison examining only the firms involved ignores this possibility. Second, there could be other changes happening around the merger that the linear model would not capture well. For example, the great recession occurred during the sample period. If it had an effect on demand for alcohol during this time compared to demand 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

I 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 with the offerings of competitors. This model is used for comparing effects on brand variety relative to that of competitors, which may be important for policymakers. Here, I describe the variables, estimation strategy and groups that I use for comparison.

I 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:

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

where α_{imt} represents market, firm and time fixed effects, (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 the Miller and Coors brands, and 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, relative to the change in the control group.

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

The difference-in-differences model implicitly assumes that both Miller and Coors and their competitors were similar prior to the merger. I provide evidence that the difference-in-differences assumption is valid when I use the top 5% of firms in the market. I first examine

how MillerCoors compares with all firms. However, this may not be an appropriate comparison. Many firms, such as craft brewing companies, are small and produce only a few brands, such as regional brands. First, I 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 that of all firms.

Figure 10

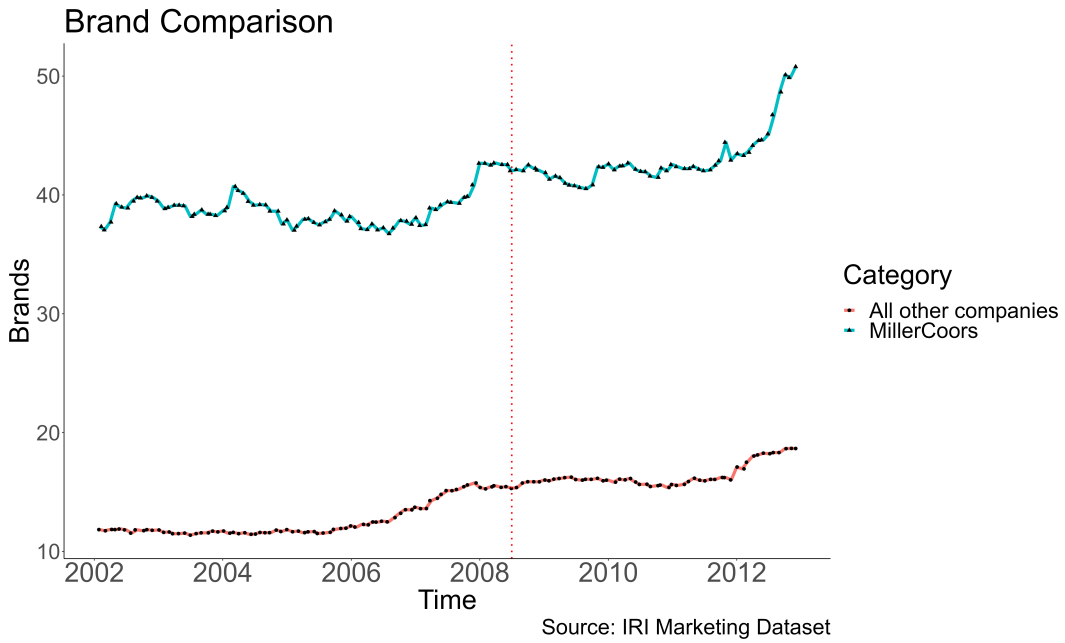
Note: Observations are at the month–year level. This graph plots the average of the number of brands offered over all markets. Miller and Coors are combined as one company prior to their merger. The red dashed line denotes the date that the MillerCoors merger was finalized.

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

I next examine how MillerCoors compares with firms in the top 5% market share quartile, which is analogous to the comparison group used in Ashenfelter, Hosken, and Weinberg (2015). I focus on the top 5% as it may be a better comparison group for Miller and Coors, which were the second and third largest breweries in the country prior to the merger. This comparison group has been used in other works in the literature (Miller and Weinberg (2017)). First, I 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 that of all firms with market shares in the top 5

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

Figure 11



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 that the MillerCoors merger was finalized.

4.4 Difference-in-Differences Model Results

The impact of the merger in a comparison with the outcomes in the first group may not represent the true outcome, as seen in Table 4.

Similarly to the results on brand variety change from 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 0.02, which would imply a 2% change in the number of brands offered after the merger for MillerCoors relative to the number for all competitors in the market. However, this coefficient is not significant, regardless of inclusion of state, month and year fixed effects.

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

Here, I find a large and significant decline in brand variety for MillerCoors compared to that of its competitors. The point estimates for the difference-in-difference coefficient, MillerCoors, is -0.22, which would imply a 22% decline in the number of brands offered after the merger for MillerCoors compared to the number for all other competitors in the AHW group. This effect remains significant with the inclusion of year, month and state fixed effects.

Finally, to verify how these results can compare against the linear model, I examine the

Table 4

	Dependent variable:				
	log(Number of brands)				
	(1)	(2)	(3)	(4)	(5)
Postmerger	1.078***	0.078***	0.073***	−0.011	−0.012
	(0.017)	(0.016)	(0.016)	(0.010)	(0.010)
Miller or Coors	2.646***	2.646***	2.646***	2.648***	2.648***
	(0.025)	(0.025)	(0.026)	(0.026)	(0.026)
MillerCoors	0.020	0.019	0.025	0.022	0.022
	(0.018)	(0.018)	(0.018)	(0.017)	(0.017)
State FE	No	No	Yes	Yes	Yes
Month FE	No	Yes	Yes	No	Yes
Year FE	No	No	No	Yes	Yes
Observations	298,153	298,153	298,153	298,153	298,153
Adjusted R^2	0.605	0.605	0.606	0.607	0.607

Note: *p<0.1; **p<0.05; ***p<0.01

Note: Observations are at the firm–market–month–year level. "Postmerger" indicates the period after July 2008, the start of the merged company's operation. Standard errors are clustered at the market level. For the last set of regressions, to remove colinearity with the year, month and postmerger variable, the December fixed effect is removed.

Table 5

	Dependent variable:				
	log(Number of brands)				
	(1)	(2)	(3)	(4)	(5)
Postmerger	2.485***	0.319***	0.318***	0.030***	0.018***
	(0.023)	(0.019)	(0.019)	(0.006)	(0.006)
Miller or Coors	1.479***	1.479***	1.479***	1.481***	1.481***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
MillerCoors	−0.221***	−0.221***	−0.220***	−0.222***	−0.222***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
State FE	No	No	Yes	Yes	Yes
Month FE	No	Yes	Yes	No	Yes
Year FE	No	No	No	Yes	Yes
Observations	45,712	45,712	45,712	45,712	45,712
Adjusted R^2	0.916	0.916	0.917	0.918	0.918

Note: *p<0.1; **p<0.05; ***p<0.01

Note: Observations are at the firm–market–month–year level. "Postmerger" indicates the period after July 2008, the start of the merged company's operation. Standard errors are clustered at the market level. For the last set of regressions, to remove colinearity with the year, month and postmerger variable, the December fixed effect is removed.

impact over time for just the top quartile results. This is to see whether the positive effect is driven by brand increases in the later years or at the start of the postmerger period. I use the model below, with observations for firm i at time t in market m:

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

The main difference between this model and the previous one is that, here, I interact each year after the merger with the MillerCoors dummy variable. After the fourth year, I 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 -0.20 to -0.23. This implies that the effect of the merger grew over time, reaching its largest toward the end of the sample period. In percentage terms and as a back-of-the-envelope calculation using the mean number of MillerCoors brands per market, these coefficients imply a loss of 10–11 brands relative to the change in brand number of competitors.

4.5 Variants on the Control Group

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

4.5.1 Key issues with the merger and comparisons

There are two main issues with the comparison group, which the following two techniques attempt to deal with. Both issues are related to the parallel trends assumption, specifically, how the control group compares in levels and in pretrends. First, most companies produce fewer 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. Given this issue, comparisons in levels may be difficult. While reducing the sample to firms in the top 5 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 differential pretrend that we observe for the control group for years prior to 2008. The majority of the increase prior to the merger is attributable to an increase

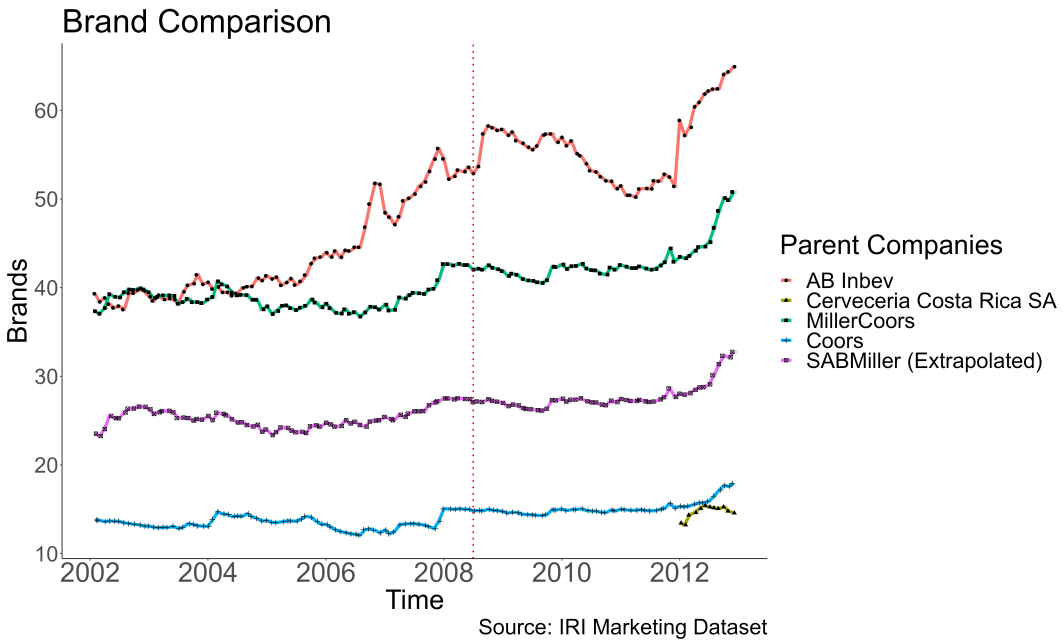
Table 6

	Dependent variable:			
	log(Number of brands)			
	(1)	(2)	(3)	(4)
Year 1 ∗MillerCoors	-2.377^{***}	-0.209^{***}	-0.209^{***}	-0.209^{***}
	(0.020)	(0.020)	(0.020)	(0.020)
Year 2 ∗MillerCoors	-2.393^{***}	-0.224^{***}	-0.225^{***}	-0.224^{***}
	(0.019)	(0.024)	(0.024)	(0.024)
Year 3 ∗MillerCoors	-2.383^{***}	-0.214^{***}	-0.216^{***}	-0.214^{***}
	(0.020)	(0.026)	(0.026)	(0.026)
Year 4+ ∗MillerCoors	-2.397^{***}	-0.227^{***}	-0.229^{***}	-0.227^{***}
	(0.025)	(0.031)	(0.031)	(0.031)
State FE	No	Yes	No	Yes
Month FE	No	No	Yes	Yes
Observations	45,712	45,712	45,712	45,712
Adjusted R^2	0.575	0.917	0.916	0.917

Note: *p<0.1; **p<0.05; ***p<0.01

Note: Observations are at the firm–market–month–year level. The year variables indicate the period 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. Standard errors are clustered at the market level. For the last set of regressions, to remove colinearity with the year, month and postmerger variable, the December fixed effect is removed.

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 mergers. The Miller and Coors numbers of brands are added to this graph for comparison. Observations are at monthly level. The red dashed line denotes the date when the MillerCoors merger was finalized. The lines in gray are firms in which the minimum number of brands produced at any time is fewer than ten.

in Anheuser-Busch's brand variety in 2006. Additionally, Anheuser-Busch and InBev merged in 2007; however, InBev is a Belgian company and had no breweries located in the United States prior to the merger.[14] 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 raises the issues with using comparable levels and companies described previously. Therefore, removing Anheuser-Busch and Inbev is not desirable. In the following sections and in the appendix, I explain how I 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 of creating 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, I estimate linear trends in the number of brands for the control group and the treatment group using only the pretreatment period. Next, I subtract the predicted time trend for 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 the year fixed effects, such as the increase in Anheuser-Busch's brand variety.

Figure 13 displays the detrended data for the top 5 percentile comparison group, which does match the pretrend prior to the merger better on levels but fluctuates more in the earlier part of the sample period. Although this method helps match the pretrend better and, based on the figure, MillerCoors still shows a large increase in brand variety after the merger, using these earlier data causes some issue.

Using these detrended data, I 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 because of the merger and because they were part of the MillerCoors company. The results are in Table 7:

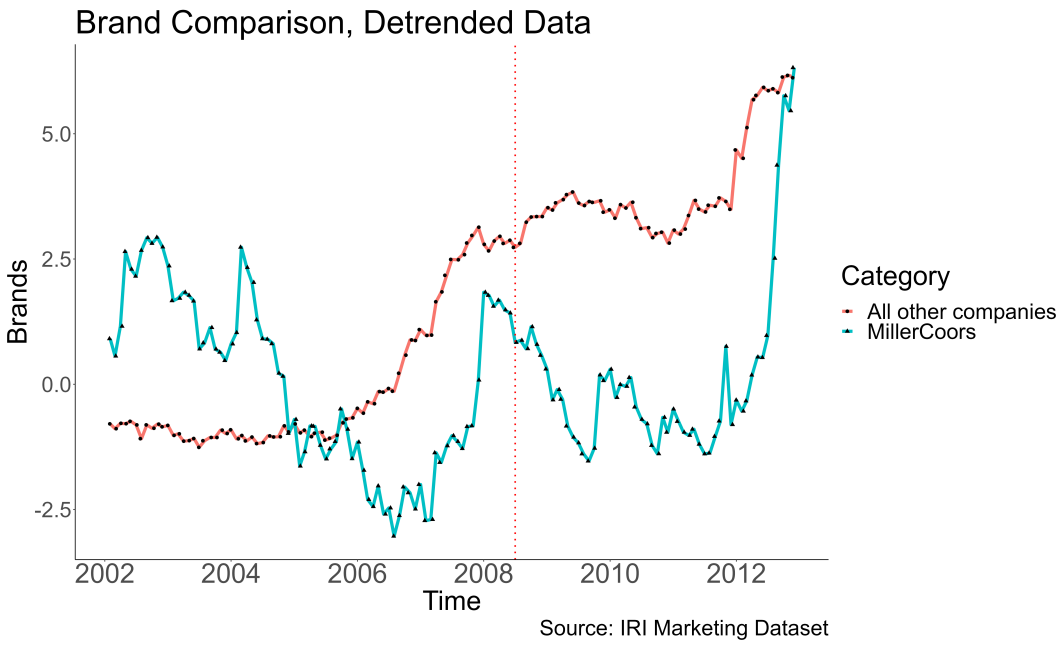
The effect on the detrended data is negative and larger than the baseline results. After the merger, the number of brands offered by MillerCoors compared to that of its competitors ranges from about -6 to -5.9 and remains significant under standard fixed effects. Net of this time trend, the effect is 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 was no decline in product variety, indicating that some products within established brands were created

[14] 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 that the MillerCoors merger was finalized. The detrending procedure is as follows: In the first stage, I estimate linear trends in the number of brands for the control group and the treatment group using only the pretreatment period. Next, I subtract the predicted time trend from the number of brands for the entire period.

Table 7

	Dependent variable:				
	Detrended Number of Brands				
	(1)	(2)	(3)	(4)	(5)
Postmerger	6.758***	6.088***	6.092***	0.922***	0.668***
	(0.372)	(0.252)	(0.252)	(0.114)	(0.118)
Miller or Coors	−0.635	−0.635	−0.632	−0.757	−0.759
	(0.833)	(0.833)	(0.829)	(0.827)	(0.827)
MillerCoors	−5.993***	−5.992***	−5.997***	−5.869***	−5.867***
	(0.557)	(0.557)	(0.555)	(0.556)	(0.556)
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^2	0.073	0.073	0.086	0.098	0.098

Note: *p<0.1; **p<0.05; ***p<0.01

Note: Observations are at the firm–market–month–year level. The "Postmerger" variable indicates the period after July 2008, the start of the merged company's operation. Only the ten largest firms by national revenue share prior to 2007 are included in this regression. Standard errors clustered at the market level. For the last set of regressions, to remove colinearity with the year, month and postmerger variable, the December fixed effect is removed.

after the merger to offset the loss of certain brands. This corroborates a finding from prior work that merging firms consolidate product lines in their core competencies.

However, the linear model alone may not be sufficient for understanding overall product variety changes after the merger. I therefore create a difference-in-difference model to control for competitor effects. I find a decrease in brand variety relative to that of top competitors but no decrease in brand variety relative to all brands on the market. Which of these effects seems more plausible is heavily reliant on how the market is defined, a matter on which this paper takes no stance but provides multiple results to inform the question.

A model is needed to explain how significant this change truly is for consumers. While the data appendix does show that 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 change in consumer welfare. Therefore, I need a consumer welfare model to see which of these two reduced-form models best aligns with final consumer outcomes. With this in mind, I return to the product level for the structural model.

5 Structural Model

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

5.1 Demand Model

I use the random coefficient nested logit (RCNL) model from Miller and Weinberg (2017) to estimate consumer demand for beer. This model and models analogous to it have been used in a variety of works studying this industry and others. This is my preferred consumer demand model, as it allows me to flexibly estimate consumer preferences for specific types of beer and may better match shopping behavior. Additionally, this allows me to match the price consumer welfare estimates from their models to mine. I use the notation from Miller and Weinberg (2017) to describe an altered version of their model below.

The model is illustrated as follows. Suppose there are $m = 1, \ldots, M$ markets observed during $t = 1, \ldots, T$ time periods. Per market and per time, there are $i = 1, \ldots, N_{mt}$ 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, she then chooses a specific good in that category. The products observed are represented as $j = 1, \ldots, J_{mt}$, with the outside good represented as $j = 0$. Products are defined by a combination of brand, the type of good that they are, the packaging type, and

the total product size in ounces. Prices are standardized to price per ounce. The conditional indirect utility that consumer i receives from a product j is represented by the following:

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

where y_i is the average income in the market, p_{jmt} is the price of the product, ν_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 the product is a light beer, $\mathbb{1}\{\text{Import}\}$ indicates whether it is an import beer, ξ_{jmt} is the product $\times$ market $\times$ time demand shock, and $\epsilon^{NL}_{ijmt}(\rho)$ is the error term, as a function of which type of product was purchased. I normalize the outside good's mean utility to 0, so buyers receive only $\epsilon^{NL}_{ijmt}(\rho)$. 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, I assume the following specification for the error term, given two groups $g \in \{0, 1\}$, where group 1 defines the ales and group 2 the lagers. Then,

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

where ϵ_{ijmt} represents the I.I.D. extreme value draw, Ξ_{igmt} is a draw from a unique distribution such that $\epsilon^{NL}_{ijmt}(\rho)$ is extreme value, and ρ is a nesting parameter between 0 and 1. A larger ρ corresponds to greater correlation for products within the same nest and less substitution between products not in the nest. I also normalize the indirect utility of the outside good such that $U_{i0mt} = \epsilon_{i0mt}$ and assume that 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 supermarkets. This implicitly assumes that these firms in the outside-good group do not price strategically with respect to the firms in this model.

From this specification, I can derive logit choice probabilities for market m and brand j at time t as in Berry, Levinsohn, and Pakes (1995). Multiplying these logit choice probabilities by the market size, I can derive demand as a function of product characteristics, prices, competitor product characteristics and consumer characteristics. The market shares can then be represented as

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

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 I use for comparison purposes later. In this case, the utility is linear in parameters:

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

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

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

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

Although this model is used for comparison, I prefer using the full RCNL for two reasons. First, the nesting parameter allows 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 whose results I want to directly compare my own with. Second, parameters on taste preferences such as light beer and international brands cannot be fully estimated without random coefficients, and this may be important given a heterogeneous customer base. I provide both the RCNL and the nested logit for comparison.

6 Results

In this section, I 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. I find coefficients consistent with intuition under the demand model and find that new and discontinued products had higher diversion ratios and were more elastic. I then use this model to estimate the two counterfactuals of the paper: what would occur if the new products had not been created after the merger and what would occur if the discontinued products had remained in markets after the merger. I find that 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 products, I estimate the demand model after the merger, from 2008 to 2010. I first estimate a standard nested logit for this period of time with monthly and quarterly data. The results are in Table 8.

Overall, the aggregate models provide more sensible results than the market-level models. The price coefficients are -0.38 and -0.48 in the monthly and quarterly models, respectively, denoting 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 light beers are all positive, indicating that the probability of purchase for these products is higher than that for their counterparts. For the market-level models, these are all of the same sign yet much smaller, potentially due to the smaller sample size for each individual model. When examining the elasticities and diversion ratios, I find that the median for the aggregate models is around 4–5 while that for the market-level models ranges from 2 to 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 are only a few years of data.

Table 8

	Monthly		Quarterly	
	Aggregate Model	Average of Market Models	Aggregate Model	Average of Market Models
	(a)	(b)	(c)	(d)
Price	-0.3813	-0.01086	-0.4837	-0.0098
	(0.0200)	(0.0036)	(0.0492)	(0.0061)
Imported	0.4020		0.63157	
	(0.0794)		(0.0199)	
Ale	0.86153		0.9140	
	(0.0613)		(0.0136)	
Lite	0.4495		0.3675	
	(0.0263)		(0.0638)	
Nested Logit Term	0.0208	0.9515	0.01987	0.9602
	(0.0189)	(0.0150)	(0.0445)	(0.0232)
Observations	155253	155253	65306	65306
Other Statistics:				
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 to 2010, I include market fixed effects. For the market-level models, which estimate demand for 2008–2010 for each of the 39 markets, I exclude the characteristic indicators for computational reasons. Only firms included in the original study of Miller and Weinberg (2017) are included. The "pyblp" package is used for model estimation.

Notably, in both models, the diversion ratio for new products is above that for 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 also 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 for them. This also shows that any results of the counterfactual may be underestimated: if these products are more easily replaceable, losing them may not decrease consumer welfare as much.

After calibrating the model under a nested logit, I now add complexity to the model and calibrate it under a random coefficient nested logit. For the random coefficient nested logit, I apply the parameters listed in Table 9:

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

7 Counterfactuals

I next examine the following two counterfactuals to examine the value of new products and discontinued products after the merger: namely, I examine what consumer surplus would be if the products newly created after the merger had never been made and what consumer surplus would be if the products discontinued after the merger had continued to exist. From these two counterfactuals, I can compare consumer surplus from the observed baseline and the change in consumer surplus, giving an estimate of the value of these goods. Both of these exercises use the model above, calibrated to the postmerger period. 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 and every discontinued product dropped because of 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.

An important caveat in these counterfactuals is what happens with prices after any market changes. For this, I consider two cases. In the first, I keep prices constant. This is to consider the scenario where other firms do not respond to any product variety changes. In the second case, I recalculate prices after products are removed from the markets. This is to allow competitors to readjust after seeing their competitor's product variety changes. I calculate these prices through finding the Bertrand price equilibrium after the products have left the market. To estimate these new prices, I 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 that these products have a sufficiently large cost that they will not be made.

To provide an appropriate baseline for these results, I replicate as closely as possible the data cleaning done in Miller and Weinberg (2017). Since these consumer surplus results ultimately rely on a specification of demand, the market definition and what data are used

Table 9

	Monthly	Quarterly
	(a)	(b)
Price	-0.3813	-0.5580
	(0.0217)	(0.0560)
Price Random Coefficient	0.0000	0.0239
	(0.2765)	(0.0734)
Ale	0.8615	1.0911
	(0.0677)	(0.2723)
Ale Random Coefficient	0.0000	0.0000
	(14.2829)	(13.1826)
Imported	0.4019	0.8515
	(0.1216)	(0.3815)
Imported Random Coefficient	0.0117	-0.0269
	(6.7652)	(16.3632)
Light	0.4496	0.3369
	(0.0352)	(0.0789)
Light Random Coefficient	0.0000	0.0000
	(10.7582)	(10.3504)
Nesting Term	0.0021	0.0027
	(0.0024)	(0.0651)
Random Coefficient Constant	0.0000	0.5036
	(4.9327)	(5.2577)
Observations	155253	65306

	Quarterly	
	MW Firms Only	Top 5% Firms
	(a)	(b)
Other Statistics:		
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 to 2010, I include market fixed effects. Only firms included in the original study of Miller and Weinberg (2017) are included. The "pyblp" package was used for the estimation of this model.

Table 10: Change in Consumer Surplus Estimating Value of New Products

		Time	Δ CS, Prices Fixed	Δ 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%

to estimate the model, to provide correct relative estimates of consumer surplus changes, I restrict my data such that they mirror the data used to derive Miller and Weinberg's (2017) results as closely 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-ounce (6-pack), 144-ounce (12-pack), and 288-ounce (24-pack) products. Second, they include products that do not drop out of markets throughout the sample. To replicate this, I consider products available in at least ten markets in each period throughout the sample. Notably, this effects the discontinued product results more, as typically products are discontinued in a few markets before being withdrawn completely. These changes reduce the number of new brands studied between 2008 and 2010 and discontinued products studied from 2008 and 2009 from 28 to 10 and from 21 to 4, respectively.

7.1 Value of New Products

To estimate the value of new products, I drop a subset of products created postmerger for the period after the merger instead. I consider two subsets: a subset where the only new products are ones added to any market nationally and a subset where, for each market, I consider which products were newly added after the merger. After dropping these products, I re-estimate consumer surplus and estimate the change in consumer surplus under this regime from the baseline of the postmerger period. The final calculation of 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. I 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 models. 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 at which the model is estimated and whether the model allows prices to readjust after the change in product variety. In terms of the results of Miller and Weinberg (2017), who estimate a -3.7% decline in consumer surplus due to both the effects of the merger and

the effects of coordinated pricing, the effect estimated in the paper is approximately 34% of its magnitude. In terms of Miller and Weinberg's (2017) estimate for unilateral effects only, this model's estimated effect is nearly 60% of the magnitude. 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.

7.2 Value of Discontinued Products

To estimate the value of discontinued products, I add a subset of products discontinued postmerger for the period after the merger instead. Due to the decline in the number of brands and therefore products studied, I examine only what happens had the discontinued products been added to their respective markets nationally, rather than on a per-market basis. Additionally, due to the data cleaning, I consider only products 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 six, twelve or twenty-four packs.

Two assumptions need to be made regarding what the prices and shares would be had the discontinued products existed after 2008. Since these products do not exist in the postmerger period, I have no price data or sense of what their shares would have been. I assume that the prices of the discontinued products follow the same pattern as 2008, the last full year in which the products were available. To calculate the new shares, I 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 assumptions here are that the discontinued products' prices changed only with inflation over time and that, with the withdrawal of these products, consumers bought the outside good rather than any products supplied by the companies. This latter assumption biases the results upward, as it is possible that consumers may have substituted to other products marketed by the same company instead of leaving the market entirely.

To do this estimation, I first recalibrate 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, the results are mostly the same, except that the coefficients on the nested logit parameter are 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.

After dropping these products, I re-estimate consumer surplus and estimate the change in consumer surplus under the baseline regime relative to that in the hypothetical situation in which the discontinued products remained on the market in the postmerger 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 one in which prices adjust further after the withdrawal of the products. For example, suppose that a supply-side issue in the counterfactual in which these products

Table 11

	Monthly	Quarterly
	(a)	(b)
Price	-0.3925	-0.4973
	(0.0188)	(0.0351)
Imported	0.4263	0.7929
	(0.0745)	(0.1413)
Ale	0.7322	0.4908
	(0.0559)	(0.0794)
Light	0.4244	0.3633
	(0.0211)	(0.0391)
Nested Logit Term	0.0000	0.0000
	(0.0198)	(0.0294)
Observations	166005	76474
Other Statistics:		
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 for which firm provided the product. For the aggregate model, which calculates demand across all markets and contains all data from 2008 to 2010, I include market fixed effects. Only firms included in the original Miller and Weinberg (2017) study are included. The "pyblp" package is used for model estimation.

Table 12: Change in Consumer Surplus Estimating Value of Discontinued Products

		Time	Δ CS, Prices Fixed	Δ CS, Prices Adjust
Brands readded to all markets in which originally discontinued, then withdrawn				
	Nested Logit	Monthly	-0.1412 %	-0.1543 %
		Quarterly	-0.1523 %	-0.1732 %
	RCNL	Monthly	-0.1412 %	-0.1543 %
		Quarterly	-0.1468%	-0.1750%

existed prevented firms from choosing optimal prices. The final calculation of 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. 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 models. 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 at which the model is estimated and whether the model allows prices to readjust after the change in product variety. In terms of the results of Miller and Weinberg (2017), who estimate a -3.7% decline in consumer surplus due to both the effects of the merger and the effects of coordinated pricing, the effect estimated in the paper is approximately 4% of that magnitude. In terms of Miller and Weinberg's (2017) estimate for unilateral effects only, this model's estimated effect is 6% of that magnitude.

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 offer only partial-equilibrium results. Second, my results are benchmarked to those of Miller and Weinberg's (2017) work and should be considered only in the context of their model. Finally, these results provide upper and lower bounds on the value of new products and discontinued products, respectively. The underlying assumption is that all products were discontinued or created because of the merger, which may not necessarily hold. These counterfactuals focus on the most extreme case to provide bounds on what the results could be.

The results are still informative, as they show that product variety changes do matter for consumer surplus effects. New product variety in particular leads to a large gain in consumer surplus. The impact of the removal of new product varieties can be considered of lesser magnitude than that of price coordination, but 34% of the effect may still be 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, I examine how a merger may affect changes in product variety offered to consumers and what the effects of product variety changes postmerger may be for consumers. I 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 corresponds to a well-established market with a large set of competitors, a merger of two large firms within it, and well-defined product variety that I can easily map to the main data source for this project, the IRI marketing database. After providing evidence of national product varieties decreasing and then increasing late in the sample period, I 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 it compares against similar competitors in the market. I 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 industrial organization literature, the model is a random coefficient nested logit model that incorporates product characteristics with the additional flexibility of product nests and idiosyncratic shocks to consumer preferences on product characteristics. I align the model closely to Miller and Weinberg's (2017) work, another paper studying this merger that uses a similar model and the same data. Using my model, I consider what the counterfactuals outcomes would have been had the new products created after the merger not been released exist and had the discontinued products been retained after the merger.

I find that, at the market level, product variety does change after a merger and this change is significant for consumers. I find that, after the merger, 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 that of competitors in the market, MillerCoors's brand variety falls by 22%. This negative result is robust to removing the time trend. Finally, in the last section of the paper, I find that the loss of new products created after the merger would be detrimental to consumers. The change in consumer surplus from the value of new products would be approximately 1.25% or—benchmarked to Miller and Weinberg's (2017) findings—approximately 34% of the change in consumer surplus occurring due to price changes and coordination. Likewise, I find that the loss in consumer surplus from discontinued products would be approximately -0.14% or—again benchmarked to Miller and Weinberg's findings—approximately 4% of the change in consumer surplus occurring due to price changes and coordination. Combining the two, I find that the value added from new products outweighs the value lost from discontinued products.

Future work can incorporate a supply-side model to find the general equilibrium and incorporate more dynamics of how product variety can change on the producer side. Work such as Wollmann (2018) provides 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. Works 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.

Appendix

Click Here for the Online Appendix.

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