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Essays in Industrial Organization: The Effects of Vertical Integration on Prices and New Product Introduction

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Essays in Industrial Organization:
The Effects of Vertical Integration on Prices and New Product Introduction

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ABSTRACT OF THE DISSERTATION

Essays in Industrial Organization:
The Effects of Vertical Integration on Prices and New Product Introduction

by

Yutong Wang
Doctor of Philosophy in Economics
University of California, Los Angeles, 2020
Professor Simon Adrian Board, Co-Chair
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This dissertation consists of three essays that study the effects of vertical integration in the field of industrial organization. The first chapter studies the effects of vertical integration on the vertically integrated company, specifically, the effects on prices and new product introduction. The second chapter studies the effects of vertical integration on the vertically integrated company's competitor. The third chapter studies the effects of vertical integration on the new product introduction in detail, and discusses the important policy implications.

In the first chapter, I study the effects of vertical integration on the vertically integrated company, specifically, the effects on prices and new product introduction. Upstream and downstream companies both charge markups, and separated production generally incurs higher cost. Different incentives of upstream and downstream companies and high negotiation costs may impede new product introduction process. Vertical integration solves these problems. This chapter studies empirically the effects of vertical integration: whether it leads to a price decrease, which comes from synergy and the elimination of double marginalization; and whether it leads to more new products introduced to market, because it eases

the new product introduction process. Specifically, this chapter studies the 2010 vertical integrations of the two largest soda companies, The Coca-Cola Company and PepsiCo, with their largest downstream bottlers, respectively, by using bottlers territory maps together with prices and sales data. In this chapter, all carbonated soft drink master brands of The Coca-Cola Company and PepsiCo are included in the analysis. Results show that the vertical integrations lead to 0.3%-0.6% price decrease for products of The Coca-Cola Company and 1.4%-1.6% price decrease for products of PepsiCo; and they lead to more new products introduced to vertically integrated markets: annually 9%-10% more new products for The Coca-Cola Company, and 5%-8% more new products for PepsiCo.

In the second chapter, I study the effects of vertical integration on the vertically integrated company's competitor, specifically, the effects on prices and new product introduction. The vertically integrated bottlers (Coca-Cola Enterprises, Pepsi Bottling Group and Pepsi Americas) bottled Dr Pepper's products both before and after the vertical integration. For Dr Pepper Snapple Group, its competitors, The Coca-Cola Company and PepsiCo, controlled its downstream bottlers after the vertical integrations. In the soda industry, the bottlers set the price of final products. Furthermore, if the upstream company wants to introduce a new product, it needs to negotiate with downstream bottlers for them to bottle and distribute the products. After the vertical integration, The Coca-Cola Company and PepsiCo have incentives to increase the price of the Dr Pepper's products so that consumers will substitute from Dr Pepper's products to Coca-Cola's and Pepsi Cola's products. Furthermore, when Dr Pepper wants to introduce a new product, The Coca-Cola Company and PepsiCo may impede this process, leading to fewer new products from Dr Pepper, which will be beneficial for The Coca-Cola Company and PepsiCo. Empirically, only products of three master brands, Coca-Cola, Pepsi Cola and Dr Pepper, are included in the analysis. Results show that the vertical integrations lead to 0.7%-1.0% price decrease for products of Coca-Cola, 1.4%-2.2% price decrease for products of Pepsi Cola, and 0.3%-0.7% price increase for products of Dr Pepper. For the new product introduction, vertical integrations lead to more new products

for the vertically integrated company and fewer new products for the vertically integrated company's competitor: annually 12%-13% more new products of Coca-Cola, 10%-12% more new products of Pepsi Cola, and 9%-15% fewer new products of Dr Pepper.

In the third chapter, I study more about these new products and about how vertical integration affects new product introduction process. Products are defined using six characteristics. For each new product, I find out what is the new characteristics of this product. For all the new products introduced before vertical integration, I draw the distribution of these new characteristics, and I do the same for all new products introduced after vertical integration. I then study how vertical integration affects the distribution of new characteristics. For the new products of the vertically integrated company, after vertical integration, the distribution of new characteristics shifts from less innovative characteristics to more innovative characteristics. That is to say, the new products introduced after vertical integration are more innovative. For the new products of the vertically integrated company's competitor, after vertical integration, the distribution of new characteristics shifts from more innovative characteristics to less innovative characteristics. That is to say, the new products introduced after vertical integration are less innovative.

I also discuss the important policy implications in the third chapter. The effect of vertical integration on new product introduction has not drawn much attention in vertical merger reviews and evaluations. The results of this research show that the effect of vertical integration on new product introduction should be emphasized in anti-trust policies and their enforcement. This policy implication is very important, especially when many recent high-profile merger cases are vertical integrations, such as the AT&T and Time Warner merger, etc. And the recent development of anti-trust policies echoes the results of this research.

The dissertation of Yutong Wang is approved.

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2020

To my parents and brother

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Chapter 1

The Effects of Vertical Integration on The Integrated Company: Lower Prices and More New Products

1.1 Introduction

Competition in vertical markets is complicated and the effects of vertical integration have always been an important research question in the field of industrial organization. Vertical integration may eliminate double marginalization and lead to synergy for the vertically integrated company, both of which may result in a decrease in price and an increase in consumer welfare. Besides the price effect, vertical integration may also make it easier to introduce new products to markets, which, in vertically separated structure, requires (incentive compatible) cooperation and thus contracts negotiation between upstream and downstream companies. Vertical integration aligns the economic incentives between upstream and downstream companies, and eliminates the management and negotiation cost, and therefore makes new product introduction process easier. Product proliferation also increases consumer welfare.

This chapter studies the effects of vertical integration on the vertically integrated com-

pany, specifically, the effects on prices and on new product introduction, by exploring recent vertical integrations in the soda (carbonated soft drink) industry. The main contribution of this research is that this is the first research that studies and quantifies the effect of vertical integration on new product introduction, which has long been overlooked in the literature and in anti-trust policy, and this research shows that the vertical integration leads to more products being introduced to market. Furthermore, this research adds more evidence to the limited empirical literature on the price effect of vertical integration, and shows that vertical integration leads to price decrease on the products of the vertically integrated company.

Soda industry is ideal for this research for several reasons. First, the two largest upstream companies, The Coca Cola Company and PepsiCo, both vertically integrated with their largest downstream bottlers in 2010, respectively. On the other hand, there are still many independent bottlers that are not vertically integrated. Second, the exclusive territory of downstream bottlers allows clear identification of markets that are vertically integrated and markets that are not. The variation in vertical structure allows me to identify the effect of vertical integration using the difference-in-difference strategy. Third, the bottling contracts between upstream company and downstream bottlers imply a double marginalization before vertical integration. Fourth, in the soda industry, when upstream company invents a new product and wants to introduce it to market, the company needs to negotiate with downstream bottlers for them to bottle and to distribute the new product within their exclusive territories, and the negotiation process is costly and time-consuming. The difficulty in new product introduction under vertically separated structure was a key motivation for upstream company to vertically integrate with downstream bottlers. This feature allows me to study the effect of vertical integration on new product introduction. An integrated company controls both production and distribution, and theoretically, it will be easier to introduce new products to market in a vertically integrated company.

Based on the institution in the soda industry and motivations for vertical integration, there are several predictions on the effects of vertical integration. First, vertical integra-

tion will lead to a lower price: this is because vertical integration will bring synergy in the production process and also eliminate the double marginalization. Second, vertical integration makes new product introduction process easier and therefore more new products will be introduced after vertical integration: this is because vertical integration aligns the economic incentives between upstream company and downstream bottler, and eliminates the costly and time-consuming negotiation process between upstream company and downstream bottler when a new product is introduced.

Empirically, I use the bottlers' territory maps to identify whether a market is affected by vertical integration. I focus on the time period between 2008 and 2012. In this research, products are defined by the unique combination of six product characteristics: brand-flavor-calorie level-container type-size-multiple in a unit of product. All carbonated soft drink master brands of the Coca-Cola Company and the PepsiCo are included in this research. For each product, I use scanner data to find monthly sales and prices in each market, i.e. the observation is at product-market-month level. I further use the scanner data to track two things: for each market, in each month, the list of products that are offered in that market in that month; and for each product, in each month, the list of markets in which the product exists in that month. The first list, the list of products in a certain market in each month, allows me to track new product introductions to the market. The second list, the list of markets where a certain product exists in each month, allows me to track the new product roll-out process, the results of which will be discussed in chapter three.

I first use the synthetic control method to study the effects of vertical integration on prices and the number of new products introduced to markets, and utilize the synthetic control weights to run weighted regressions and to quantify the effects of vertical integration. I then use the difference-in-difference method to further quantify the effects of vertical integration on prices and the number of new products introduced to markets, by exploring the longitudinal and cross-sectional variations in vertical structures in markets. In chapter three, I explore in much more detail about these new products and about how vertical integration

affects the new product introduction.

The synthetic control analysis shows that vertical integration leads to price decrease and more new products introduced to markets. Specifically, the vertical integration leads to 0.3% price decrease for the products of The Coca-Cola Company, and 1.4% price decrease for the products of PepsiCo. In addition, for new products of The Coca-Cola Company, the vertical integration leads to 1.5 more new products annually being introduced to markets that are vertically integrated than markets that are not vertically integrated. On average, there are 15.9 new products of The Coca-Cola Company introduced annually, and vertical integration leads to 10% more new products. For PepsiCo, the vertical integration leads to 2.6 more new products annually being introduced to markets that are vertically integrated than markets that are not vertically integrated. On average, there are 30.8 new products of PepsiCo introduced annually, and vertical integration leads to 8% more new products. These results are consistent with theoretical predictions.

The difference-in-difference analysis finds similar results to those in the synthetic control analysis. Specifically, the vertical integration leads to 0.65% price decrease for the products of The Coca-Cola Company, and 1.59% price decrease for the products of PepsiCo. In addition, for The Coca-Cola Company, the vertical integration leads to 1.48 more new products annually being introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 9% more new products; for PepsiCo, the vertical integration leads to 1.54 more new products annually being introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 5% more new products. All these results are consistent with theoretical predictions that vertical integration leads to a price decrease, and makes the new product introduction process easier.

These results on the effects of vertical integration have important policy implications, and I discuss it in chapter three.

The rest of the chapter is organized as follows. After a review on literature, Section 2

introduces the background in the soda industry, and Section 3 describes the data I use in this chapter. By using the synthetic control method, Section 4 shows the trends in prices and the trends in the number of new products. This section also shows the estimation results of synthetic control method. Section 5 builds an empirical model to apply the difference-in-difference method, and discusses identification and shows the estimation results. Section 6 concludes this chapter.

1.1.1 Literature

The theoretical literature on vertical integration suggests that it will eliminate double marginalization (Spengler, 1950), which will lead to positive effect on consumer welfare through a lower price. On the other hand, it may cause the foreclosure for rivals and leads to a higher price (Hart and Tirole, 1990). Furthermore, vertical integration solves hold-up problems caused by relation-specific investments and may lead to increase in investment (Williamson, 1985; Grossman and Hart, 1986). There is a limited but growing literature on the empirical evidence of the effects of vertical relations. These papers study different industries, with some papers presenting reduced form evidence, and others presenting results from structural models. Hastings (2004) and Hastings and Gilbert (2005) study the retail and wholesale gasoline markets and show that more vertically integrated gas stations do not lead to higher retail price and yet vertical integration leads to higher wholesale price. Different from gasoline markets, in the soda industry, there is no concern about higher price of intermediary goods, which is the concentrate and syrup, due to the exclusivity between the soda company and bottler. Hortacsu and Syverson (2007) study the vertical integration in cement and concrete markets and show that, after vertical integration, prices fall and quantities rise due to efficiency and productivity advantages. Some other papers use structural models to study the welfare effect and foreclosure effect from vertical integration and other vertical relations. In the multichannel television industry, Crawford and Yurukoglu (2012) show that comparing to bundling of television channels, the alternative of individual channels for sale to consumers

does not change consumer surplus very much, and yet input costs for downstream distributors will rise. Crawford, Lee, Whinston and Yurukolu, (2018) show that vertical integration can lead to welfare gains or losses, depending on whether rival distributors have access to the content from the integrated upstream content provider. Villa-Boas (2007) studies the vertical relationships between manufacturers and retailers by studying the yogurt industry.

For product choices and innovations, Draganska, Mazzeo and Seim (2009) studies how ice-cream companies make product-choice decisions. Wollman (2018) studies the endogenous choice of new products in commercial vehicle industry. While these researches focus on the product choice and innovation *per se*, in this research, I study the process of new product introduction.

For the soda industry specifically, Muris, Scheffman and Spiller (1992) studies the organization of distribution in the soda industry. Dube (2005) studies product differentiation in simulated horizontal mergers. A recent work by Luco and Marshall (2019) studies the effect of vertical integration by also exploring the several vertical integrations in the soda industry in 2010. However, they focus on the price effect of vertical integration on competitor's products. And in this research, I focus on a different question: the price effect and the effect on new product introduction of the vertical integration.

1.2 Industry Background

1.2.1 Soda Industry

In the soda (carbonated soft drink) industry, there are three major companies, The Coca-Cola Company, PepsiCo, and Dr Pepper Snapple Group [1]. These companies are upstream companies and they produce concentrate and syrup of soda drinks, and sell them to bottlers. Bottlers are downstream companies and they combine the concentrate and syrup with

[1] According to IBIS World, these three companies have market share of 32.4%, 25.9% and 9.4% in 2016, respectively.

carbonated water, and bottle them in cans or bottles. Bottlers are also responsible for distribution.

Several terms in the bottling contracts between upstream and downstream companies are important for this research. Firstly, upstream companies sell concentrate and syrup to bottlers and upstream companies set the price of concentrate and syrup. Secondly, bottlers sell and distribute final products to grocery stores and convenience stores. Bottlers set the prices of final products and upstream companies have no rights to establish these resale prices. These contract terms indicate a vertical structure in the soda industry and suggests that there is double marginalization in this vertical structure before integration.

Another term in the bottling contract that is important for this research is that each bottler has the exclusive right to manufacture and distribute the specified products within specified territory. This term implies that, a market has only one bottler of The Coca-Cola Company and has only one bottler of PepsiCo, etc. For The Coca-Cola Company, a market can be either vertically integrated, or not vertically integrated (cannot be both). Similarly, for PepsiCo, a market can be either vertically integrated, or not vertically integrated (cannot be both). Together with the bottlers territory map, I can identify which markets are affected by vertical integration, and which markets are not.

There are two types of distribution in the soda industry: direct store delivery and warehouse delivery. Under direct-store-delivery distribution, bottlers' employees bring products to a store, set up promotional displays, and keep the shelves stocked. Under warehouse-delivery distribution, products are shipped to retailers' warehouses and they are put on the store shelves by store employees. The vast majority of branded soft drinks, such as The Coca-Cola Company and the PepsiCo's products that I study in this research, are distributed via direct store delivery. On the other hand, private label soft drinks, such as Walmart's Great Value [2], are distributed via warehouse-delivery. The distribution method is also important to this study for two reasons. First, bottlers control distribution and they bring products

[2]Nielsen data masks all retailers in the data. This is named for comparison reasons and is not from Nielsen data.

to stores. Having the control of distribution ("route-to-market") is one of many motivations why upstream companies want to vertically integrate with their downstream bottlers. Second, the bottlers' employees set up promotional displays and keep the shelves stocked. This implies that bottlers have direct control of the final product price that consumers pay. Therefore, I do not consider a third layer of retailers and I use retail price as a proxy for the price that bottlers set.

Another aspect of the soda industry that is important to this research is the new product introduction process. Upstream companies can introduce new brands and have research and development department to innovate new formulas for soft drinks. Besides, upstream companies may also want to change container type and container size from time to time. If upstream companies want to test and introduce a new product, they need to negotiate with downstream bottlers. This is specified in the bottling contract and bottlers have the right but not obligation to elect to manufacture and distribute new products.

For downstream bottlers, testing and introducing a new product is costly and risky. First, it involves relation specific investments and is risky. To test and introduce a new product, local marketing and advertising, such as promotions, advertisements on local newspaper and radio, are essential. These investments are relation specific because a promotion for a new product is specific to this product, and if this product is a failure, the investment cannot be used for other products. Another term in the bottling contract that is relevant to product offering and new product introduction is that downstream bottlers are responsible for local marketing and promotion activities. Under this term, the burden of local marketing and advertisement is on the shoulder of local bottlers. Second, testing and incubating a new product is costly, because new product does not have the heft and velocity of legacy products and there is no economy of scale. PepsiCo CEO Nooyi mentioned this specifically in PepsiCo's SEC filing on 2009 Aug 4 about the integration: "*The only way we can successfully launch these [new] products and make them compelling for consumers to buy them is if we can get them on the retail shelf cost effectively and incubate them so they can establish a*

franchise with consumers. The [bottler] system that exists in beverages today is inadequate to accomplish this because new products, which don't have the heft or velocity of legacy products, get prematurely minimized sometimes."

Downstream bottlers face costly and risky new product testing and introduction, and they do not want to bear the heavy cost and high risk. This leads to the costly and time-consuming negotiation between upstream companies and downstream bottlers when the upstream companies want to test and introduce a new product.

1.2.2 Vertical integration and its motivations

Both The Coca-Cola Company and PepsiCo have their own nationwide bottler networks. In February 2010, PepsiCo acquired two of its largest bottlers, Pepsi Bottling Group (PBG) and Pepsi Americas (PAS); and in October 2010, the Coca-Cola Company acquired its largest bottler Coca-Cola Enterprises (CCE). These vertical integrations are large in scale. As shown in the data section, the vertically integrated markets in U.S. span from east coast to west coast, and furthermore, not only many urban markets are vertically integrated, many rural areas are also vertically integrated.

Upstream companies vertically integrate their downstream bottlers in order to integrate supply chain and to streamline production and distribution. Several specific benefits motivate the vertical integration.

First, vertical integration will bring synergy and lead to a lower cost. The Coca-Cola Company's 2010 annual report states that "*(Vertical integration will) improve efficiency by streamlining operations and reducing or eliminating the costs, expenses, management time and resources associated with interactions and negotiations between the previously separate organizations.*"

Second, vertical integration will align economic incentives among upstream companies and downstream bottlers. An industry report from IBIS World points out that bottlers have the ability to switch to another product if the terms of their agreements with beverage base

manufacturer lose appeal. And The Coca-Cola Company's 2009 annual report raises the same concern about the misalignment of incentives: "*Many of our bottling partners have the right to manufacture or distribute their own products or certain products of other beverage companies ... they may devote more of their energy and resources to business opportunities or products other than those of the (Coca-Cola) Company.*" As an extreme example, in 2008, Pepsi Bottling Group and Pepsi Americas took on Dr Pepper Snapple Group's Crush line of flavored soda drink, in lieu of PepsiCo's Tropicana Twister. Vertical integration will solve such misalignment of economic incentives.

Another important benefit of vertical integration is that upstream companies can control the distribution and increase the flexibility in product offering. The Coca-Cola Company states the benefit of vertical integration in its 2010 annual report. "*(Vertical integration will) strategically position us to better market and distribute our nonalcoholic beverage brands in North America.*"

The control of distribution will make the product offering more flexible and will make new production introduction easier. Specifically, PepsiCo CEO Nooyi said in her interview with Wall Street Journal, "This (vertical integration) will allow us to really strategically transform the supply chain". The company no longer would have to persuade its big bottlers to take on each new product, a time-consuming process involving frequent negotiations at a time when new drinks are proliferating and Pepsi is trying to keep up and overcome small, niche players. Getting control over much of its route-to-market will help PepsiCo get new, low-volume brands onto retailer shelves. Nooyi also said that: "The fully integrated beverage business will enable us to bring innovative products and packages to market faster, streamline our manufacturing and distribution systems and react more quickly to changes in the marketplace."

In summary, the vertical integration will bring synergy and streamline production for the vertically integrated company, which leads to a lower price, and it will also allow upstream companies to control distribution, which will make product offering and new product

introduction easier and more flexible.

1.2.3 Predicted effects of vertical integrations

Based on the institution in soda industry and these motivations for vertical integration, there are some predictions on the effects of vertical integration. First, vertical integration will lead to a lower price: this is because vertical integration brings synergy in the production process and also eliminates the double marginalization. Second, vertical integration will make new product introduction process easier and therefore more new products will be introduced to markets after vertical integration: this is because vertical integration aligns the economic incentive between upstream company and downstream bottler, and eliminates the costly and time-consuming negotiation process between upstream company and downstream bottler when a new product is being introduced.

1.3 Data

There are two data sources for the research in this chapter, scanner data from Nielsen[3] and the bottler territory maps from Beverage Digest. [4] The first dataset, Nielsen scanner data, provides Universal Product Code (UPC) level data on price and quantity from each participating store for every week starting from 2006. Besides the price and quantity data, this dataset also provides product characteristics for specific products. Furthermore, participating stores are divided into different markets. For the second dataset, Beverage Digest, a market research company, collects data on The Coca-Cola Company and PepsiCo bottlers' exclusive territory. These territory maps are essential to the analysis, because they allow

[3]Results in this paper are my own analyses calculated (or derived) based in part on data from The Nielsen Company (U.S.), LLC and marketing databases provided through the Nielsen Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the Nielsen data are those of the researcher(s) and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.

[4]The territory maps are from the sixth edition of the books *The Coke System: Detailed Territory Information, Ownership and Contacts* and *The Pepsi System: Detailed Territory Information, Ownership and Contacts* published by market research company Beverage Digest in 2010.

me to identify which markets are served by vertical integrated bottlers and which are not. With this information, a difference-in-difference method could be used to identify the effects of vertical integration.

This project studies the time period from 2008 to 2012, by combining the data from these two sources. And the data is aggregated to month level. The 20,271 food and merchandise stores are located in 874 counties and each county is treated as a market.

I use the bottlers' territory maps from Beverage Digest to identify which counties are served by vertically integrated bottlers and which counties are served by bottlers that are not vertically integrated. I do this for The Coca-Cola Company and for PepsiCo separately. As shown in Table 1.1, before the vertical integration, all markets are served by The Coca-Cola Company bottlers that are not vertically integrated; after the vertical integration, among the 874 markets, 596 markets are served by vertically integrated The Coca-Cola Company bottlers, and 278 markets are served by The Coca-Cola Company bottlers that are not vertically integrated. Before the vertical integration, all markets are served by PepsiCo bottlers that are not vertically integrated; after the vertical integration, among the 874 markets, 604 markets are served by vertically integrated PepsiCo bottlers and 270 markets are served by bottlers that are not vertically integrated. In the Table 1.2, I show the demographics of markets that are vertically integrated and markets that are not vertically integrated. The demographics I consider are population, population density, income, and unemployment rate. There are some differences in the demographics between markets that are vertically integrated and markets that are not vertically integrated, but as shown in the table, the difference are not significant.

In Figure 1.1 and 1.2, I plot the 874 counties that are in the sample, and show whether they are affected by the vertical integrations or not. As shown in the maps, the counties in the sample range from east coast to west coast and from south to north, and they cover urban areas as well as rural areas. Furthermore, the vertically integrated markets are scattered around all U.S. instead of clustering in one area only.

Products are defined by the unique combination of six product characteristics: brand-flavor-calorie level-container type-size-multiple in a unit of product. Calorie level are either regular or diet. Size refers to the size of a single container, such as 12 fluid ounce. Multiple in a unit of product refers to how many single containers are there in one single unit of product, such as 12 cans. For example, a product is: Coca-Cola Coke (Brand) - Cola (Flavor) - Regular (Calorie level) - Aluminum Can (Container type) - 12 fluid ounce (Size) - 12 (Multiple in a unit of product). This product is a case of 12 can 12 fluid ounces Coca-Cola Coke. This way of product definition has the advantage of taking into account detailed characteristics, and it will capture all the new products, including those with changes in characteristics such as size and multiple. This is consistent with the product definition in the marketing literature. Furthermore, PepsiCo CEO Nooyi said that: "The fully integrated beverage business will enable us to bring innovative products and packages to market faster, streamline our manufacturing and distribution systems and react more quickly to changes in the marketplace." Clearly, new packages are considered as innovations. Therefore, both size and multiple in a unit of product are considered as the characteristics that define a product.

The order of these six product characteristics is important: going from brand down to multiple, the characteristic becomes less innovative. I recognize the importance of this order and utilize it to find out the new characteristics in a new product. I will discuss this in more detail in chapter three.

Furthermore, about the brands and master brands, Coca-Cola and Pepsi Cola are considered as master brands. The brands as defined in the Nielsen data are more detailed brands. Specifically, there still can be many brands under one master brand. For example, under the master brand Coca-Cola, there are brands such as Coca-Cola, Coca-Cola Zero, Coca-Cola Cherry, Coca-Cola Caffeine Free, etc.

In this research, the data includes all carbonated soft drink products of the Coca-Cola Company and PepsiCo, and many master brands are shown in the data, such as Seagram's (of The Coca-Cola Company) and Mountain Dew (of the PepsiCo), etc.

Table 1.3 shows the summary statistics of these six characteristics in the sample. In the five-year sample period, there are 37 brands from the Coca-Cola Company's products, and there are 56 brands from PepsiCo's products. For flavors, there are 84 flavors from the Coca-Cola Company's products, and there are 120 flavors from the PepsiCo's products. Some of the flavors are common to many different brands, and there are many flavors that are brand specific and show up only in specific brands. This leads to many different flavors showing up in the data. There are two types of calorie level and four types of containers. For the size characteristic, there is a lot of variation, ranging from 7.5 fluid ounces to 101.4 fluid ounces. There are 27 different sizes from the Coca-Cola Company's products, and there are 21 different sizes from PepsiCo's products. There is also a lot of variation in the multiple characteristics in the sample, ranging from 1 to 36. There are 13 different multiples in a package from the Coca-Cola Company's products, and there are 11 different multiples in a package from PepsiCo's products.

By this product definition as discussed above, there are 516 products from The Coca-Cola Company and 680 products from PepsiCo in the sample period. There are total 10,617,522 market-product-month observations on prices and quantities.

If a product exists on a market for the first time, then this product is counted as one new product for that market in that month. For any month after that month, the product is considered as an existing product on that market. Specifically, if the product leaves the market and reintroduced to that market some time later, it is still considered as an existing product.

1.4 Synthetic control analysis

1.4.1 Method

I apply the synthetic control method proposed by Abadie and Gardeazabal (2003) and Abadie, Diamond, and Hainmueller (2010) to show graphical trends of prices and the num-

ber of new products that demonstrate the effects of vertical integration. I further utilize the synthetic control weights to quantify the effects using weighted regressions.

As discussed in the data section, the demographics in the markets that are vertically integrated and markets that are not vertically integrated are somewhat different, although the differences are not significant. This might be a concern, and one may argue that the vertically integrated markets are selected based on such differences. Although there is actually no such selection concern, as shown in the previous data section, I use synthetic control method to further address this concern.

I first aggregate all markets that are vertically integrated into one treated unit and find the price and number of new products in each time period. I aggregate data to quarter level. Then among the markets that are not vertically integrated, I assign weights on these control markets such that the weighted average of control markets mimics the treatment unit best for each period before the vertical integration. In this way, I find some markets, among the markets that are not vertically integrated, that are most similar to the markets that are vertically integrated, and this will help solve the concern that markets that are vertically integrated and markets that are not vertically integrated may be different.

Specifically, for a product, I first normalize the quantities sold of this product in a given market and in a given week to a standard unit of 12-pack 12 fl oz case. I do this for all the products from The Coca-Cola Company and for all market-week combination. Then for each market, I aggregate revenues of all these products and further aggregate them to quarter level. I aggregate quantities in the same way. For each market that are not affected by the vertical integration, dividing the aggregated revenue by the aggregated quantity gives the price, which is at market-quarter level. For the markets that are affected by the vertical integration, I further aggregate revenues of all markets that are affected by vertical integration. I do the same for quantities. Then, dividing the aggregated revenue by the aggregated quantity gives the price of the treated unit. For the number of new products, I do the aggregation similarly without the normalization, which is not needed for the number

of new products.

I use the aggregated markets that are affected by the vertical integration as the treated unit, and use all other markets that are not affected by the vertical integration as donor pool to find the synthetic control weights for the treatment unit, which follows the method proposed by Abadie and Gardeazabal (2003) and Abadie, Diamond, and Hainmueller (2010). For price, I find the weights such that the weighted average price of control units mimics the price of treatment unit best for each period before the vertical integration. Then I use this weight to find the weighted average price on control units for each period after the vertical integration, and these are the synthetic control prices. I apply this analysis method to the number of new products of The Coca-Cola Company, and to the price of PepsiCo products and the number of new products of PepsiCo.

I further utilize the synthetic control weights to run weighted regressions:

$$\log(p_{mt}) = \beta VI_{mt} + \phi_m + \tau_t + \epsilon_{mt} \tag{1.1}$$

In this model, p_{mt} is the aggregated price, average over all products in market m at time t; VI_{mt} is the indicator of vertical integration, and VI_{mt} is 1 if market m at time t is vertically integrated and is 0 otherwise; ϕ_m is market fixed effect and τ_t is time fixed effect.

For the effect of vertical integration on new product introduction, I estimate a similar equation:

$$n_{mt} = \gamma VI_{mt} + \pi_m + \nu_t + \xi_{mt} \tag{1.2}$$

where n_{mt} is the number of new products in market m at time t. Market and time fixed effects are also included.

For each market that is not affected by vertical integration, the weight is the synthetic control weight that is found earlier. For each market that is affected by vertical integration, the weight is $\frac{1}{n_{VI}}$ where n_{VI} is the total number markets that are affected by the vertical

integrations.

Specifically, all the carbonated soft drink products of The Coca-Cola Company and PepsiCo are included in the analysis. (For example, the analysis includes but not limits to the products of the master brands Coca-Cola, Seagram's, Pepsi Cola, Mountain Dew, etc.)

The key parameters of interest are β and γ. β represents the effect of vertical integration on price, and γ represents the effect of vertical integration on the number of new products. I run the weighted regressions for The Coca-Cola Company and PepsiCo separately.

1.4.2 Results

Figure 1.3 shows the price trend of The Coca-Cola Company's products. The solid curve represents the price trend in vertically integrated markets and the dashed curve represents the price trend in the synthetic control markets. The dotted vertical line indicates the time of vertical integration. The synthetic control weights are listed in Table 1.4. As shown in the graph, the price trend of synthetic control unit mimics the price trend of treated unit in each period before the vertical integration very well. After vertical integration, there is a lower price in markets that are vertically integrated than in markets that are not vertically integrated. Similarly, Figure 1.4 shows the price trend of PepsiCo's products. The synthetic control weights are listed in Table 1.5. The price trend of synthetic control unit follows the price trend of treated unit in each period before the vertical integration, although not matched perfectly. After vertical integration, the price in markets that are vertically integrated goes below the price in markets that are not vertically integrated, and the change is in a larger scale than The Coca-Cola Company. These results are consistent with the prediction that vertical integration leads to a lower price.

Figure 1.5 shows the trend of the number of new products from The Coca-Cola Company that are introduced to markets every quarter. The synthetic control weights are listed in Table 1.6. As shown in the graph, the trend of the number of new products in synthetic control unit perfectly mimics the trend of the number of new products in treated unit in each

period before the vertical integration. After vertical integration, there is a larger number of new products introduced to markets that are vertically integrated than the number of new products introduced to markets that are not vertically integrated. Similarly, Figure 1.6 shows the trend of the number of new products from PepsiCo that are introduced to markets every quarter. The synthetic control weights are listed in Table 1.7. As shown in the graph, the trend of the number of new products in synthetic control unit perfectly mimics the trend of the number of new products in treated unit in each period before the vertical integration. After vertical integration, there is a larger number of new products introduced to markets that are vertically integrated than the number of new products introduced to markets that are not vertically integrated. These results are consistent with that vertical integration makes new product introduction easier and more new products are introduced.

The results from weighted regressions are presented in Table 1.8 and Table 1.9. The effect of vertical integration on price is shown in Table 1.8. For The Coca-Cola Company, the vertical integration leads to 0.3% price decrease, and this result is significant at 10% level. For PepsiCo, the vertical integration leads to a 1.4% price decrease, and this result is significant at 1% level. These results are consistent with the prediction that vertical integration leads to price decrease. The effect of vertical integration on the number of new products introduced to markets is shown in Table 1.9. For the Coca-Cola Company, the vertical integration leads to 0.367 more new products introduced to markets that are affected by vertical integration than markets that are not affected by vertical integration every quarter. The result is significant at 1% level. This number translates to 1.5 more new products annually. To understand this number, the average number of new products of the Coca-Cola Company introduced to a market annually is 15.9. That is to say, the vertical integration leads to 10% more new products. For PepsiCo, the vertical integration leads to 0.647 more new products introduced to markets that are affected by vertical integration than markets that are not affected by vertical integration every quarter. The result is significant at 1% level. This number translates to 2.6 more new products annually. The average number

of new products of PepsiCo introduced to a market annually is 30.8. That is to say, the vertical integration leads to 8% more new products. All these results are consistent with the prediction that vertical integration leads to more new products introduced and leads to product proliferation.

1.5 Difference-in-difference model and estimation results

1.5.1 Model

In the synthetic control analysis discussed above, the trends in price and the trends in the number of new products are shown using data that are aggregated. Furthermore, only the control markets with positive weights are used in the regressions.

To better quantify the effects of vertical integration, I estimate "difference-in-difference" regression equations using detailed product-market-month level data without aggregation. The empirical model is as following:

$$\log(p_{jmt}) = \beta VI_{mt} + x'_{jmt}\theta + \delta_j + \phi_m + \tau_t + \epsilon_{jmt} \tag{1.3}$$

where p_{jmt} is the price of product j in market m at month t; VI_{mt} is the indicator of vertical integration, and VI_{mt} is 1 if market m at time t is vertically integrated and is 0 otherwise; δ_j is product fixed effect; ϕ_m is market fixed effect and τ_t is time fixed effect. x_{jmt} is a vector of product characteristics such as discount and promotions.

For the effect of vertical integration on new product introduction, I estimate a similar equation:

$$n_{mt} = \gamma VI_{mt} + z'_{mt}\eta + \pi_m + \nu_t + \xi_{mt} \tag{1.4}$$

where n_{mt} is the number of new products in market m at month t; z_{mt} is a vector of market characteristics, such as the number of stores, etc. Market and time fixed effects are also included.

I estimate the above equations for The Coca-Cola Company and PepsiCo separately.

Among these coefficients in the equations (1.3) and (1.4) above, the coefficients of interest are β and γ. β captures the price effect of vertical integration and thus β captures synergy and elimination of double marginalization on the prices of products. γ measures how the integrated structure help new production introduction. Market fixed effects and time fixed effects are also included in the regression equation. For example, the population in a market affects the demand and thus affects prices, and furthermore, it may also affect company's decision of new product introduction. Companies may want to test new products in a market with large population. This is captured by market fixed effects.

The identification strategy is difference-in-difference strategy. The underlying assumption is that the markets that are vertically integrated and markets that are not vertically integrated are fundamentally the same, and the dependent variables, the price and the number of new product introduced to markets, follow the same trend in markets that are vertically integrated and markets that are not vertically integrated before vertical integration, and would have followed the same trend in markets that are vertically integrated and markets that are not vertically integrated after vertical integration if the vertical integration had not happened. And most importantly, there should be no selection concern about which markets are vertically integrated and which markets are not.

As shown in the demographics analysis earlier, there are no significant differences between markets that are vertically integrated and markets that are not vertically integrated. Besides, from the maps of sample markets (Figure 1.1 and 1.2), it is shown that markets that are vertically integrated scatter around U.S., instead of clustering around one or a few areas. Markets that are not vertically integrated also scatter around U.S. Both types of markets cover urban and rural areas and span from east to west and from north to south. Further-

more, each of the two types of markets consists of a large number of markets: for each of The Coca-Cola Company and PepsiCo, there are about six hundred markets that are vertically integrated, and there are about two hundred markets that are not vertically integrated. The possible difference would be averaged out among hundreds of markets. Lastly, both The Coca-Cola Company and PepsiCo vertically integrated with their bottlers entirely, and did not divest any vertically integrated markets after the vertical integration. This means that there is no selection concern. The companies wanted to streamline the production process and to streamline the new product introduction process, and they simply vertically integrated with bottlers to cover large areas. Market coverage, instead of specific markets *per se*, was considered. For The Coca-Cola Company, the largest bottler Coca-Cola Enterprise account for about seventy-five percent of The Coca-Cola Company's total markets, and The Coca-Cola Company vertically integrated this one bottler. For PepsiCo, bottlers are smaller, so it vertically integrated with two largest bottlers, Pepsi Bottling Group and Pepsi Americas, and they jointly cover about seventy-five percent of PepsiCo's total markets. All these facts make the selection concern unlikely to be a threat to the analysis, and the difference-in-difference assumption is very likely to hold.

1.5.2 Results

The estimation results of equation (1.3) are presented in Table 1.10. In the first column, it shows that, for The Coca-Cola Company, after the vertical integration, the price in markets that are vertically integrated is 0.65% lower than the price in markets that are not vertically integrated. In the second column, it shows that, for PepsiCo, the price effect is larger, and after the vertical integration, the price in markets that are vertically integrated is 1.59% lower than the price in markets that are not vertically integrated. Both results are statistically significant are 1% level. The signs of these estimates are consistent with the theoretical prediction that vertical integration leads to a lower price.

For the effect of vertical integration on new product introduction, the estimates are

presented in Table 1.11. I measure the number of new products introduced to each market in each month. After vertical integration, the number of new products introduced to markets that are served by vertically integrated bottlers increases significantly relative to markets that are served by bottlers that are not vertically integrated. Specifically, the result in the first column of Table 1.11 shows that, for The Coca-Cola Company, the vertical integration leads to 0.123 more new products per month, i.e. annually about 1.48 more new products, being introduced to markets that are vertically integrated than markets that are not vertically integrated. The result is statistically significant at 1% level. The average number of new products of The Coca-Cola Company introduced to a market annually is 15.9. That is to say, the vertical integration leads to 9% more new products. In the second column of Table 1.11, it shows that for PepsiCo, the effect of vertical integration is similar and a little bit larger in scale: the vertical integration leads to 0.128 more new products per month, i.e. annually about 1.54 more new products, being introduced to markets that are vertically integrated than markets that are not vertically integrated. The result is statistically significant at 5% level. The average number of new products of PepsiCo introduced to a market annually is 30.8. That is to say, the vertical integration leads to 5% more new products. These results are consistent with the theoretical prediction. Vertical integration eliminates the time-consuming negotiation process and aligns the economic incentives of upstream company and downstream bottlers, and therefore it is easier to introduce new products into markets that are vertically integrated.

Comparing the results in the synthetic control analysis and the results in difference-in-difference analysis, the results are largely the same. There are some small differences that should not be a concern. As discussed earlier, the synthetic control method uses more aggregated data than the difference-in-difference method, and that naturally leads to some differences in the results. Although the detailed number are somewhat different, the signs of these estimates in both synthetic control method and the difference-in-difference method are same, and are consistent with the theoretical predictions.

1.5.3 Robustness

In this subsection, I check the effects of vertical integration on prices and on new product introduction using a subsample that consists of neighboring markets. Specifically, I choose the counties that are next to each other but were affected by vertical integration differently. For The Coca-Cola Company, I choose the counties that are next to each other and one county is affected by vertical integration, and the other county is not affected by vertical integration. Furthermore, one county that is affected by vertical integration can be next to several counties in the sample that are not affected by vertical integration. In such case, all these counties are selected into the subsample. As a result, for a market A in the subsample, there is at least one other market B in the subsample such that market A and market B are neighboring markets and that one of them is vertically integrated in 2010 and the other is not vertically integrated in 2010. I do the same for PepsiCo. And I repeat the difference-in-difference analysis on the subsample that consists of neighboring markets.

For The Coca-Cola Company, there are 107 markets in the subsample of neighboring markets, which account for 12% of the 874 markets in the full sample. For PepsiCo, there are 146 markets in the subsample of neighboring markets, which account for 17% of the 874 markets in the full sample. The maps of these subsample markets are shown in Figure 1.7 and Figure 1.8. As shown in these maps, in the subsample of neighboring markets, markets that are vertically integrated scatter around U.S., instead of clustering around one or a few areas. Markets that are not vertically integrated also scatter around U.S. Both types of markets cover urban and rural areas and span from east to west and from north to south.

I repeat the difference-in-difference analysis on the subsamples of neighboring markets. The results are shown in Table 1.12 and Table 1.13. These results are largely unchanged and are consistent with the results in full sample difference-in-difference analysis, and are consistent with the theoretical predictions: vertical integration leads to a lower price, and leads to more new products being introduced to markets.

1.6 Conclusion

This chapter studies the effects of vertical integration on the vertically integrated company, specifically, the effects on prices and on new product introduction by exploring recent vertical integrations in the soda industry.

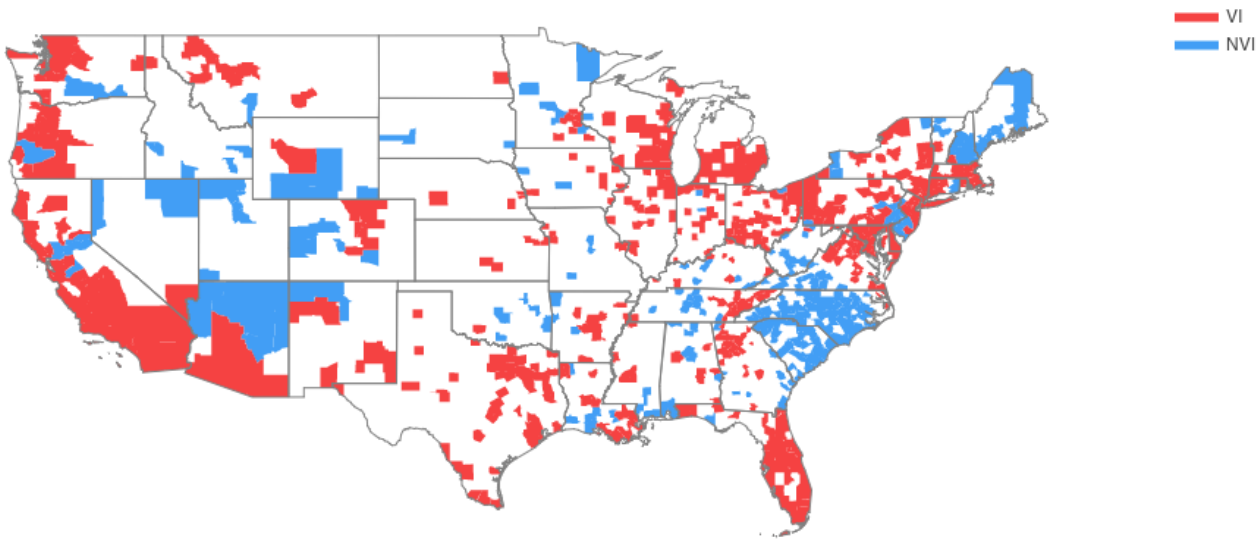
Several features in the soda industry make it ideal for this study. There are vertical integrations in soda industry, and the exclusive territory of downstream bottlers allows clear identification of markets that are vertically integrated. Furthermore, only some parts of the U.S. markets are vertically integrated while other parts are not vertically integrated, and this justifies a difference-in-difference strategy to identify the effects of vertical integration. Besides, the bottling contracts between upstream company and downstream bottlers imply a double marginalization before vertical integration. Furthermore, the new product introduction process involves cooperation and negotiation between upstream company and downstream bottlers, and the difficulty in new product introduction under vertically separated structure was a key motivation for upstream company to vertically integrate with downstream bottlers.

This research first uses synthetic control method to study the vertical integrations in The Coca-Cola Company and in PepsiCo, and find that vertical integration leads to price decrease and more new product introduction. For The Coca-Cola Company, vertical integration leads to 0.3% price decreases and 1.5 more new products annually introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 10% more new products. For PepsiCo, vertical integration leads to 1.4% price decreases and 2.6 more new products annually introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 8% more new products. Furthermore, this research uses the difference-in-difference strategy to further quantify the effect of vertical integration, and finds similar results to those in synthetic control analysis. Specifically, the vertical integration leads to 0.65% price decrease for the products of The Coca-Cola Company, and 1.59% price decrease for the products

of PepsiCo. In addition, for The Coca-Cola Company, the vertical integration leads to 1.48 more new products annually introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 9% more new products; for PepsiCo, the vertical integration leads to 1.54 more new products annually introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 5% more new products. All these results are consistent with theoretical predictions that vertical integration leads to a price decrease and makes new product introduction process easier.

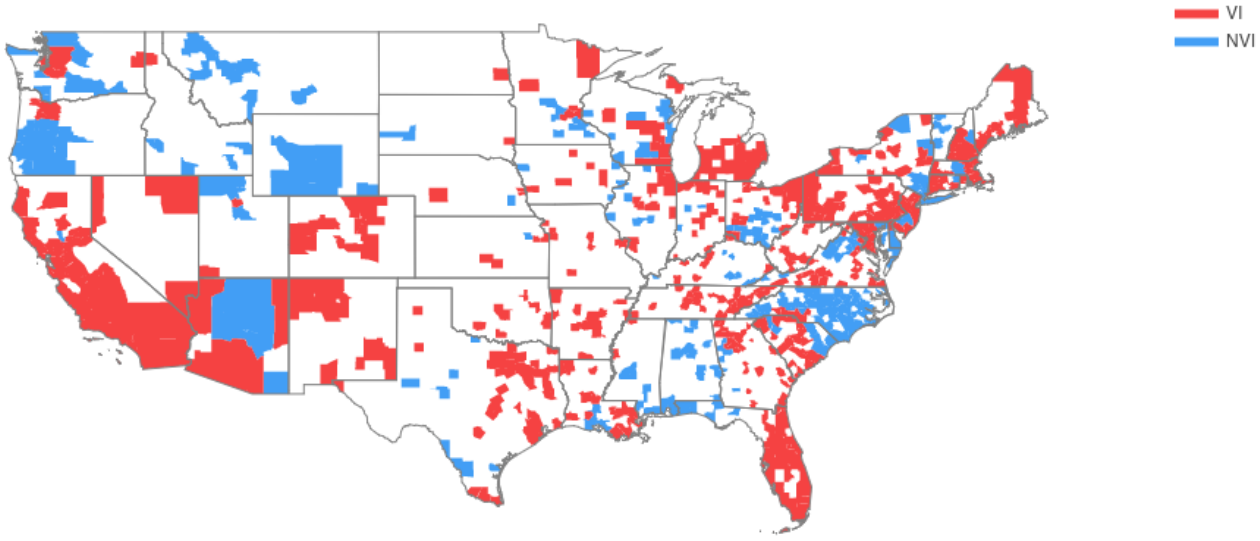
The main contribution of this chapter is that this is the first research that studies and quantifies the effect of vertical integration on new product introduction, which has long been overlooked in the literature and in anti-trust policy, and this chapter shows that the vertical integration leads to more products being introduced to market. Furthermore, this chapter adds more evidence to the limited empirical literature on the price effect of vertical integration, and shows that vertical integration leads to price decrease.

Figure 1.1: The Coca-Cola Company vertically integrated markets and non vertically integrated markets in the data



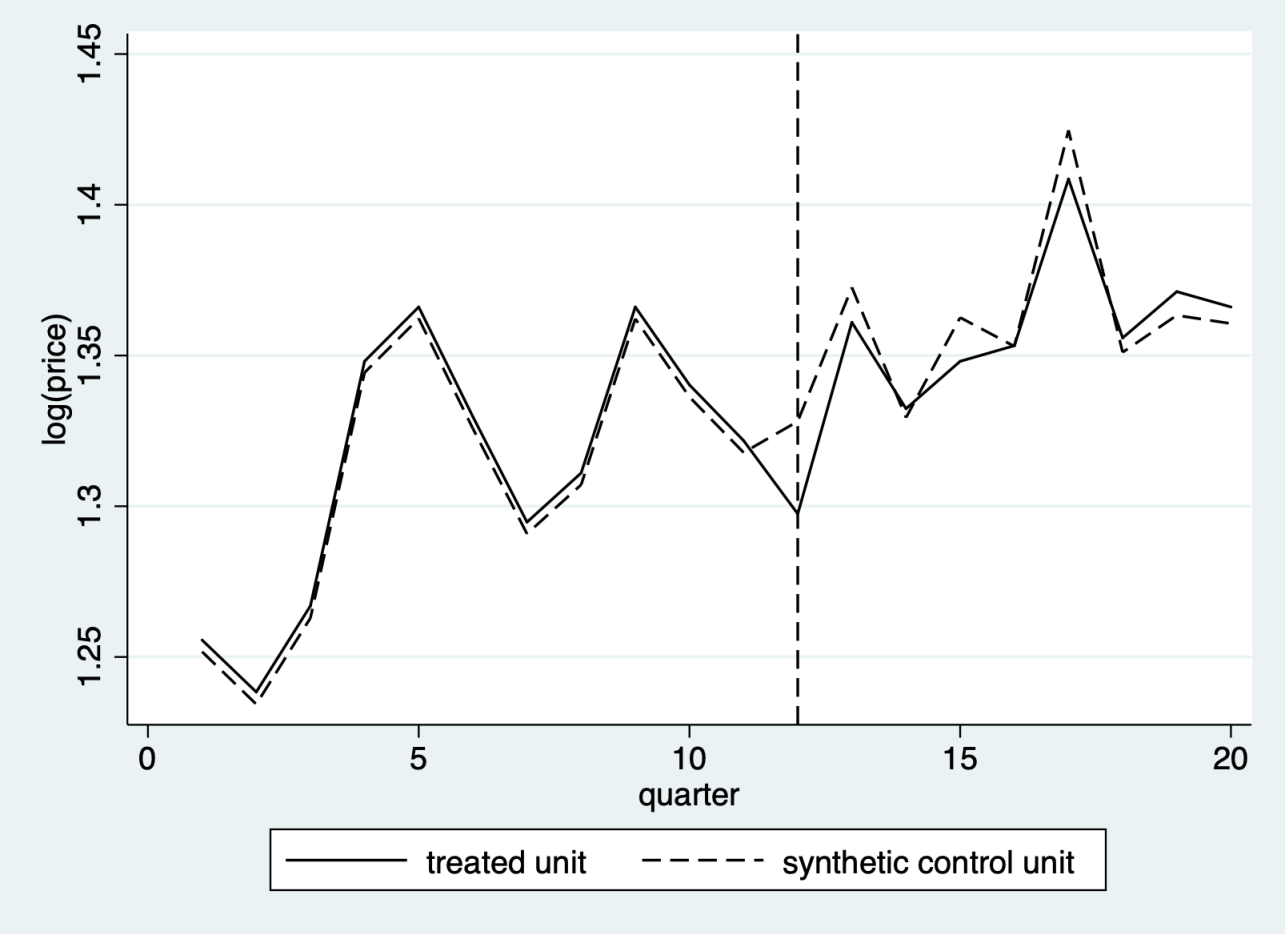
Source: Beverage Digest bottler's territory map. Markets in the data are shown in the map with color. Markets affected by vertical integration are shown in red, and markets not affected by vertical integration are shown in blue. Markets affected by vertical integration are served by vertically separated bottlers before October, 2010 and are served by vertically integrated bottler after October, 2010.

Figure 1.2: PepsiCo vertically integrated markets and non vertically integrated markets in the data



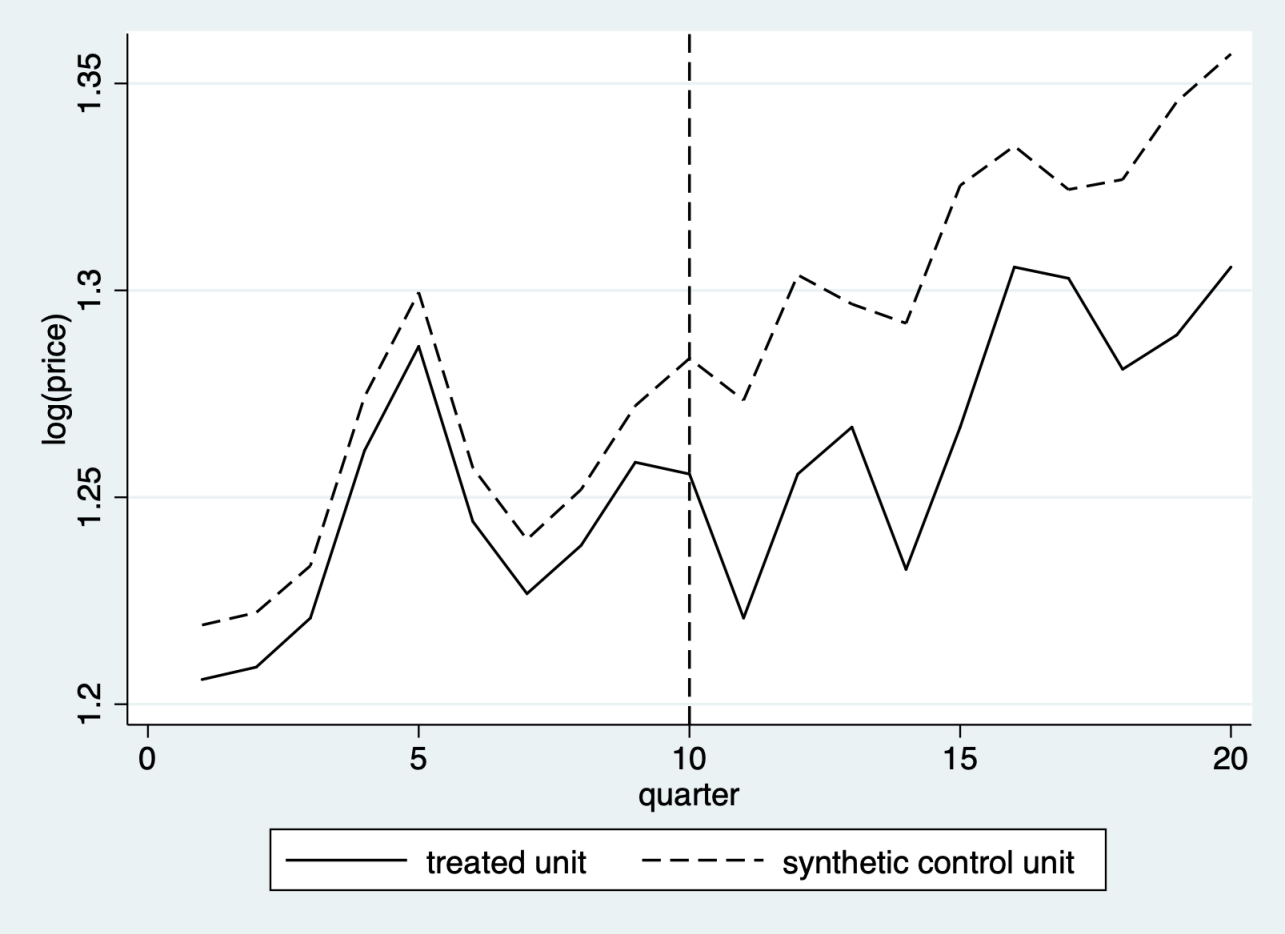
Source: Beverage Digest bottler's territory map. Markets in the data are shown in the map with color. Markets affected by vertical integration are shown in red, and markets not affected by vertical integration are shown in blue. Markets affected by vertical integration are served by vertically separated bottlers before February, 2010 and are served by vertically integrated bottler after February, 2010.

Figure 1.3: Synthetic control method, price trend, The Coca-Cola Company



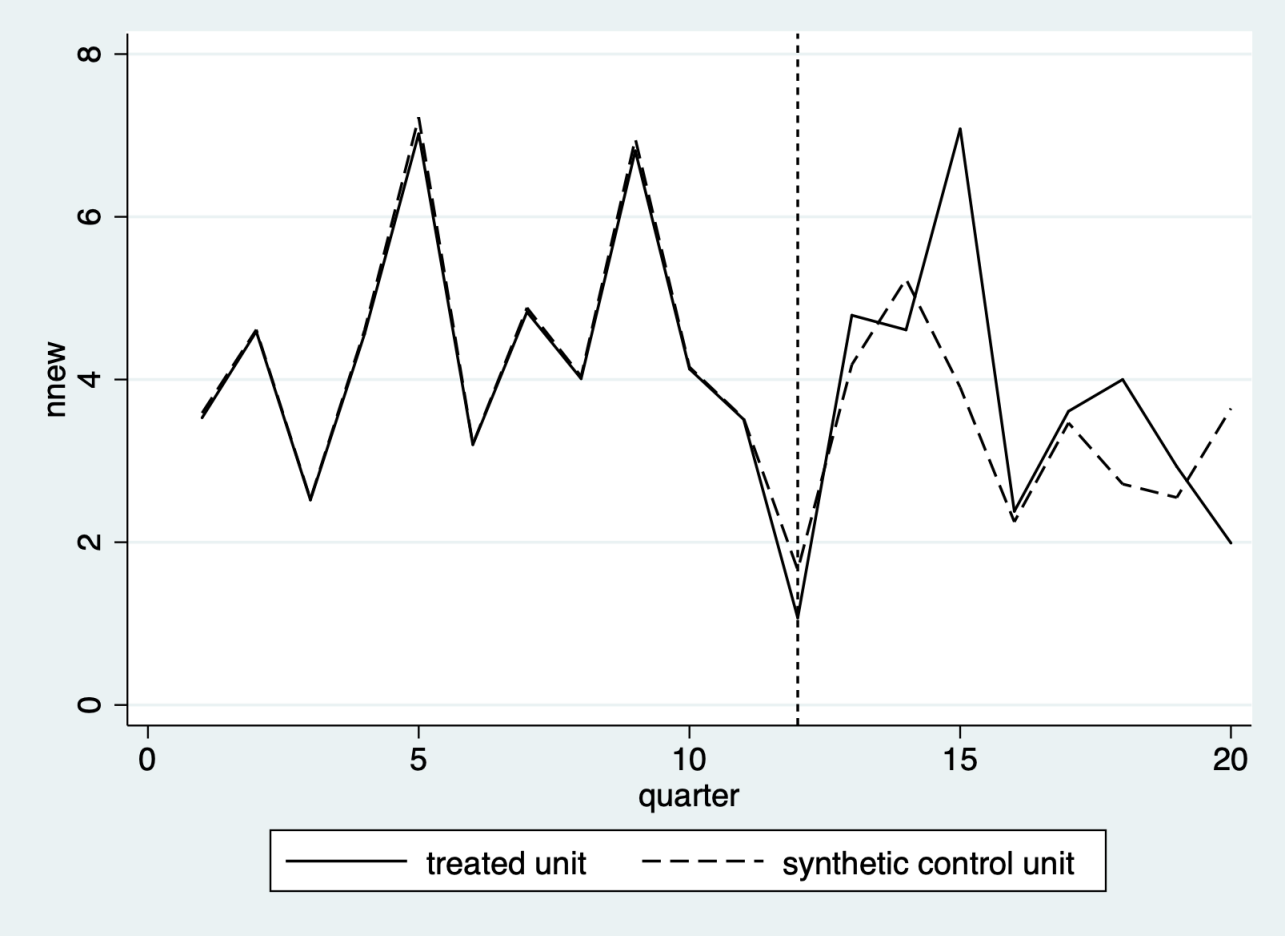
The graph shows the price trend in vertically integrated market as treated unit, and shows the price trend in the synthetic non-vertically integrated market as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes all carbonated soft drink master brands of The Coca-Cola Company, such as Coca-Cola, Seagram's, etc.

Figure 1.4: Synthetic control method, price trend, PepsiCo



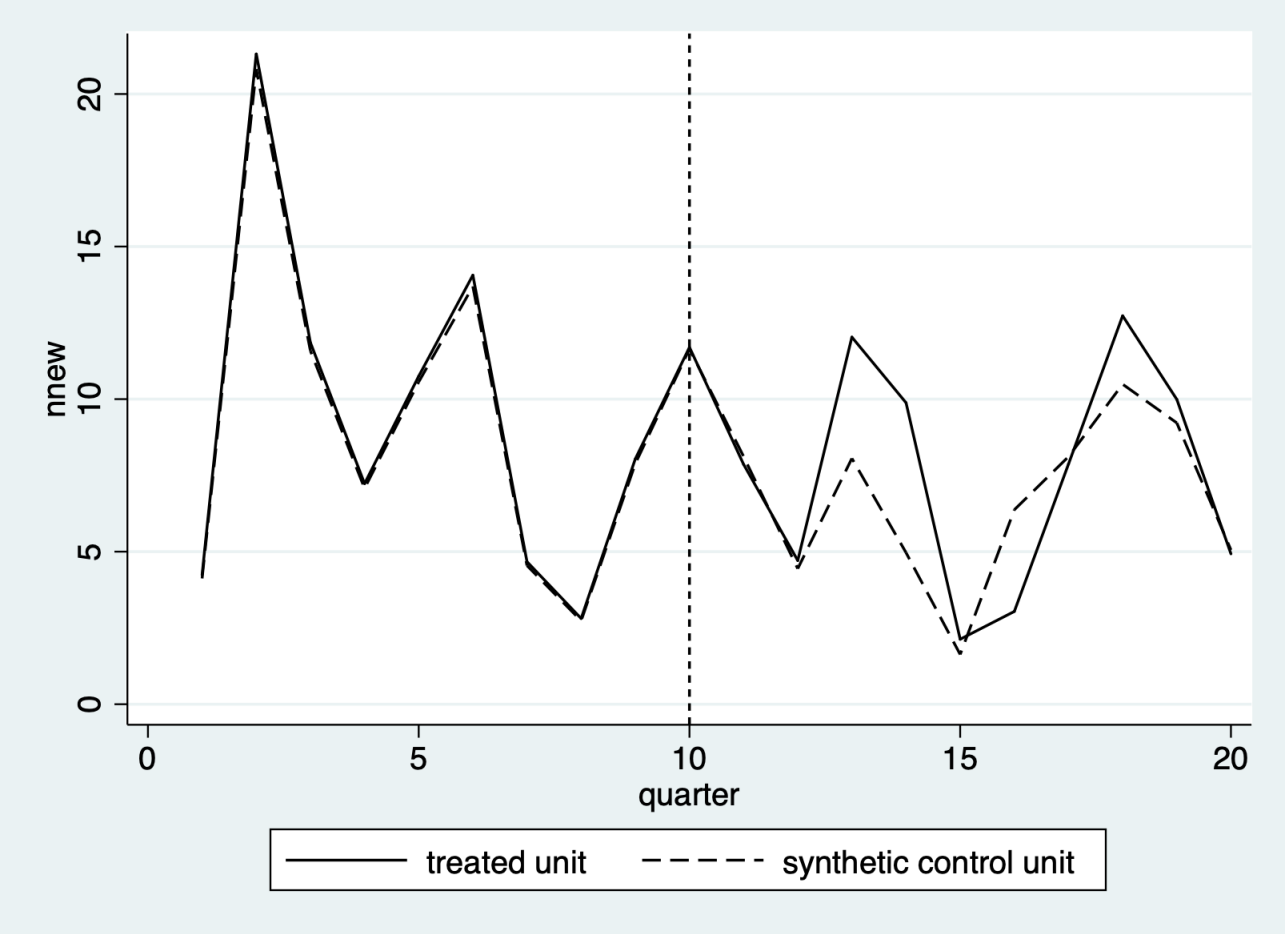
The graph shows the price trend in vertically integrated market as treated unit, and shows the price trend in the synthetic non-vertically integrated market as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes all carbonated soft drink master brands of PepsiCo, such as Pepsi Cola, Mountain Dew, etc.

Figure 1.5: Synthetic control method, trend of number of new products, The Coca-Cola Company



The graph shows the trend of the number of new products in vertically integrated market as treated unit, and shows the trend of the number of new products in the synthetic non-vertically integrated market as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes all carbonated soft drink master brands of The Coca-Cola Company, such as Coca-Cola, Seagram's, etc.

Figure 1.6: Synthetic control method, trend of number of new products, PepsiCo

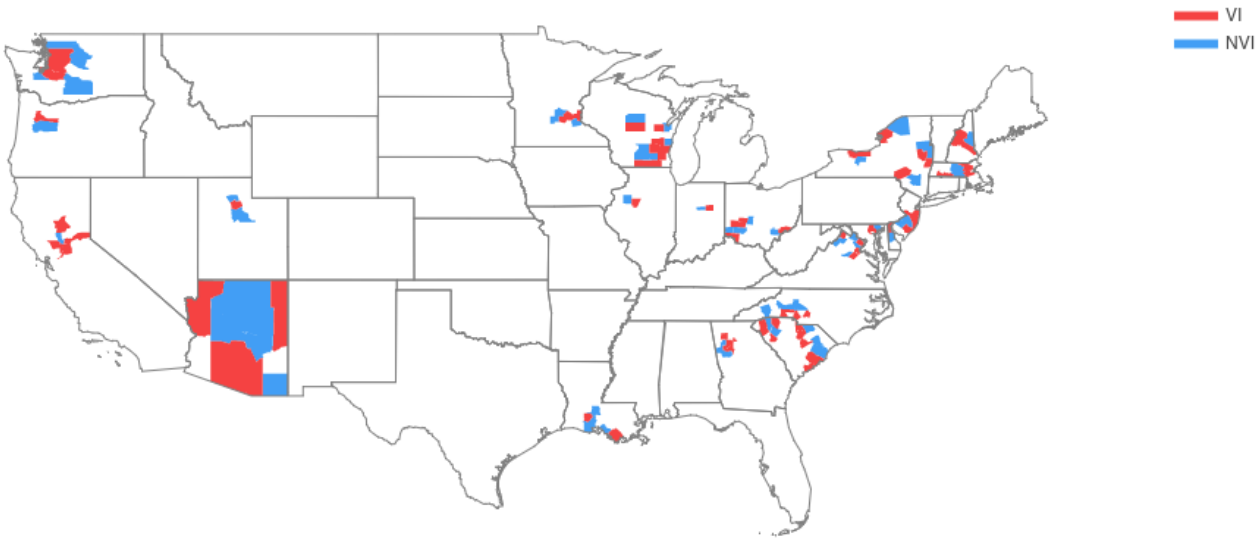


The graph shows the trend of the number of new products in vertically integrated market as treated unit, and shows the trend of the number of new products in the synthetic non-vertically integrated market as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes all carbonated soft drink master brands of PepsiCo, such as Pepsi Cola, Mountain Dew, etc.

Figure 1.7: Neighboring markets: The Coca-Cola Company vertically integrated markets and non vertically integrated markets in the data

Source: Beverage Digest bottler's territory map. Subsample of neighboring markets is shown in the map with color. 107 markets are in the subsample. For a market A in the subsample, there is at least one other market B in the subsample such that A and B are neighboring markets and that one of them is vertically integrated in 2010 and the other is not vertically integrated in 2010. Markets affected by vertical integration are shown in red, and markets not affected by vertical integration are shown in blue. Markets affected by vertical integration are served by vertically separated bottlers before October, 2010 and are served by vertically integrated bottler after October, 2010.

Figure 1.8: Neighboring markets: PepsiCo vertically integrated markets and non vertically integrated markets in the data



Source: Beverage Digest bottler's territory map. Subsample of neighboring markets is shown in the map with color. 146 markets are in the subsample. For a market A in the subsample, there is at least one other market B in the subsample such that A and B are neighboring markets and that one of them is vertically integrated in 2010 and the other is not vertically integrated in 2010. Markets affected by vertical integration are shown in red, and markets not affected by vertical integration are shown in blue. Markets affected by vertical integration are served by vertically separated bottlers before February, 2010 and are served by vertically integrated bottler after February, 2010.

Table 1.1: Counties that are and are not vertically integrated

	The Coca-Cola Company	PepsiCo
Vertically integrated counties	596	604
Non-vertically integrated counties	278	270
Total	874	874

This table shows the number of counties in the data. For the Coca-Cola Company, vertically integrated counties were not vertically integrated before October 2010, and were vertically integrated after October 2010. For PepsiCo, vertically integrated counties were not vertically integrated before February 2010, and were vertically integrated after February 2010. Non-vertically integrated counties were not vertically integrated through out the sample period from 2008 to 2012.

Table 1.2: County demographics (2010 Census)

	n	Population	Pop Density	Income	Unemployment
Coca-Cola VI	596	348743	914	26035	7.21
		(637385)	(3785)	(6401)	(2.05)
Coca-Cola non-VI	278	172274	317	23564	7.20
		(209402)	(768)	(4768)	(2.03)
PepsiCo VI	604	342038	657	25688	7.25
		(621305)	(1433)	(6162)	(2.04)
PepsiCo non-VI	270	182045	873	24267	7.12
		(287457)	(5283)	(5642)	(2.04)

This table summarizes the demographics in counties that are and are not affected by Coca-Cola vertical integrations, and that are and are not affected by PepsiCo vertical integrations. The average of each demographic over each type of market is shown in the table with standard deviations shown in parenthesis.

Table 1.3: Summary statistics of product characteristics

Company	The Coca-Cola Company	PepsiCo
Number of products	516	680
Number of brands	37	56
Number of flavors	84	120
Number of calorie levels	2	2
Number of container types	4	4
Number of sizes	27	21
Number of multiples	13	11

This table shows the statistics for each characteristic that is used to define product. Specifically, product is defined as the unique combination of brand, flavor, calorie level, container type, size of the container and the multiple, i.e. the number of can or bottle in one package. All carbonated soft drink master brands of The Coca-Cola Company and PepsiCo are included in the data, such as Coca-Cola, Seagram's, Pepsi Cola, Mountain Dew, etc.

Table 1.4: Synthetic control weights (above 0.01), The Coca-Cola Company price trend

State	County	Weight
NJ	WARREN	0.239
CA	SOLANO	0.227
OH	CUYAHOGA	0.125
NH	STRAFFORD	0.099
CO	EAGLE	0.084
NM	SANTA FE	0.073
IA	WOODBURY	0.065
MN	SAINT LOUIS	0.03
IA	DALLAS	0.026
AZ	APACHE	0.016

This table shows the synthetic control weights for The Coca-Cola Company price trends using data aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes all carbonated soft drink master brands of The Coca-Cola Company, such as Coca-Cola, Seagram's, etc.

Table 1.5: Synthetic control weights (above 0.01), PepsiCo price trend

State	County	Weight
WA	WALLA WALLA	0.066
TX	MAVERICK	0.026
IN	HOWARD	0.015
OH	JACKSON	0.015
OH	FAIRFIELD	0.014
AZ	YAVAPAI	0.013
TX	NUECES	0.013
AL	BALDWIN	0.012
TX	ECTOR	0.011

This table shows the synthetic control weights for PepsiCo price trends using data aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes all carbonated soft drink master brands of PepsiCo, such as Pepsi Cola, Mountain Dew, etc.

Table 1.6: Synthetic control weights (above 0.01), The Coca-Cola Company trend of the number of new products

State	County	Weight
MO	BOONE	0.167
CA	EL DORADO	0.135
CA	SOLANO	0.091
OH	CUYAHOGA	0.087
UT	CACHE	0.073
NC	HENDERSON	0.058
OK	OKLAHOMA	0.048
UT	DAVIS	0.043
NC	TRANSYLVANIA	0.035
PA	MONTGOMERY	0.028

This table shows the synthetic control weights for The Coca-Cola Company trends of number of new products using data aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes all carbonated soft drink master brands of The Coca-Cola Company, such as Coca-Cola, Seagram's, etc.

Table 1.7: Synthetic control weights (above 0.01), PepsiCo trend of the number of new products

State	County	Weight
NY	WESTCHESTER	0.325
WA	SKAGIT	0.188
FL	LEON	0.161
WI	DANE	0.083
MN	DAKOTA	0.064
NC	LINCOLN	0.063
NY	SUFFOLK	0.017
OH	LAWRENCE	0.016
NE	LANCASTER	0.015
WI	COLUMBIA	0.012

This table shows the synthetic control weights for PepsiCo trends of number of new products using data aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes all carbonated soft drink master brands of PepsiCo, such as Pepsi Cola, Mountain Dew, etc.

Table 1.8: Synthetic control method:
The effect of vertical integration on log prices

	The Coca-Cola Company	PepsiCo
VI	-0.00307*	-0.0142***
s.e.	(0.00159)	(0.00162)
N	12220	17340
R-square	0.797	0.746
adj. R-square	0.786	0.733
Time FE	Yes	Yes
Market FE	Yes	Yes
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

The table shows the results of synthetic control method analysis using data aggregated at quarter level. Standard errors are clustered at the county level. For The Coca-Cola Company, vertical integration leads to 0.31% price decrease. For PepsiCo, vertical integration leads to 1.42% price decrease. All carbonated soft drink master brands of The Coca-Cola Company and PepsiCo are included in the data, such as Coca-Cola, Seagram's, Pepsi Cola, Mountain Dew, etc.

Table 1.9: Synthetic control method:
The effect of vertical integration on the number of new products

	The Coca-Cola Company	PepsiCo
VI	0.367***	0.647***
s.e.	0.0989	0.133
N	16000	12400
R-square	0.228	0.625
adj. R-square	0.187	0.604
Time FE	Yes	Yes
Market FE	Yes	Yes
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

This table shows the results of synthetic control method analysis using data aggregated at quarter level. Standard errors are clustered at the county level. For The Coca-Cola Company, the vertical integration leads to 0.367 more new products introduced to markets that are affected by vertical integration than markets that are not affected by vertical integration every quarter. This number translates to 1.5 more new products annually. The average number of new products of The Coca-Cola Company introduced to a market annually is 15.9. That is to say, the vertical integration leads to 10% more new products. For PepsiCo, the vertical integration leads to 0.647 more new products introduced to markets that are affected by vertical integration than markets that are not affected by vertical integration every quarter. This number translates to 2.6 more new products annually. The average number of new products of PepsiCo introduced to a market annually is 30.8. That is to say, the vertical integration leads to 8% more new products. All carbonated soft drink master brands of The Coca-Cola Company and PepsiCo are included in the data, such as Coca-Cola, Seagram's, Pepsi Cola, Mountain Dew, etc.

Table 1.10: Difference-in-difference method:
The effect of vertical integration on log prices

	The Coca-Cola Company	PepsiCo
VI	-0.00652***	-0.0159***
s.e.	(0.00170)	(0.00245)
N	5046227	5571295
R-square	0.965	0.939
adj. R-square	0.965	0.939
Time FE	Yes	Yes
Market FE	Yes	Yes
Product FE	Yes	Yes
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

The table shows the results of difference-in-difference analysis using data aggregated at month level. Standard errors are clustered at the county level. For The Coca-Cola Company, vertical integration leads to 0.65% price decrease. For PepsiCo, vertical integration leads to 1.59% price decrease. All carbonated soft drink master brands of The Coca-Cola Company and PepsiCo are included in the data, such as Coca-Cola, Seagram's, Pepsi Cola, Mountain Dew, etc.

Table 1.11: Difference-in-difference method:
The effect of vertical integration on the number of new products

	The Coca-Cola Company	PepsiCo
VI	0.123***	0.128**
s.e.	(0.0394)	(0.0517)
N	52440	52440
R-square	0.208	0.500
adj. R-square	0.193	0.491
Time FE	Yes	Yes
Market FE	Yes	Yes
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

The table shows the results of difference-in-difference analysis using data aggregated at month level. Standard errors are clustered at the county level. For The Coca-Cola Company, the vertical integration leads to 0.123 more new products per month, i.e. annually about 1.48 more new products, being introduced to markets that are vertically integrated than markets that are not vertically integrated. The average number of new products of The Coca-Cola Company introduced to a market annually is 15.9. That is to say, the vertical integration leads to 9% more new products. For PepsiCo, the vertical integration leads to 0.128 more new products per month, i.e. annually about 1.54 more new products, being introduced to markets that are vertically integrated than markets that are not vertically integrated. The average number of new products of PepsiCo introduced to a market annually is 30.8. That is to say, the vertical integration leads to 5% more new products. All carbonated soft drink master brands of The Coca-Cola Company and PepsiCo are included in the data, such as Coca-Cola, Seagram's, Pepsi Cola, Mountain Dew, etc.

Table 1.12: Robustness check
Difference-in-difference method on neighboring markets:
The effect of vertical integration on log prices

	The Coca-Cola Company	PepsiCo
VI	-0.00405	-0.0016
s.e.	(0.00405)	(0.00650)
N	597673	965454
R-square	0.962	0.936
adj. R-square	0.962	0.936
Time FE	Yes	Yes
Market FE	Yes	Yes
Product FE	Yes	Yes
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

The table shows the results of difference-in-difference analysis using the subsample of neighboring markets. Data is aggregated at month level. Standard errors are clustered at the county level. For The Coca-Cola Company, vertical integration leads to 0.4% price decrease. For PepsiCo, vertical integration leads to 0.2% price decrease. All carbonated soft drink master brands of The Coca-Cola Company and PepsiCo are included in the data, such as Coca-Cola, Seagram's, Pepsi Cola, Mountain Dew, etc.

Table 1.13: Robustness check
Difference-in-difference method on neighboring markets:
The effect of vertical integration on the number of new products

	The Coca-Cola Company	PepsiCo
VI	0.198*	0.125
s.e.	(0.104)	(0.124)
N	6420	8760
R-square	0.178	0.500
adj. R-square	0.156	0.488
Time FE	Yes	Yes
Market FE	Yes	Yes
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

The table shows the results of difference-in-difference analysis using the subsample of neighboring markets. Data is aggregated at month level. Standard errors are clustered at the county level. For The Coca-Cola Company, the vertical integration leads to 0.198 more new products per month, i.e. annually about 2.376 more new products, being introduced to markets that are vertically integrated than markets that are not vertically integrated. The average number of new products of The Coca-Cola Company introduced to a market annually is 15.9. That is to say, the vertical integration leads to 15% more new products. For PepsiCo, the vertical integration leads to 0.125 more new products per month, i.e. annually about 1.5 more new products, being introduced to markets that are vertically integrated than markets that are not vertically integrated. The average number of new products of PepsiCo introduced to a market annually is 30.8. That is to say, the vertical integration leads to 5% more new products. All carbonated soft drink master brands of The Coca-Cola Company and PepsiCo are included in the data, such as Coca-Cola, Seagram's, Pepsi Cola, Mountain Dew, etc.

Chapter 2

The Effects of Vertical Integration on The Competitor: Higher Prices and Fewer New Products

2.1 Introduction

The effects of vertical integration on the integrated company are beneficial for consumers, as it leads to lower price and more new products, which is shown in chapter one. And yet, to draw a full picture of the effects of the vertical integration, one cannot ignore the possible effects on competitors.

This chapter studies the effects on vertical integration on the competitor, by exploring several vertical integrations in the soda industry. The vertically integrated bottlers (Coca-Cola Enterprises, Pepsi Bottling Group and Pepsi Americas) bottled Dr Pepper's products both before and after the vertical integration. For Dr Pepper Snapple Group, its competitors, The Coca-Cola Company and PepsiCo, controlled its downstream bottlers after the vertical integrations. In the soda industry, the bottlers set the price of final products. If the upstream company wants to introduce a new product, it needs to negotiate with downstream

bottlers for them to bottle and distribute the products. After the vertical integration, The Coca-Cola Company and PepsiCo have incentives to increase the price of Dr Pepper's products so that consumers will substitute to Coca-Cola's products and Pepsi Cola's products. Furthermore, when Dr Pepper wants to introduce a new product, The Coca-Cola Company and PepsiCo may impede this process, leading to fewer new products from Dr Pepper, which will be beneficial for The Coca-Cola Company and PepsiCo. These two effects will decrease consumer welfare.

The main contribution of this chapter is that: this is the first research that studies and quantities the effect of vertical integration on the competitor's new product introduction process. Furthermore, this research adds more evidence to the limited empirical literature on the price effect of vertical integration. Luco and Marshall (2019) studies the same vertical integrations in the soda industry, and shows that, for the competitor, Dr Pepper, vertical integration leads to higher price. This paper verifies and confirms their results.

The soda industry is ideal for this research for several reasons. First, three of Dr Pepper's bottlers (Coca-Cola Enterprise, Pepsi Bottling Group and Pepsi Americas) were vertically integrated by competitors. On the other hand, there are still many independent bottlers that are not vertically integrated. Second, the exclusive territory of downstream bottlers allows clear identification of markets that are affected by vertical integration and markets that are not. The variation in vertical structure allows me to identify the effect of vertical integration using the difference-in-difference strategy. Third, in the soda industry, downstream bottlers set the price of the final products, and after vertical integration, The Coca-Cola Company and PepsiCo have incentive to increase price of Dr Pepper's products. Fourth, in the soda industry, when upstream company invents a new product and wants to introduce it to market, the company needs to negotiate with downstream bottlers for them to bottle and to distribute the new product within their exclusive territories, and the negotiation process is costly and time-consuming. The Coca-Cola company and PepsiCo may have incentive to impede this process for Dr Pepper's new products. This feature allows me to study the effect

of vertical integration on the competitor's new product introduction.

Based on the institution in the soda industry, there are several predictions on the effects of vertical integration on the competitor. First, vertical integration will lead to a higher price for competitor's products: this is because after vertical integration, The Coca-Cola Company and PepsiCo have incentives to increase the price of the Dr Pepper's products so that consumers will substitute to Coca-Cola's products and Pepsi Cola's products. Second, vertical integration makes competitor's new product introduction process more difficult and therefore fewer new products will be introduced after vertical integration: this is because after vertical integration, The Coca-Cola Company and PepsiCo may impede this process so that consumers would stay with their own products.

A key difference between the analysis in this chapter and that in chapter one is that: the analysis in chapter one studies all master brands of The Coca-Cola Company (such as Coca-Cola, Seagram's, etc) and PepsiCo (such as Pepsi Cola, Mountain Dew, etc), and yet, the analysis in this chapter studies only the anchor master brands, i.e. Coca-Cola of The Coca-Cola Company, Pepsi Cola of PepsiCo, and Dr Pepper of Dr Pepper Snapple Group. This is due to the data availability and the fact that different master brands of Dr Pepper Snapple Group may have different bottlers even in the same market. I will discuss this in more detail later in the industry background section.

Empirically, I use the bottles' territory map to identify whether a market is affected by the vertical integrations. I focus the time period between 2008 and 2012. In this research, products are defined by the unique combination of six product characteristics: brand-flavor-calorie level-container type-size-multiple in a unit of product. For each product, I use scanner data to find monthly sales and prices in each market, i.e. the observation is at product-market-month level. I further use the scanner data to track two things: for each market, in each month, the list of products that are offered in that market in that month; and for each product, in each month, the list of markets in which the product exists in that month. The first list, the list of products in a certain market in each month, allows me to track new

product introductions to the market. The second list, the list of markets where a certain product exists in each month, allows me to track the new product roll-out process.

I first use the synthetic control method to study the effects of vertical integration on prices and the number of new products introduced to markets, and utilize the synthetic control weights to run weighted regressions and to quantify the effects of vertical integration. I then use the difference-in-difference method to further quantify the effects of vertical integration on prices and the number of new products introduced to markets, by exploring the longitudinal and cross-sectional variations in vertical structures in markets. In next chapter, I also examine the new products in more detail.

The results of the synthetic control method show that, for the Coca-Cola vertical integration, it leads to 0.7% price decrease of Coca-Cola products but leads to 0.25% price increase of Dr Pepper products. For the PepsiCo vertical integration, it leads to 1.4% price decrease of Pepsi Cola products but leads to 0.68% price increase of Dr Pepper products. Furthermore, for the Coca-Cola vertical integration, it leads to 0.92 more new Coca-Cola products annually introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 12% more new Coca-Cola products annually. But the vertical integration leads to 0.88 fewer new Dr Pepper products annually introduced to markets that are affected by the Coca-Cola vertical integration than markets that are not affected, i.e. vertical integration leads to 15% fewer new Dr Pepper products annually. Similarly, for the PepsiCo vertical integration, it leads to 1.08 more new Pepsi Cola products annually introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 12% more new Pepsi Cola products annually. But the vertical integration leads to 0.56 fewer new Dr Pepper products annually introduced to markets that are affected by the PepsiCo vertical integration than markets that are not affected, i.e. vertical integration leads to 9% fewer new Dr Pepper products annually.

Furthermore, the difference-in-difference strategy finds similar results to those in the syn-

thetic control analysis. Specifically, the Coca-Cola vertical integration leads to 1.02% price decrease of Coca-Cola products and leads to 0.09% price decrease of Dr Pepper products. The PepsiCo vertical integration leads to 2.19% price decrease of Pepsi Cola products and leads to 0.71% price increase of Dr Pepper products. Furthermore, for the Coca-Cola vertical integration, it leads to 1.03 more new Coca-Cola products annually introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 13% more new Coca-Cola products annually. But the vertical integration leads to 0.80 fewer new Dr Pepper products annually introduced to markets that are affected by the Coca-Cola vertical integration than markets that are not affected, i.e. vertical integration leads to 13% fewer new Dr Pepper products annually. Similarly, for the PepsiCo vertical integration, it leads to 0.86 more new Pepsi Cola products annually introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 10% more new Pepsi Cola products annually. But the vertical integration leads to 0.68 fewer new Dr Pepper products annually introduced to markets that are affected by the PepsiCo vertical integration than markets that are not affected, i.e. vertical integration leads to 11% fewer new Dr Pepper products annually.

These results on the effects of vertical integration have important policy implications, and I discuss it in the next chapter.

The rest of this chapter is organized as follows. Section 2 introduces the background in the soda industry, and specifically, the Dr Pepper Snapple Group and its relation with The Coca-Cola Company and PepsiCo. Section 3 describes the data I use. By using the synthetic control method, Section 4 shows the trends in prices and the trends in the number of new products. This section also shows the estimation results of synthetic control method. Section 5 builds an empirical model to apply the difference-in-difference method, and discusses identification and shows the estimation results. Section 6 concludes this chapter.

2.2 Industry Background

2.2.1 Dr Pepper Snapple Group and its bottlers

In chapter one, I discussed the soda industry in detail, with the emphasis on the upstream and downstream vertical relation between The Coca-Cola Company, PepsiCo and their downstream bottlers. In this section, I will discuss more about the Dr Pepper Snapple Group and the industry institution that is relevant to studying the effects of vertical integration on competitors.

Dr Pepper Snapple Group is the third largest company in the soda industry, after The Coca-Cola Company and PepsiCo. It is an upstream company that produces concentrate and syrup, and sells these intermediary products to downstream bottlers. However, for the bottling business, there are two major differences between Dr Pepper Snapple Group and The Coca-Cola Company, PepsiCo. The first major difference is that Dr Pepper Snapple Group does not have its own nation-wide bottling network: in some markets, its bottlers are not The Coca-Cola Company's bottlers or PepsiCo's bottlers; in some other markets, it contracts with either The Coca-Cola Company's bottlers or PepsiCo's bottlers. Specifically, the three vertically integrated bottlers (Coca-Cola Enterprise, Pepsi Bottling Group, and Pepsi Bottling Group) all contracted with Dr Pepper Snapple Group to bottle and distribute its products in some of their territories. This means that the vertical integration affects differently for The Coca-Cola Company, PepsiCo and Dr Pepper Snapple Group. Before the vertical integration, all three companies are vertically separated, and after the vertical integration, The Coca-Cola Company and PepsiCo are vertically integrated but Dr Pepper Snapple Group is still vertically separated. Most importantly, Dr Pepper Snapple Group's upstream competitors now controls its downstream.

There is a second major difference in the bottling business that is relevant. Dr Pepper Snapple Group has many different master brands, such as Dr Pepper, Schweppes, Canada Dry, etc. Different master brands may have different bottlers and bottling territories, i.e.

the bottling contracts are for each master brand but not for all the products of Dr Pepper Snapple Group. For example, in one market, it is possible that Dr Pepper is produced by The Coca-Cola Company's bottler and Schweppes is produced by an independent bottler. The bottling territories are still exclusive but it is based on master brands. This means that, for a master brand such as Dr Pepper, in any market, there is only one bottler that can produce and distribute Dr Pepper in this market. This exclusivity allows me to identify with markets are affected by the vertical integrations on the master brand level.

Ideally, with each master brand having its own bottling territory map, I could identify, for each master brand, the markets that are affected by vertical integrations. These are part of the Coca-Cola Enterprise, Pepsi Bottling Group, and Pepsi Bottling Group territories on which bottler's have the bottling contract of specific master brand of Dr Pepper Snapple Group. Ideally, I could quantify the effects of vertical integration on each of these master brand.

Yet, due to the limited territory map data, which will be discussed in the data section, this chapter studies only the Dr Pepper master brand. To make the analysis consistent and to make the comparison meaningful, only two other master brands, Cola-Cola and Pepsi Cola, are studied, while other master brands such as Seagram's (of The Coca-Cola Company) and Mountain Dew (of the PepsiCo) etc, are excluded in this chapter.

2.2.2 Predicted effects of vertical integration on competitor

Based on the institution in soda industry and specifically the Dr Pepper Snapple Group, there are some predictions on the effects of vertical integration on competitor. First, the vertical integration of The Coca-Cola Company and PepsiCo will lead to a higher price of Dr Pepper's products: this is because after vertical integration, The Coca-Cola Company and PepsiCo have incentives to increase the price of Dr Pepper's products so that consumers will substitute to Coca-Cola's products and Pepsi's products. Second, the vertical integration of The Coca-Cola Company and PepsiCo will make new product introduction of Dr Pepper Snapple

Group more difficult and therefore fewer new products of Dr Pepper will be introduced to markets after vertical integration: this is because after vertical integration, The Coca-Cola Company and PepsiCo may impede this process so that consumers would stay with their own products.

2.3 Data

In addition to the two datasets mentioned in chapter one, I use a third data set from FTC public documents. FTC investigated the vertical integrations of The Coca-Cola Company, PepsiCo and their downstream bottlers, respectively, and generated territory maps. For example, one specific map documents the counties within Coca-Cola Enterprise's territory on which Coca-Cola Enterprise has the bottling and distribution rights of Dr Pepper. Similarly, FTC documents include such territory maps for PepsiCo. FTC documents also include territory maps for other master brand of Dr Pepper Snapple Group, and yet for each of these master brand other then Dr Pepper, the number of markets that are affected by vertical integration is very small. For Dr Pepper, however, the number of markets that are affected by the vertical integration is similar to that of Coca-Cola and Pepsi Cola. Therefore, this chapter studies only the Dr Pepper master brand. In order to make the analysis consistent and to make the comparison meaningful, only two other master brands, Cola-Cola and Pepsi Cola, are studied, while other master brands such as Seagram's (of The Coca-Cola Company) and Mountain Dew (of the PepsiCo) etc, are excluded in this chapter.

This chapter studies the time period from 2008 to 2012, by combining the data from the three sources. And the data is aggregated to month level. The 20,271 food and merchandise stores are located in 874 counties and each county is treated as a market.

I use the bottlers' territory maps from Beverage Digest to identify which counties are served by vertically integrated bottlers and which counties are served by bottlers that are not vertically integrated. I did this for Coca-Cola and for Pepsi Cola, separately. Furthermore,

for Dr Pepper, I use the FTC documents to identity which counties are served by vertically integrated bottlers and which counties are served by bottlers that are not vertically integrated. As shown in Table 2.1, for Coca-Cola, before the vertical integration, all markets are served by bottlers that are not vertically integrated; after the vertical integration, among the 874 markets, 596 markets are served by vertically integrated The Coca-Cola Company bottlers, and 278 markets are served by The Coca-Cola Company bottlers that are not vertically integrated. For Pepsi Cola, before the vertical integration, all markets are served by bottlers that are not vertically integrated; after the vertical integration, among the 874 markets, 604 markets are served by vertically integrated PepsiCo bottlers and 270 markets are served by PepsiCo bottlers that are not vertically integrated. For Dr Pepper, among the 874 markets, 493 markets are affected by either The Coca-Cola Company's vertical integration or PepsiCo's vertical integration. Specifically, 195 markets are served by the bottler Coca-Cola Enterprise, which was vertically integrated in October 2010, and 298 markets are served by either Pepsi Bottling Group or Pepsi Americas, which were vertically integrated in February 2010. The remaining 381 markets are not affected by the vertical integration. In the Table 2.2, I show the demographics of markets that are affected by vertical integration and markets that are not affected by vertical integration. The demographics I consider are population, population density, income, and unemployment rate. There are some differences in the demographics between markets that are affected by vertical integration and markets that are not affected by vertical integration, but as shown in the table, the difference are not significant.

In addition to the territory maps of Coca-Cola and Pepsi Cola, as shown in Figure 1.1 and 1.2 in chapter one, in Figure 2.1 and 2.2, I plot the territory map for Dr Pepper over the 874 counties that are in the sample, and show whether they are affected by the vertical integrations or not. Figure 2.1 shows markets that are affected by vertical integrations altogether, and Figure 2.2 further decompose these into markets affected by The Coca-Cola Company vertical integration and markets affected by PepsiCo vertical integration. As shown

in the maps, the counties in the sample range from east coast to west coast and from south to north, and they cover urban areas as well as rural areas. Furthermore, the vertically integrated markets are scattered around all U.S. instead of clustering in one area only.

Same as chapter one, products are defined by the unique combination of six product characteristics: brand-flavor-calorie level-container type-size-multiple in a unit of product. Specifically, there still can be many brands under one master brand. For example, under the master brand Coca-Cola, there are brands such as Coca-Cola, Coca-Cola Zero, Coca-Cola Cherry, Coca-Cola Caffeine Free, etc.

Table 2.3 shows the summary statistics of these six characteristics in the sample. Each of the three master brand, Coca-Cola, Pepsi Cola and Dr Pepper, has many different brands. And they also have many different flavors. There are two types of calorie level and four types of containers. For the size characteristic, there is a lot of variation and there are about 15 to 20 different sizes, ranging from 7.5 fluid ounces to 101.4 fluid ounces. There is also a lot of variation in the multiple characteristics in the sample, and there are about 11 to 13 different multiples for each master brand, ranging from 1 to 36.

By this product definition as we discussed above, there are 204 Coca-Cola products, 243 Pepsi Cola products and 128 Dr Pepper products in the sample period. There are total 5,739,473 market-product-month observations on prices and quantities.

Same as chapter one, if a product exists on a market for the first time, then this product is counted as one new product for that market in that month. For any month after that month, the product is considered as an existing product on that market. Specifically, if the product leaves the market and reintroduced to that market some time later, it is still considered as an existing product.

2.4 Synthetic control analysis

2.4.1 Method

I apply the same synthetic control method used in chapter one to show graphical trends of prices and the number of new products that demonstrate the effects of vertical integration. I further utilize the synthetic control weights to quantify the effects using weighted regressions.

For Dr Pepper, the demographics in the markets that are affected by the Coca-Cola vertical integration, markets that are affected by the PepsiCo vertical integration and markets that are not affected bt vertical integration are somewhat different, although the differences are not significant. (This is similar to The Coca-Cola Company and PepsiCo, as discussed in chapter one.) This might be a concern, and one may argue that the vertically integrated markets are selected based on such differences. Although there is actually no such selection concern, as shown in the previous data section, I use synthetic control method to further address this concern.

I run two separate synthetic control analyses, one for the markets that are affected by the Coca-Cola vertical integration, and one for the markets that are affected by the PepsiCo vertical integration. For example, for the markets that are affected by the Coca-Cola vertical integration, I first aggregate such markets into one treated unit and find the price and number of new products in each time period. I aggregate data to quarter level. Then among the markets that are not affected by vertical integration, I assign weights on these control markets such that the weighted average of control markets mimics the treatment unit best for each period before the vertical integration. In this way, I find some markets, among the markets that are not affected by vertical integration, that are most similar to the markets that are affected by the Coca-Cola vertical integration, and this will help solve the concern that markets that are affected by vertical integration and markets that are not affected by the Coca-Coca vertical integration may be different. Similar for the markets that are affected by the PepsiCo vertical integration.

Specifically, for a product, I first normalize the quantities sold of this product in a given market and in a given week to a standard unit of 12-pack 12 fl oz case. I do this for all the products from the master brand Dr Pepper and for all market-week combination. Then for each market, I aggregate revenues of all these products and further aggregate them to quarter level. I aggregate quantities in the same way. For each market that are not affected by any vertical integration, dividing the aggregated revenue by the aggregated quantity gives the price, which is at market-quarter level. For the markets that are affected by the Coca-Cola vertical integration, I further aggregate revenues of all markets that are affected by the Coca-Cola vertical integration. I do this same for quantities. Then, dividing the aggregated revenue by the aggregated quantity gives the price of the treated unit. For the number of new products, I do the aggregation similarly without the normalization, which is not needed for the number of new products.

I use the aggregated markets that are affected by the Coca-Cola vertical integration as the treated unit, and use all markets that are not affected by any vertical integration as donor pool to find the synthetic control weights for the treatment unit, which follows the method proposed by Abadie and Gardeazabal (2003) and Abadie, Diamond, and Hainmueller (2010). For price, I find the weights such that the weighted average price of control units mimics the price of treatment unit best for each period before the vertical integration. Then I use this weight to find the weighted average price on control units for each period after the vertical integration, and these are the synthetic control prices. I apply this analysis method to the number of new products of the master brand Dr Pepper. Furthermore, I do the same for the markets that are affected by the PepsiCo vertical integration.

For the master brand Coca-Cola and Pepsi Cola, I apply the same method as in chapter one, except that the products are aggregated to the master brand level, using only data of the master brands Coca-Cola and Pepsi Cola, respectively, in stead of the company level as in chapter one.

I further utilize the synthetic control weights to run weighted regressions:

$$\log(p_{mt}) = \beta VI_{mt} + \phi_m + \tau_t + \epsilon_{mt} \tag{2.1}$$

In this model, p_{mt} is the aggregated price, average over all products in market m at time t; VI_{mt} is the indicator of vertical integration, and VI_{mt} is 1 if market m at time t is affected by vertical integration and is 0 otherwise; ϕ_m is market fixed effect and τ_t is time fixed effect.

For the effect of vertical integration on new product introduction, I estimate a similar equation:

$$n_{mt} = \gamma VI_{mt} + \pi_m + \nu_t + \xi_{mt} \tag{2.2}$$

where n_{mt} is the number of new products in market m at time t. Market and time fixed effects are also included.

For each market that is not affected by vertical integration, the weight is the synthetic control weight that are found earlier. For each market that is affected by vertical integration, the weight is $\frac{1}{n_{VI}}$ where n_{VI} is the total number markets that are affected by the vertical integrations.

Specifically, only the carbonated soft drink products of the master brands Coca-Cola, Pepsi Cola and Dr Pepper are included in the analysis. (For example, the products of the master brand Seagram's and Mountain Dew etc are not included in the analysis.)

The key parameters of interest are β and γ. β represents the effect of vertical integration on price, and γ represents the effect of vertical integration on the number of new products. I run the weighted regressions for Coca-Cola, Pepsi Cola and Dr Pepper separately.

2.4.2 Results

Figure 2.3 shows the price trend of Coca-Cola products. The solid curve represents the price trend in vertically integrated markets and the dashed curve represents the price trend in the

synthetic control markets. The dotted vertical line indicates the time of vertical integration. The synthetic control weights are listed in Table 2.4. As shown in the graph, the price trend of synthetic control unit mimics the price trend of treated unit in each period before the vertical integration very well. After vertical integration, price is lower in markets that are vertically integrated than in markets that are not vertically integrated. Figure 2.5 shows the price trend of Dr Pepper products on the markets that are affected by the Coca-Cola vertical integration and on the synthetic control market. The synthetic control weights are listed in Table 2.6. The price trend of synthetic control unit follows the price trend of treated unit in each period before the vertical integration, although not matched perfectly. After vertical integration, the difference between prices on markets that are affected by the Coca-Cola vertical integration and on markets that are not affected by vertical integration does not change much comparing to that before the vertical integration. This shows that the Coca-Cola vertical integration leads to price decrease of Coca-Cola products, but lead to no obvious change in the price of Dr Pepper products.

Similarly, Figure 2.4 shows the price trend of Pepsi Cola products. The synthetic control weights are listed in Table 2.5. The price trend of synthetic control unit follows the price trend of treated unit in each period before the vertical integration, although not matched perfectly. After vertical integration, the price in markets that are vertically integrated goes below the price in markets that are not vertically integrated, and the change is in a larger scale than Coca-Cola. Figure 2.6 shows the price trend of Dr Pepper products on the markets that are affected by the PepsiCo vertical integration and on the synthetic control market. The synthetic control weights are listed in Table 2.7. The price trend of synthetic control unit follows the price trend of treated unit in each period before the vertical integration, although not matched perfectly. After vertical integration, the difference between prices on markets that are affected by the PepsiCo vertical integration and on markets that are not affected by vertical integration becomes smaller comparing to that before the vertical integration. This shows that the PepsiCo vertical integration leads to price decrease of Pepsi

Cola products, but lead to price increase of Dr Pepper products. This is consistent with the prediction that the vertically integrated company has incentive to increase the competitor's products so that consumers will substitute from the competitor's products to the vertically integrated firm's own products.

Figure 2.7 shows the trend of the number of new Coca-Cola products that are introduced to markets every quarter. The synthetic control weights are listed in Table 2.8. As shown in the graph, the trend of the number of new products in synthetic control unit mimics the trend of the number of new products in treated unit in each period before the vertical integration perfectly. After vertical integration, there is a larger number of new products introduced to markets that are vertically integrated than the number of new products introduced to markets that are not vertically integrated. Figure 2.9 shows the trend of the number of new Dr Pepper products that are introduced to the markets that are affected by the Coca-Cola vertical integration and to the synthetic control markets. The synthetic control weights are listed in Table 2.10. As shown in the graph, the trend of the number of new products in synthetic control unit mimics the trend of the number of new products in treated unit in each period before the vertical integration perfectly. After vertical integration, there is a smaller number of new products introduced to markets that are affected by the Coca-Cola vertical integration than the number of new products introduced to markets that are not affected by the vertical integration. This shows that the Coca-Cola vertical integration leads to more new Coca-Cola products introduced to vertically integrated markets, but lead to fewer new Dr Pepper products introduced to the markets affected by such vertical integration.

Similarly, Figure 2.8 shows the trend of the number of new Pepsi Cola products that are introduced to markets every quarter. The synthetic control weights are listed in Table 2.9. As shown in the graph, the trend of the number of new products in synthetic control unit mimics the trend of the number of new products in treated unit in each period before the vertical integration perfectly. After vertical integration, there is a larger number of new products introduced to markets that are vertically integrated than the number of new

products introduced to markets that are not vertically integrated. Figure 2.10 shows the trend of the number of new Dr Pepper products that are introduced to the markets that are affected by the PepsiCo vertical integration and to the synthetic control markets. The synthetic control weights are listed in Table 2.11. As shown in the graph, the trend of the number of new products in synthetic control unit mimics the trend of the number of new products in treated unit in each period before the vertical integration perfectly. After vertical integration, there is a smaller number of new products introduced to markets that are affected by the PepsiCo vertical integration than the number of new products introduced to markets that are not affected by the vertical integration. This shows that the PepsiCo vertical integration leads to more new PepsiCo products introduced to vertically integrated markets, but lead to fewer new Dr Pepper products introduced to the markets affected by such vertical integration. This is consistent with the prediction that the vertically integrated company has incentive to impede the new product introduction process for competitor, so that consumers would stay with the vertically integrated company's products.

The results from weighted regressions are presented in Table 2.12 and Table 2.13. The effect of vertical integration on price is shown in Table 2.12. The Coca-Cola vertical integration leads to 0.7% price decrease of Coca-Cola products, and this result is significant at 1% level. However, this vertical integration leads to 0.3% price increase of Dr Pepper products. Similarly, the PepsiCo vertical integration leads to a 1.4% price decrease of Pepsi Cola products, and this result is significant at 1% level. However, this vertical integration leads to 0.7% price increase of Dr Pepper products, and this result is significant at 1% level. These results are consistent with the prediction that the vertically integrated company has incentive to increase the price of competitor's products so that consumers will substitute from the competitors products to the vertically integrated firm's own products.

The effect of vertical integration on the number of new products introduced to markets is shown in Table 2.13. The Coca-Cola vertical integration leads to 0.23 more new Coca-Cola products introduced to markets that are affected by vertical integration than markets

that are not affected by vertical integration every quarter. The result is significant at 1% level. This number translates to 0.92 more new products annually. To understand this number, the average number of new Coca-Cola products introduced to a market annually is 8. That is to say, the vertical integration leads to 12% more new Coca-Cola products. This vertical integration leads to 0.22 fewer new Dr Pepper products introduced to markets that are affected by this vertical integration than markets that are not affected by vertical integration every quarter. The result is significant at 1% level. This number translates to 0.88 fewer new products annually. To understand this number, the average number of new Dr Pepper products introduced to a market annually is 6. That is to say, the vertical integration leads to 15% fewer new Dr Pepper products. Similarly, the PepsiCo vertical integration leads to 0.27 more new Pepsi Cola products introduced to markets that are affected by vertical integration than markets that are not affected by vertical integration every quarter. The result is significant at 1% level. This number translates to 1.08 more new products annually. To understand this number, the average number of new Pepsi Cola products introduced to a market annually is 9. That is to say, the vertical integration leads to 12% more new Pepsi Cola products. This vertical integration leads to 0.14 fewer new Dr Pepper products introduced to markets that are affected by this vertical integration than markets that are not affected by vertical integration every quarter. The result is significant at 5% level. This number translates to 0.56 fewer new products annually. That is to say, the vertical integration leads to 9% fewer new Dr Pepper products. All these results are consistent with our predictions that the vertically integrated company has incentive to impede the new product introduction process for competitor, so that consumers would stay with the vertically integrated company's products.

2.5 Difference-in-difference model and estimation results

2.5.1 Model

In the synthetic control analysis discussed above, the trends in price and the trends in the number of new products are shown using data that are aggregated. Furthermore, only the control markets with positive weights are used in the regressions.

To better quantify the effects of vertical integration, I estimate "difference-in-difference" regression equations using detailed product-market-month level data without aggregation. The regression equations are same as those in chapter one, but I use the data from three master brands only: Coca-Cola, Pepsi Cola and Dr Pepper. Specifically, the empirical model is as following:

$$\log(p_{jmt}) = \beta VI_{mt} + x'_{jmt}\theta + \delta_j + \phi_m + \tau_t + \epsilon_{jmt} \tag{2.3}$$

where p_{jmt} is the price of product j in market m at month t; VI_{mt} is the indicator of vertical integration, and VI_{mt} is 1 if market m at time t is affected by vertical integration and is 0 otherwise; δ_j is product fixed effect; ϕ_m is market fixed effect and τ_t is time fixed effect. x_{jmt} is a vector of product characteristics such as discount and promotions

For the effect of vertical integration on new product introduction, I estimate a similar equation:

$$n_{mt} = \gamma VI_{mt} + z'_{mt}\eta + \pi_m + \nu_t + \xi_{mt} \tag{2.4}$$

where n_{mt} is the number of new products in market m at month t; z_{mt} is a vector of market characteristics, such as number of stores, etc. Market and time fixed effects are also included.

I estimate the above equations for Coca-Cola, Pepsi Cola and Dr Pepper separately.

Among these coefficients in the equations (2.3) and (2.4) above, the coefficients of interest are β and γ. β captures the price effect of vertical integration and thus β captures synergy and elimination of double marginalization on the prices of products for Coca-Cola and Pepsi Cola, and captures the anticompetitive effects for Dr Pepper. γ measures how the integrated structure help new product introduction for Coca-Cola and PepsiCo, and how it impede the new product introduction for Dr Pepper. Market fixed effects and time fixed effects are also included in the regression equation. For example, the population in a market affects the demand and thus affects prices, and furthermore, it may also affect company's decision of new product introduction. Companies may want to test new product in a market with large population. This is captured by market fixed effects.

The identification strategy is difference-in-difference strategy. The underlying assumption is that the markets that are affected by vertical integration and markets that are not affected by vertical integration are fundamentally the same, and the dependent variables, the price and the number of new product introduced to markets, follow the same trend in markets that are affected by vertical integration and markets that are not affected by vertical integration before vertical integration, and would have followed the same trend in markets that are affected by vertical integration and markets that are not affected by vertical integration after vertical integration if the vertical integration had not happened. And most importantly, there should be no selection concern about which markets are affected by vertical integration and which markets are not.

As can be seen in the demographics analysis earlier, there are no significant differences between markets that are affected by vertical integration and markets that are not affected by vertical integration. Besides, from the maps of sample markets (Figure 1.1 and 1.2 in chapter one and Figure 2.1 and 2.2 in this chapter), it is shown that markets that are affected by vertical integration scatter around U.S., instead of clustering around one or a few areas. Markets that are not affected by vertical integration also scatter around U.S. Both types of markets cover urban and rural areas and span from east to west and from north to south.

Furthermore, each type of markets consists of a large number of markets: specifically, for Dr Pepper, there are about four hundred markets that are not affected by vertical integration, about two hundred markets that are affected by the Coca-Cola vertical integration and about three hundred markets that are affected by the PepsiCo vertical integration. For Coco-Cola and Pepsi Cola, things are similar and are discussed in chapter one. The possible difference would be averaged out among hundreds of markets. Lastly, as discussed in chapter one, both The Coca-Cola Company and PepsiCo vertically integrated with their bottlers entirely, and did not divest any vertically integrated markets after the vertical integration. All these facts make the selection concern unlikely to be a threat to the analysis, and the difference-in-difference assumption is very likely to hold.

2.5.2 Results

The estimation results of equation (2.3) are presented in Table 2.14. In the first column, it shows that, for Coca-Cola, after the Coca-Cola vertical integration, the price in markets that are vertically integrated is 1.02% lower than the price in markets that are not vertically integrated. In the third column, it shows that the Coca-Cola vertical integration leads prices of Dr Pepper products to decrease by 0.09%, which is not significant. Similarly, in the second column, it shows that, for Pepsi Cola, the price effect is larger, and after the PepsiCo vertical integration, the price in markets that are vertically integrated is 2.19% lower than the price in markets that are not vertically integrated. In the forth column, it shows that the PepsiCo vertical integration leads prices of Dr Pepper products to increase by 0.71%, which is significant at 1% level. These results are consistent with theoretical prediction and show that the vertically integrated company has incentive to increase the price of competitor's products so that consumers will substitute from the competitors products to the vertically integrated firm's own products.

For the effect of vertical integration on new product introduction, the estimates are presented in Table 2.15. The number of new products introduced is measured at market-month

level. For Coca-Cola and Pepsi Cola, after vertical integration, the number of new products introduced to markets that are affected by vertical integration increased significantly relative to markets that are not affected by vertical integration. Yet, for Dr Pepper, after vertical integration, the number of new products introduced to markets that are affected by vertical integration decreased significantly relative to markets that are not affected by vertical integration. Specifically, the result in the first column shows that, for Coca-Cola, the Coca-Cola vertical integration leads to 0.086 more new products per month, i.e. annually about 1.03 more new products, being introduced to markets that are vertically integrated than markets that are not vertically integrated. The result is statistically significant at 1% level. The average number of new Coca-Cola products introduced to a market annually is 8. That is to say, the vertical integration leads to 13% more new products. As shown in the third column, for Dr Pepper, the Coca-Cola vertical integration leads to 0.067 fewer new products per month, i.e. annually about 0.80 fewer new products, being introduced to markets that are affected by the vertical integration than markets that are not affected by the vertical integration. The result is statistically significant at 1% level. The average number of new Dr Pepper products introduced to a market annually is 6. That is to say, the Coca-Cola vertical integration leads to 13% fewer new Dr Pepper products on the markets that are affected by the vertical integration.

Similarly, in the second column of Table 2.15, it shows that for Pepsi Cola, the PepsiCo vertical integration leads to 0.071 more new products per month, i.e. annually about 0.86 more new products, being introduced to markets that are vertically integrated than markets that are not vertically integrated. The result is statistically significant at 1% level. The average number of new Pepsi Cola products introduced to a market annually is 9. That is to say, the vertical integration leads to 10% more new products. As shown in the fourth column, for Dr Pepper, the PepsiCo vertical integration leads to 0.057 fewer new products per month, i.e. annually about 0.68 fewer new products, being introduced to markets that are affected by the vertical integration than markets that are not affected by the vertical

integration. The result is statistically significant at 1% level. That is to say, the PepsiCo vertical integration leads to 11% fewer new Dr Pepper products on the markets that are affected by the vertical integration. These results are consistent with the theoretical prediction. The vertically integrated company has incentive to impede the new product introduction process for competitor, so that consumers would stay with the vertically integrated company's products.

Comparing the results in the synthetic control analysis and the results in difference-in-difference analysis, the results are largely the same. There are some small differences that should not be a concern. As discussed earlier, the synthetic control method uses more aggregated data than the difference-in-difference method, and that naturally leads to some differences in the results.

2.5.3 Robustness

In this subsection, I check the effects of vertical integration on prices and on new product introduction using a subsample that consists of neighboring markets. Specifically, I choose the counties that are next to each other but were affected by vertical integration differently. For Coca-Cola and Pepsi Cola, the method is same as chapter one. For Dr Pepper, from the markets that are affected by the Coca-Cola vertical integration and the markets that are not affected by the Coca-Cola vertical integration, I choose the counties that are next to each other and one county is affected by vertical integration, and the other county is not affected by vertical integration. Furthermore, one county that is affected by vertical integration can be next to several counties in the sample that are not affected by vertical integration. In such case, all these counties are selected into the subsample. As a result, for a market A in the subsample, there is at least one other market B in the subsample such that market A and market B are neighboring markets and that one of them is affected by the Coca-Cola vertical integration and the other is not. I do the same for the Dr Pepper markets that are affected by the PepsiCo vertical integration. And I repeat the difference-in-difference analysis on the

subsample that consists of neighboring markets.

For Coca-Cola, there are 107 markets in the subsample of neighboring markets, which accounts for 12% of the 874 markets in the full sample. For Pepsi Cola, there are 146 markets in the subsample of neighboring markets, which accounts for 17% of the 874 markets in the full sample. The maps of these subsample markets are shown in Figure 1.7 and Figure 1.8 in chapter one. For Dr Pepper and the Coca-Cola vertical integration, there are 72 markets in the subsample, which accounts for 8% of the 874 markets in the full sample. For Dr Pepper and the PepsiCo vertical integration, there are 104 markets in the subsample, which accounts for 12% of the 874 markets in the full sample. The maps of these subsample markets are shown in Figure 2.11 and Figure 2.12. As shown in these maps, in the subsample of neighboring markets, markets that are affected by vertical integration scatter around US, instead of clustering around one or a few areas. Markets that are not affected by vertical integration scatter around US. Both types of markets cover urban and rural areas and span from east to west and from north to south.

I repeat the difference-in-difference analysis on the subsamples of neighboring markets. The results are shown in Table 2.16 and Table 2.17. These results are largely unchanged and are consistent with the results in full sample difference-in-difference analysis, and are consistent with the theoretical predictions: for the competitor, vertical integration leads to a higher price, and leads to fewer new products being introduced to markets that are affected by the vertical integration.

2.6 Conclusion

This chapter studies the effects of vertical integration on the competitor, by exploring several vertical integrations in the soda industry. Specifically, this chapter studies how the Coca-Cola vertical integration and PepsiCo vertical integration affect Dr Pepper's prices and new product introduction.

Several features in the soda industry make it ideal for this study. There are vertical integrations in the soda industry, and the exclusive territory of downstream bottlers allows clear identification of markets that are vertically integrated. Furthermore, only some parts of the US markets are vertically integrated while other parts are not vertically integrated, and this justifies a difference-in-difference strategy to identify the effects of vertical integration. Besides, after the Coca-Cola and PepsiCo vertical integrations, Dr Pepper is still vertically separated, and its upstream competitors control its downstream after vertical integration. Furthermore, the new product introduction process involves cooperation and negotiation between upstream company and downstream bottlers. After vertical integration, The Coca-Cola Company and PepsiCo may have incentive to impede this process for Dr Pepper's new products. This feature allows me to study the effect of vertical integration on the competitor's new product introduction.

This chapter first uses synthetic control method to study the effects of the vertical integrations, and find that although vertical integration leads to price decrease and more new product introduction for the vertically integrated companies, it leads to price increase and fewer new product introduction for the competitor. Specifically, for the Coca-Cola vertical integration, it leads to 0.7% price decrease of Coca-Cola products but leads to 0.25% price increase of Dr Pepper products. For the PepsiCo vertical integration, it leads to 1.4% price decrease of Pepsi Cola products but leads to 0.68% price increase of Dr Pepper products. Furthermore, for the Coca-Cola vertical integration, it leads to 0.92 more new Coca-Cola products annually introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 12% more new Coca-Cola products annually. But the vertical integration leads to 0.88 fewer new Dr Pepper products annually introduced to markets that are affected by the Coca-Cola vertical integration than markets that are not affected, i.e. vertical integration leads to 15% fewer new Dr Pepper products annually. Similarly, for the PepsiCo vertical integration, it leads to 1.08 more new Pepsi Cola products annually introduced to markets that are vertically integrated than markets

that are not vertically integrated, i.e. vertical integration leads to 12% more new Pepsi Cola products annually. But the vertical integration leads to 0.56 fewer new Dr Pepper products annually introduced to markets that are affected by the PepsiCo vertical integration than markets that are not affected, i.e. vertical integration leads to 9% fewer new Dr Pepper products annually.

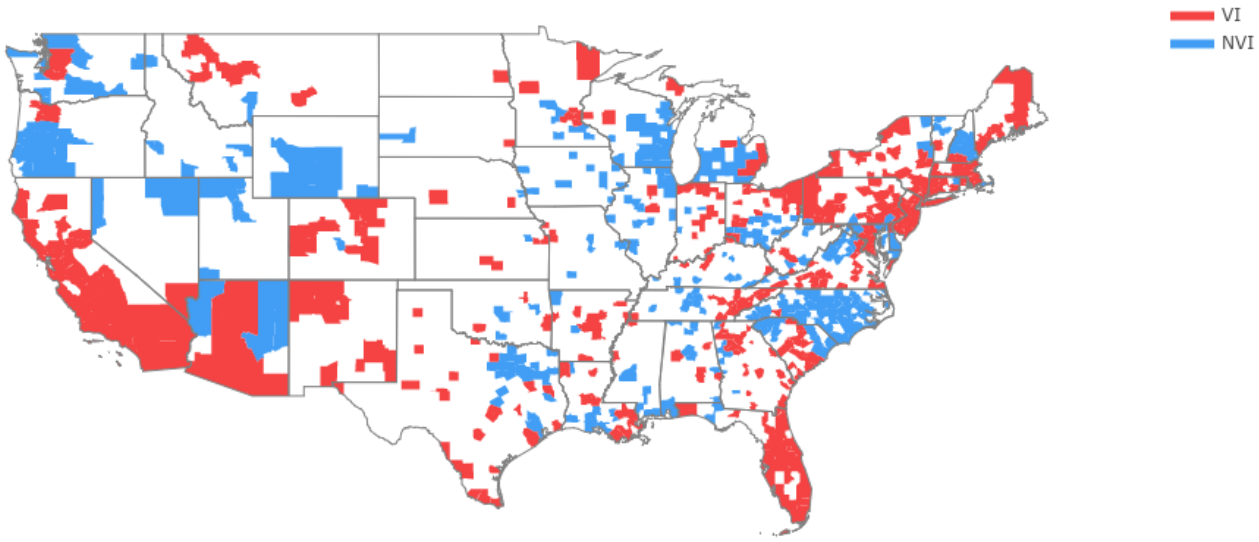
Furthermore, this chapter uses difference-in-difference strategy to further quantify the effect of vertical integration, and finds similar results to those in synthetic control analysis. Specifically, the Coca-Cola vertical integration leads to 1.02% price decrease of Coca-Cola products and leads to 0.09% price decrease of Dr Pepper products. The PepsiCo vertical integration leads to 2.19% price decrease of Pepsi Cola products and leads to 0.71% price increase of Dr Pepper products. Furthermore, for the Coca-Cola vertical integration, it leads to 1.03 more new Coca-Cola products annually introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 13% more new Coca-Cola products annually. But the vertical integration leads to 0.80 fewer new Dr Pepper products annually introduced to markets that are affected by the Coca-Cola vertical integration than markets that are not affected, i.e. vertical integration leads to 13% fewer new Dr Pepper products annually. Similarly, for the PepsiCo vertical integration, it leads to 0.86 more new Pepsi Cola products annually introduced to markets that are vertically integrated than markets that are not vertically integrated, i.e. vertical integration leads to 10% more new Pepsi Cola products annually. But the vertical integration leads to 0.68 fewer new Dr Pepper products annually introduced to markets that are affected by the PepsiCo vertical integration than markets that are not affected, i.e. vertical integration leads to 11% fewer new Dr Pepper products annually.

All these results are consistent with theoretical predictions. The results show that the vertically integrated company has incentive to increase the price of competitor's products so that consumers will substitute from the competitor's products to the vertically integrated company's own products. Furthermore, they also show that the vertically integrated com-

pany has incentive to impede the new product introduction process for competitor, so that consumers would stay with the vertically integrated company's products.

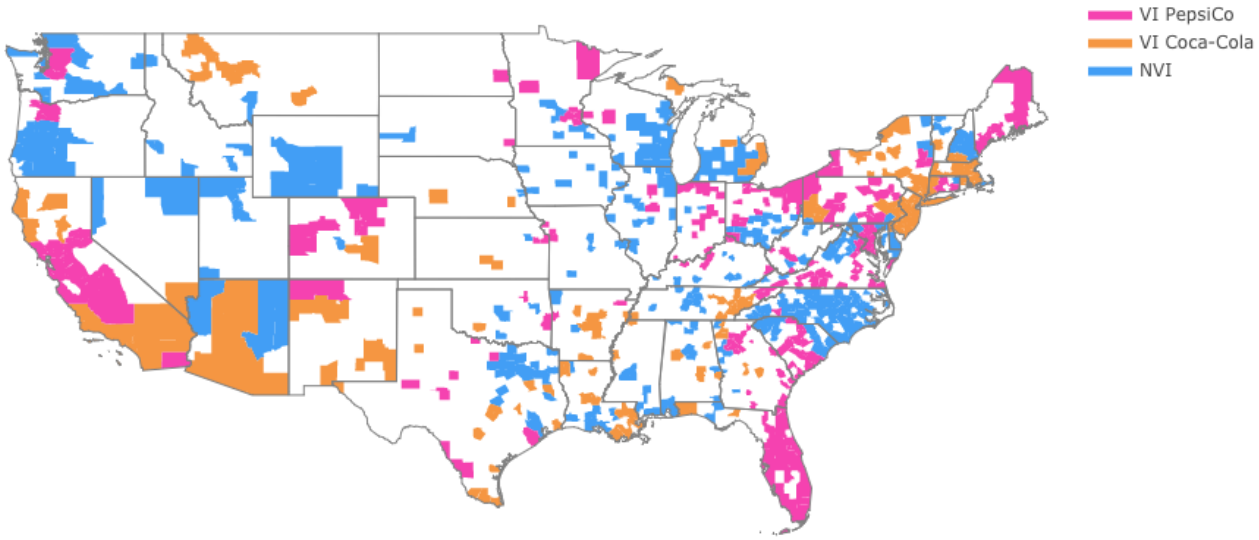
The main contribution of this chapter is that: this is the first research that studies and quantities the effect of vertical integration on the competitor's new product introduction process. Furthermore, it adds more evidence to the limited empirical literature on the price effect of vertical integration. Luco and Marshall (2019) studies the same vertical integrations in the soda industry, and shows that, for the competitor, Dr Pepper, vertical integration leads to higher price. This paper verifies and confirms their results.

Figure 2.1: Dr Pepper: markets affected and markets not affected by vertical integration in the data



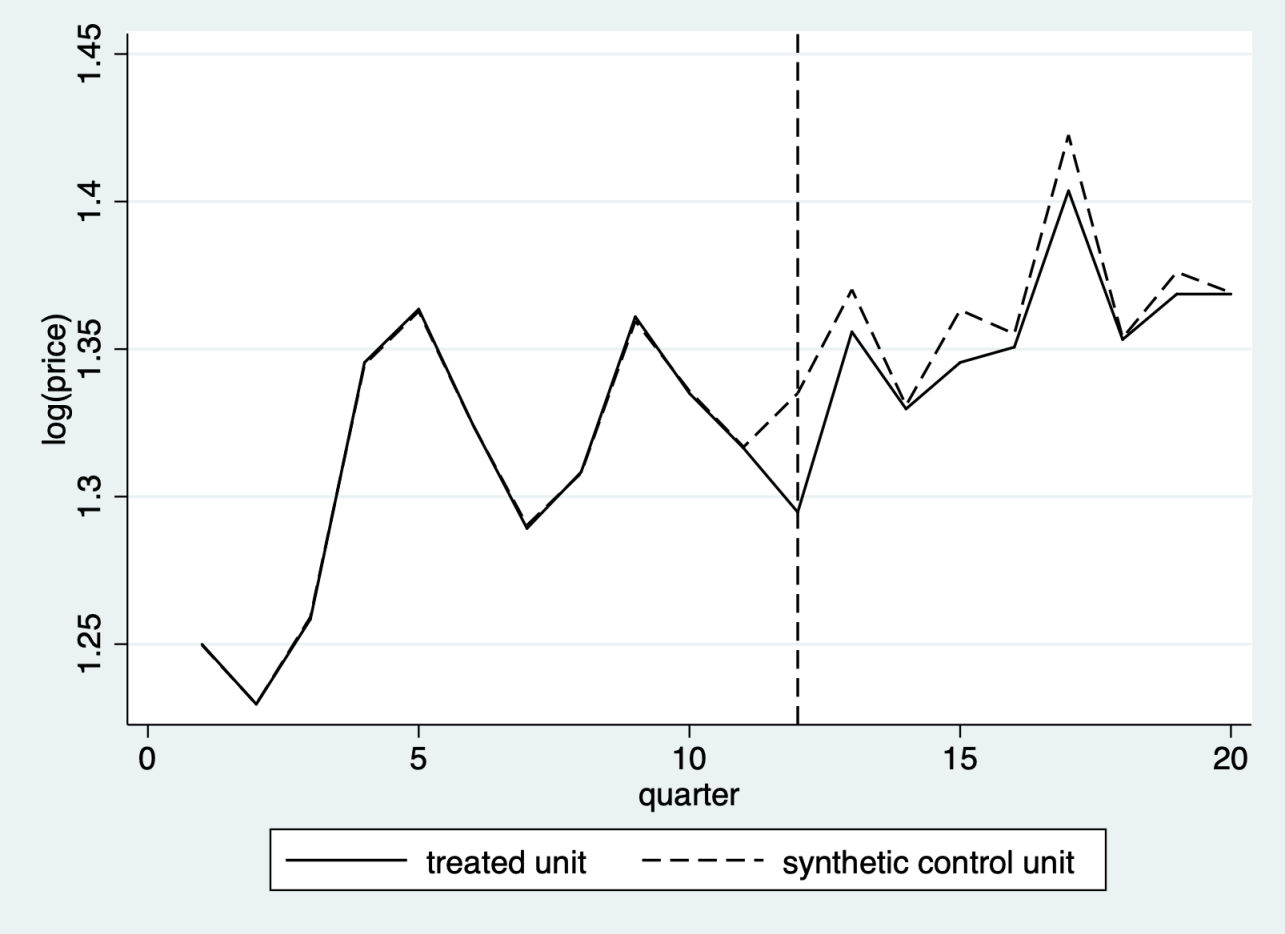
Source: FTC documents on bottler's territory map. Markets in the data are shown in the map with color. Markets affected by vertical integration are shown in red, and markets not affected by vertical integration are shown in blue.

Figure 2.2: Dr Pepper: markets affected by The Coca-Cola Company vertical integration, markets affected by PepsiCo vertical integration, and markets not affected by vertical integration in the data



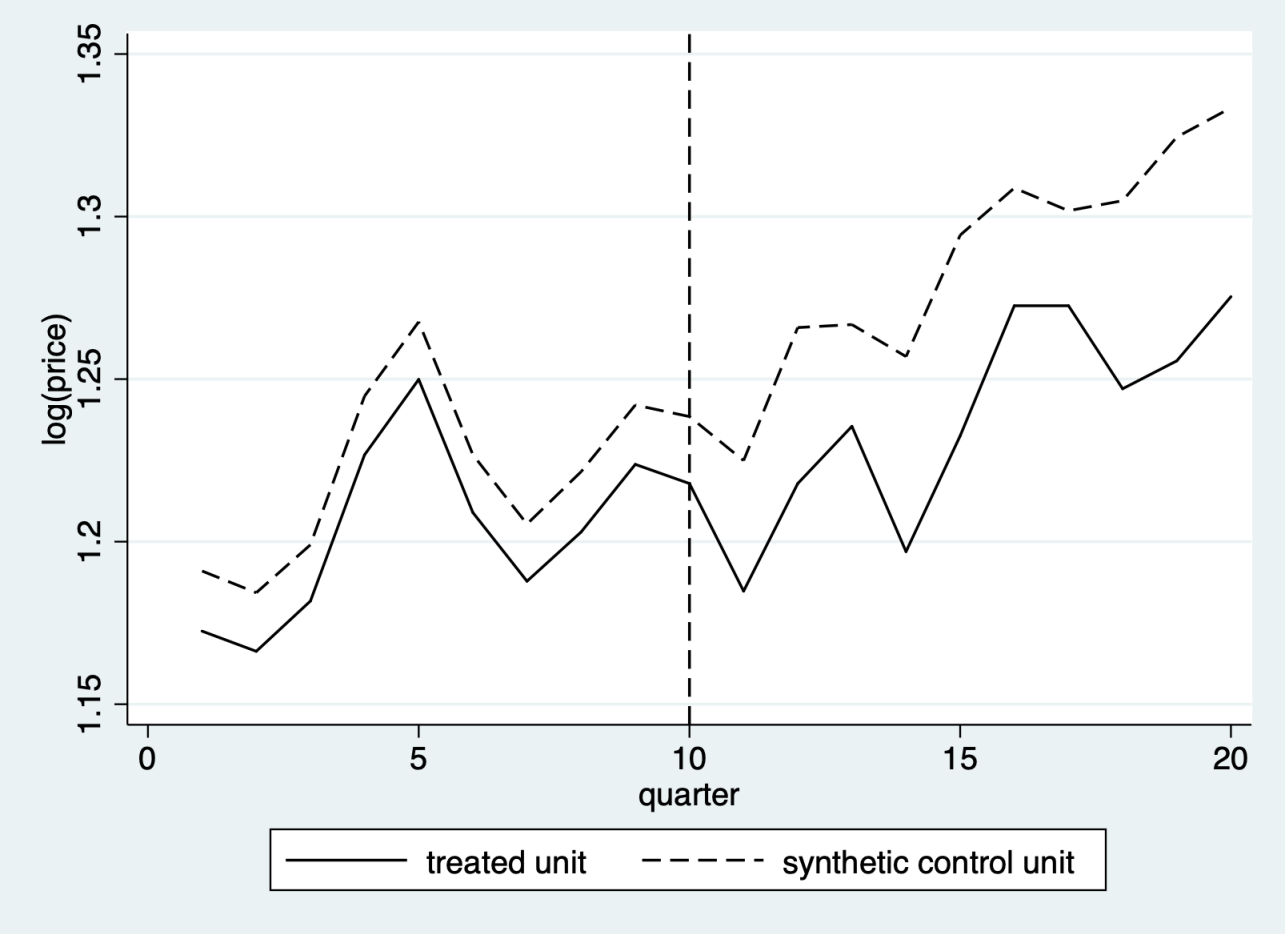
Source: FTC documents on bottler's territory map. Markets in the data are shown in the map with color. Markets affected by the Coca-Cola vertical integration are shown in orange, markets affected by the PepsiCo vertical integration are shown in pink and markets not affected by vertical integration are shown in blue. The Coca-Cola vertical integration happened in October, 2010, and the PepsiCo vertical integration happened in February, 2010.

Figure 2.3: Synthetic control method, price trend, Coca-Cola



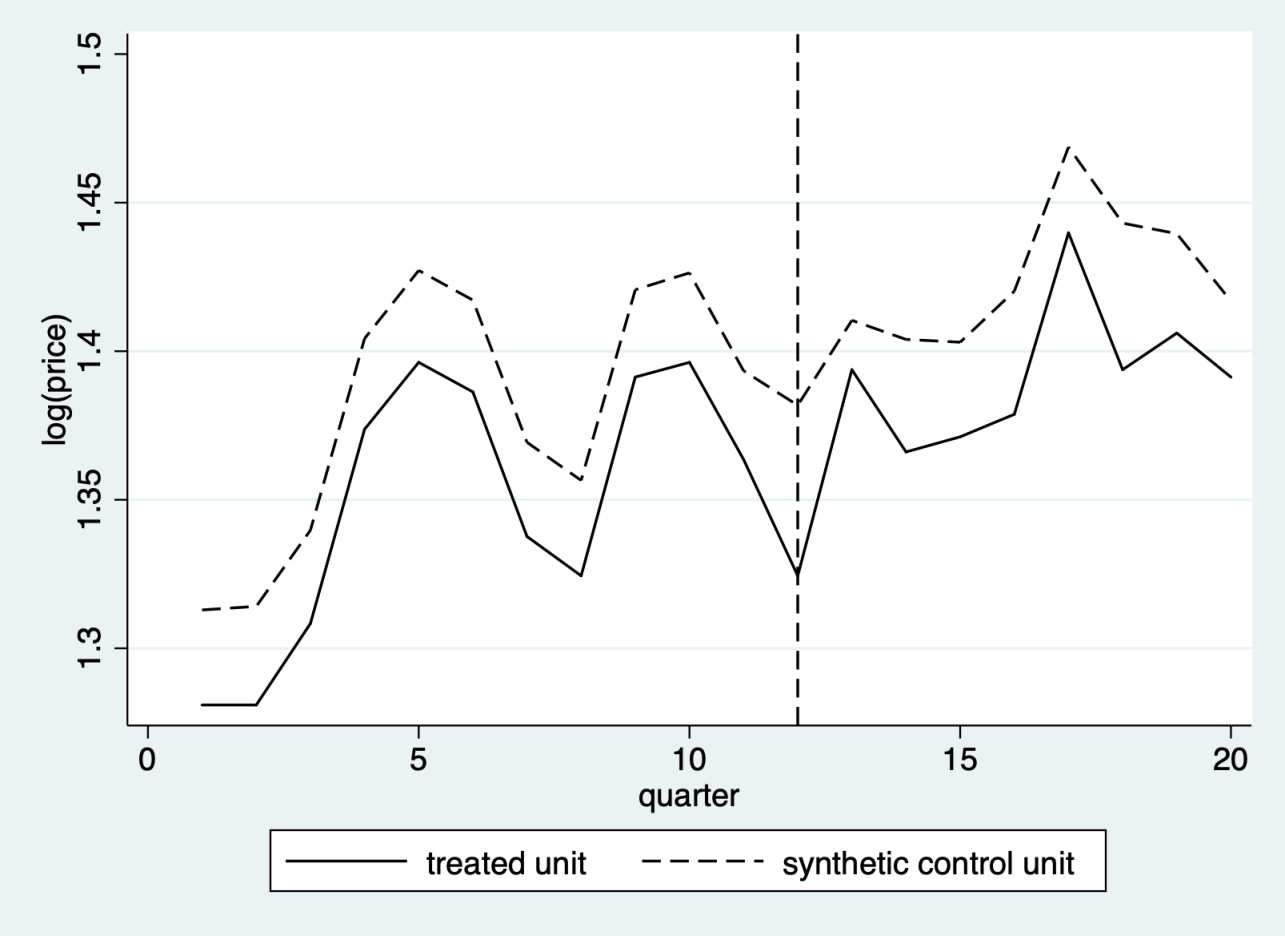
The graph shows the price trend in vertically integrated market as treated unit, and shows the price trend in the synthetic non-vertically integrated market as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes only the master brand Coca-Cola.

Figure 2.4: Synthetic control method, price trend, Pepsi Cola



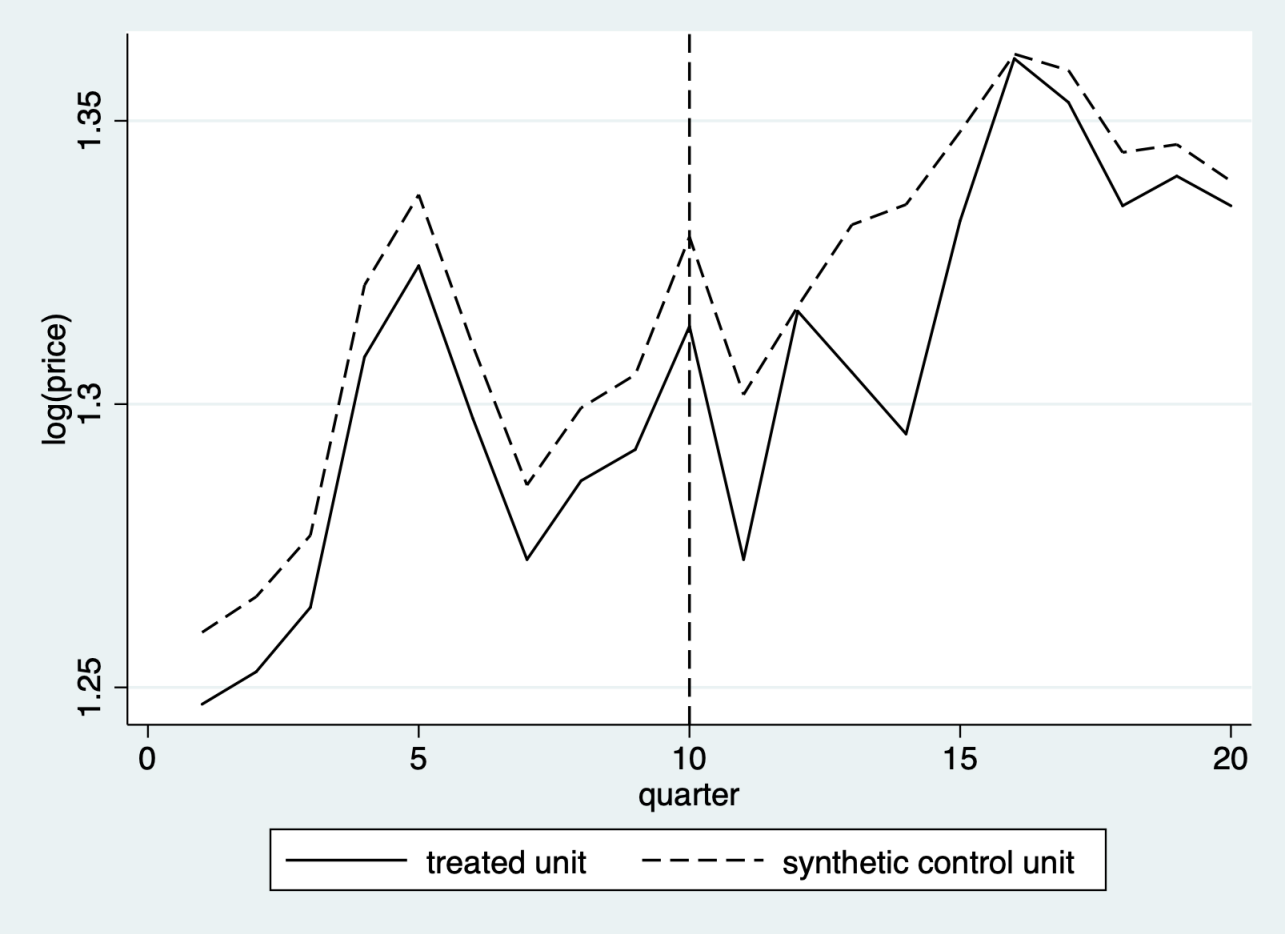
The graph shows the price trend in vertically integrated market as treated unit, and shows the price trend in the synthetic non-vertically integrated market as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes only the master brand Pepsi Cola.

Figure 2.5: Synthetic control method, price trend, Dr Pepper (The Coca-Cola Company vertical integration)



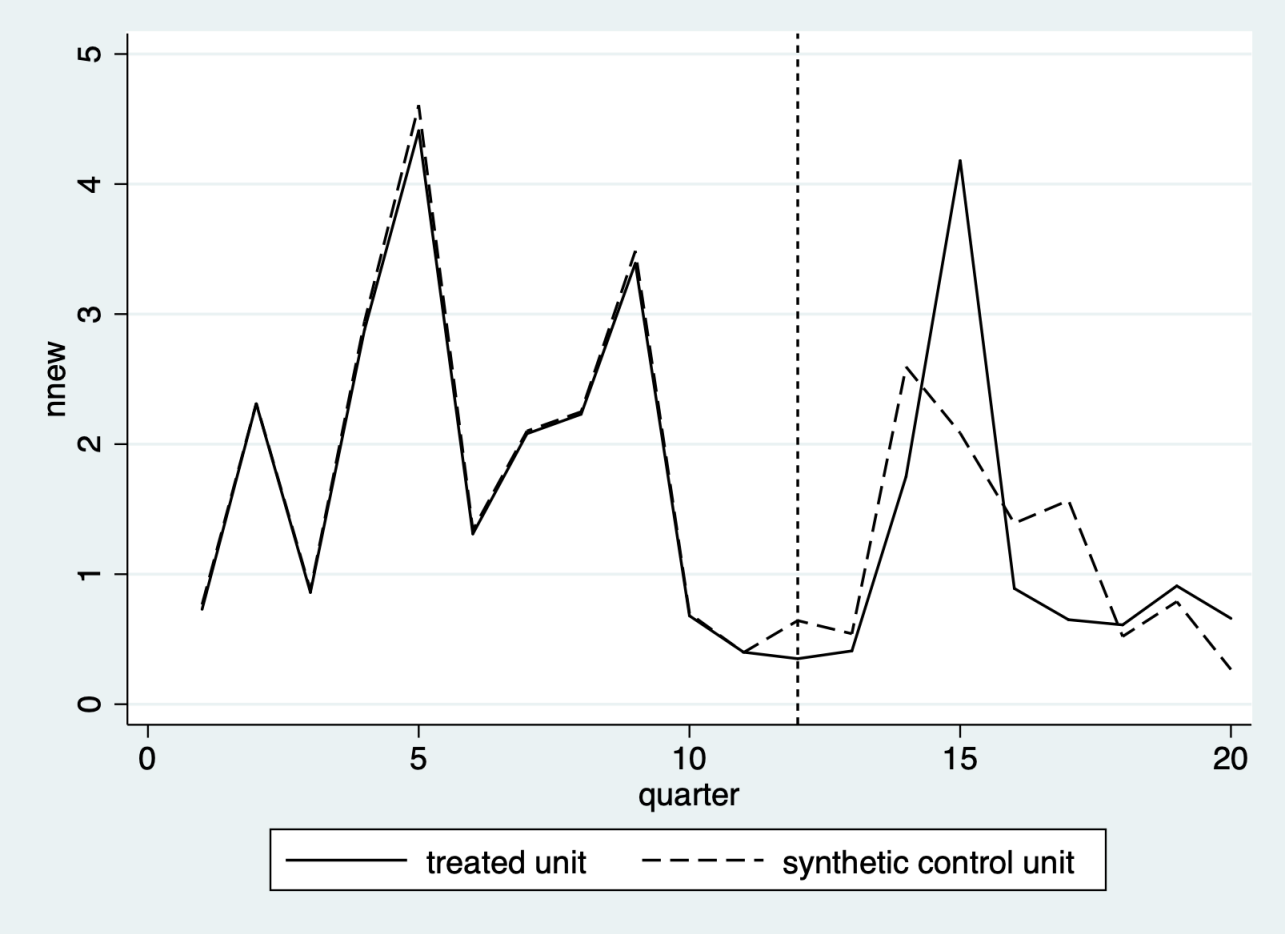
The graph shows the price trend in the aggregated market that is affected by the Coca-Cola vertical integration as treated unit, and shows the price trend in the synthetic market that are not affected by vertical integration as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes only the master brand Dr Pepper.

Figure 2.6: Synthetic control method, price trend, Dr Pepper (PepsiCo vertical integration)



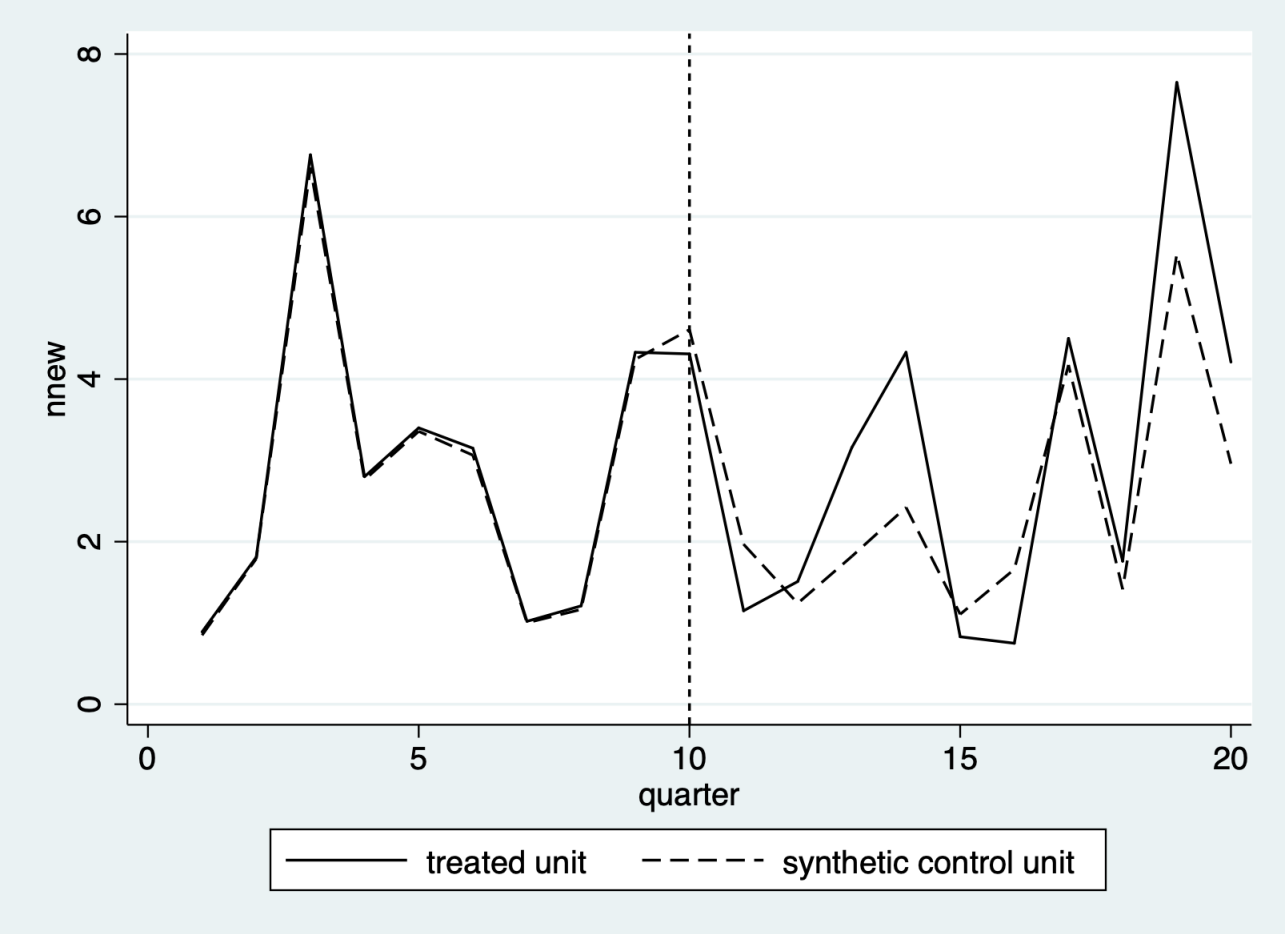
The graph shows the price trend in the aggregated market that is affected by the PepsiCo vertical integration as treated unit, and shows the price trend in the synthetic market that are not affected by vertical integration as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes only the master brand Dr Pepper.

Figure 2.7: Synthetic control method, trend of number of new products, Coca-Cola



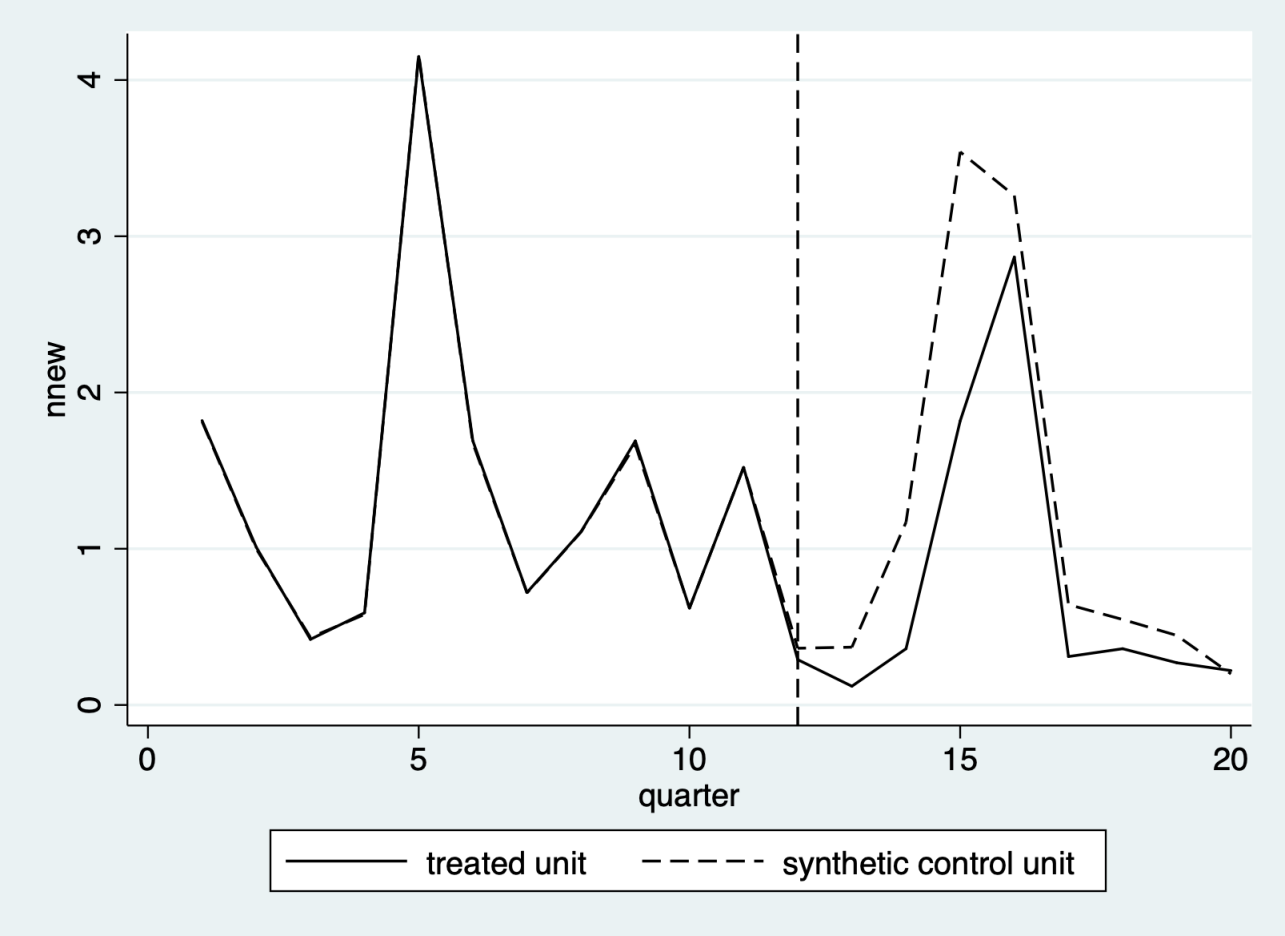
The graph shows the trend of the number of new products in vertically integrated market as treated unit, and shows the trend of the number of new products in the synthetic non-vertically integrated market as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes only the master brand Coca-Cola.

Figure 2.8: Synthetic control method, trend of number of new products, Pepsi Cola



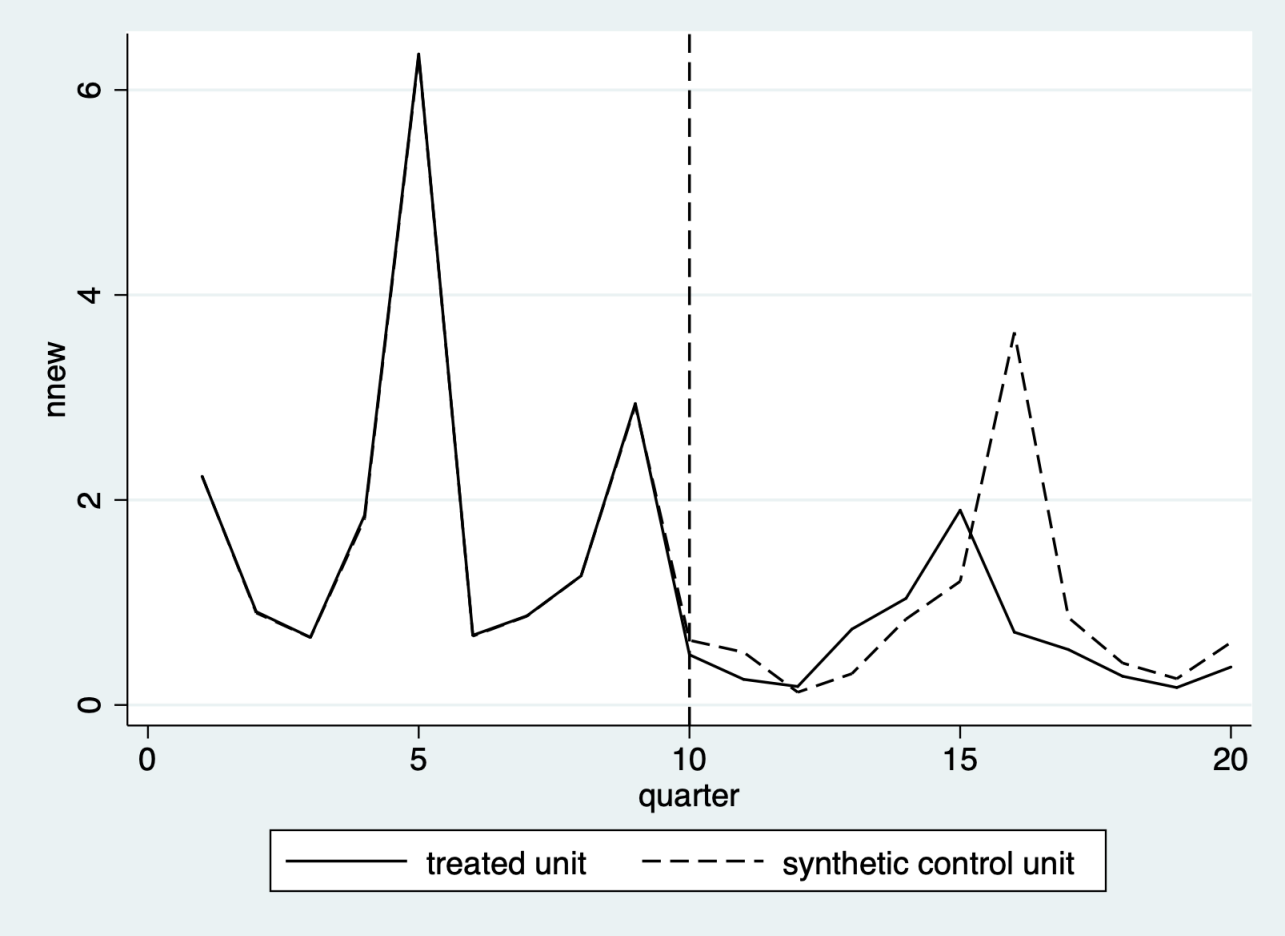
The graph shows the trend of the number of new products in vertically integrated market as treated unit, and shows the trend of the number of new products in the synthetic non-vertically integrated market as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes only the master brand Pepsi Cola.

Figure 2.9: Synthetic control method, trend of number of new products, Dr Pepper (The Coca-Cola Company vertical integration)



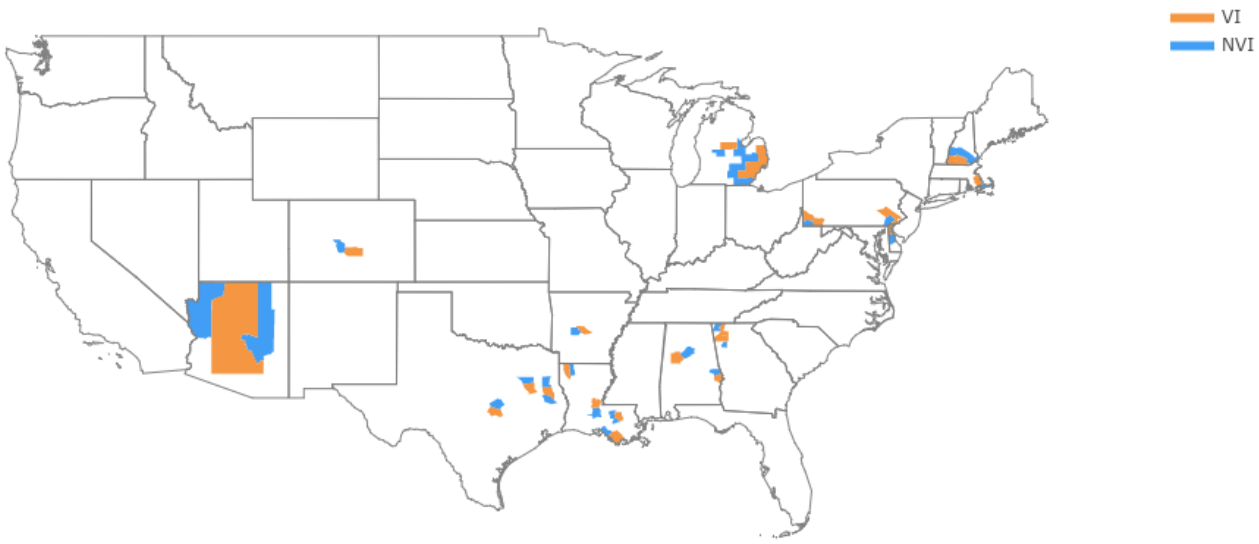
The graph shows the trend of the number of new products in the aggregated market that is affected by the Coca-Cola vertical integration as treated unit, and shows the trend of the number of new products in the synthetic market that are not affected by vertical integration as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes only the master brand Dr Pepper.

Figure 2.10: Synthetic control method, trend of number of new products, Dr Pepper (PepsiCo vertical integration)



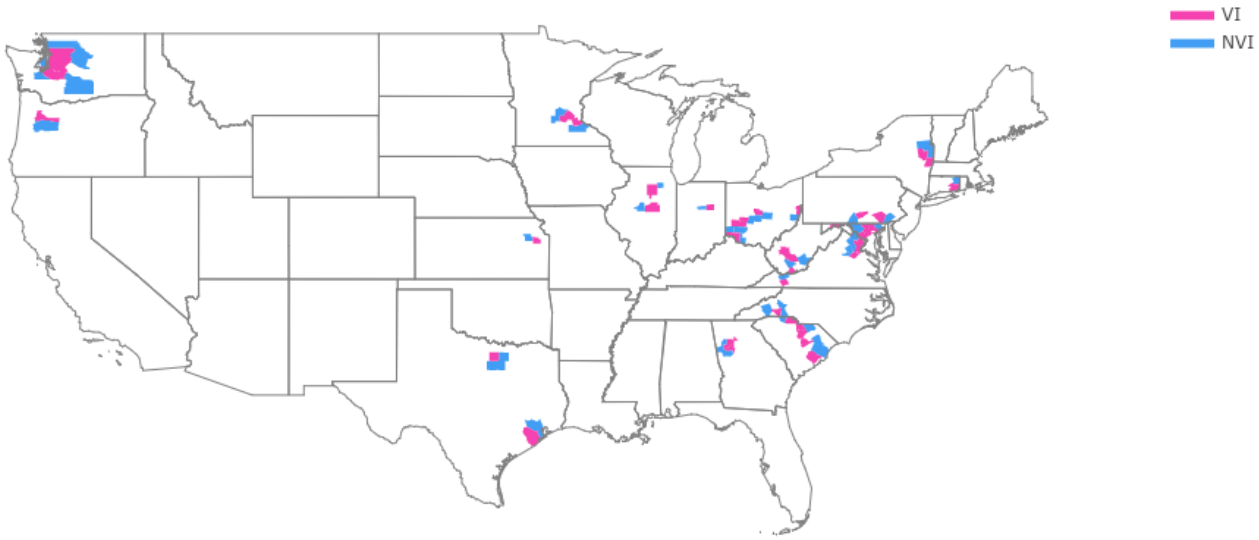
The graph shows the trend of the number of new products in the aggregated market that is affected by the PepsiCo vertical integration as treated unit, and shows the trend of the number of new products in the synthetic market that are not affected by vertical integration as synthetic control unit. The vertical dashed line represents the time of vertical integration. The data is aggregated at quarter level, and there are 20 quarters in the time period from 2008 to 2012. The data includes only the master brand Dr Pepper.

Figure 2.11: Neighboring markets: Dr Pepper markets affected by The Coca-Cola Company vertical integration and markets not affected by vertical integration in the data



Source: FTC documents on bottler's territory map. Subsample of neighboring markets is shown in the map with color. Markets affected by the Coca-Cola vertical integration are shown in orange, and markets not affected by vertical integration are shown in blue. 72 markets are in the subsample. For a market A in the subsample, there is at least one other market B in the subsample such that A and B are neighboring markets and that one of them is affected by the Coca-Cola vertical integration and the other is not. The Coca-Cola vertical integration happened in October, 2010.

Figure 2.12: Neighboring markets: Dr Pepper markets affected by PepsiCo vertical integration and markets not affected by vertical integration in the data



Source: FTC documents on bottler's territory map. Subsample of neighboring markets is shown in the map with color. Markets affected by the PepsiCo vertical integration are shown in pink, and markets not affected by vertical integration are shown in blue. 104 markets are in the subsample. For a market A in the subsample, there is at least one other market B in the subsample such that A and B are neighboring markets and that one of them is affected by the PepsiCo vertical integration and the other is not. The PepsiCo vertical integration happened in February, 2010.

Table 2.1: Counties that are and are not vertically integrated

	Coca-Cola	Pepsi Cola	Dr Pepper
Vertically integrated counties	596	604	493
Non-vertically integrated counties	278	270	381
Total	874	874	874

This table shows the number of counties in the data. For The Coca-Cola Company, vertically integrated counties were not vertically integrated before October 2010, and were vertically integrated after October 2010. For PepsiCo, vertically integrated counties were not vertically integrated before February 2010, and were vertically integrated after February 2010. Non-vertically integrated counties were not vertically integrated through out the sample period from 2008 to 2012. For Dr Pepper, among the 493 counties that are affected by vertical integration, 195 counties are affected by the Coca-Cola vertical integration, and 298 counties are affected by the PepsiCo vertical integration.

Table 2.2: County demographics (2010 Census)

	n	Population	Population Density	Income	Unemployment
Coca Cola VI	596	348743	914	26035	7.21
		(637385)	(3785)	(6401)	(2.05)
Coca Cola non-VI	278	172274	317	23564	7.20
		(209402)	(768)	(4768)	(2.03)
Pepsi Cola VI	604	342038	657	25688	7.25
		(621305)	(1433)	(6162)	(2.04)
Pepsi Cola non-VI	270	182045	873	24267	7.12
		(287457)	(5283)	(5642)	(2.04)
Dr Pepper VI	493	369178	1037	26063	7.22
		(628093)	(4163)	(6757)	(1.99)
Dr Pepper non-VI	381	193539	319	24196	7.20
		(394201)	(552)	(4762)	(2.10)
Dr Pepper VI: Coca-Cola	195	479122	1629	25750	7.40
		(893793)	(6355)	(7158)	(2.06)
Dr Pepper VI: PepsiCo	298	297235	649	26268	7.09
		(344337)	(1396)	(6486)	(1.94)

This table summarizes the demographics in counties that are and are not affected by the Coca-Cola vertical integrations, and that are and are not affected by PepsiCo vertical integrations. The average of each demographic over each type of market is shown in the table with standard deviations shown in parenthesis.

Table 2.3: Summary statistics of product characteristics

Master Brand	Coca-Cola	Pepsi Cola	Dr.Pepper
Number of products	204	243	128
Number of brands	9	18	9
Number of flavors	8	14	7
Number of calorie levels	2	2	2
Number of container types	4	4	3
Number of sizes	19	15	17
Number of multiples	13	11	13

This table shows the statistics for each characteristic that is used to define product. Specifically, product is defined as the unique combination of brand, flavor, calorie level, container type, size of the container and the multiple, i.e. the number of can or bottle in one package. Only the products of three master brands, Coca-Cola, Pepsi Cola and Dr Pepper, are included.

Table 2.4: Synthetic control weights (above 0.01), Coca-Cola price trend

State	County	Weight
CA	SOLANO	0.265
NJ	WARREN	0.196
OH	CUYAHOGA	0.194
CO	EAGLE	0.086
NH	STRAFFORD	0.081
NM	SANTA FE	0.072
MN	SAINT LOUIS	0.039
KY	LAUREL	0.038
NH	ROCKINGHAM	0.016

This table shows the synthetic control weights for Coca-Cola price trends using data aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes only the master brand Coca-Cola.

Table 2.5: Synthetic control weights (above 0.01), Pepsi Cola price trend

State	County	Weight
MT	MISSOULA	0.053
OH	FAIRFIELD	0.035
TX	MAVERICK	0.03
AL	BALDWIN	0.021
IA	DES MOINES	0.019
AZ	COCHISE	0.015
MS	PEARL RIVER	0.011
AZ	YAVAPAI	0.011

This table shows the synthetic control weights for Pepsi Cola price trends using data aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes only the master brand Pepsi Cola.

Table 2.6: Synthetic control weights (above 0.01), Dr Pepper (The Coca-Cola Company vertical integration) price trend

State	County	Weight
IL	VERMILION	0.155
AZ	GILA	0.074
NY	CLINTON	0.06
WY	CARBON	0.06
WI	WOOD	0.045
OH	SCIOTO	0.039
WI	DODGE	0.033
NV	ELKO	0.026
AL	HOUSTON	0.019
FL	JACKSON	0.017
PA	GREENE	0.011

This table shows the synthetic control weights for Dr Pepper price trends using the data from markets that are affected by the Coca-Cola vertical integration and markets that are not affected by any vertical integrations, and data is aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes only the master brand Dr Pepper.

Table 2.7: Synthetic control weights (above 0.01), Dr Pepper (PepsiCo vertical integration) price trend

State	County	Weight
FL	JACKSON	0.06
MI	IONIA	0.045
IN	HOWARD	0.041
WI	DODGE	0.016
LA	ACADIA	0.014
MS	FORREST	0.011

This table shows the synthetic control weights for Dr Pepper price trends using the data from markets that are affected by the PepsiCo vertical integration and markets that are not affected by any vertical integrations, and data is aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes only the master brand Dr Pepper.

Table 2.8: Synthetic control weights (above 0.01), Coca-Cola trend of the number of new products

State	County	Weight
CA	SOLANO	0.195
MO	BOONE	0.179
MN	WRIGHT	0.118
OK	CLEVELAND	0.089
NC	PENDER	0.067
NH	BELKNAP	0.022
NC	LENOIR	0.018
NC	HALIFAX	0.016
OK	OKLAHOMA	0.014
NC	SURRY	0.012
AL	MADISON	0.012

This table shows the synthetic control weights for Coca-Cola trends of number of new products using data aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes only the master brand Coca-Cola.

Table 2.9: Synthetic control weights (above 0.01), Pepsi Cola trend of the number of new products

State	County	Weight
NY	WESTCHESTER	0.183
NY	PUTNAM	0.126
NC	CABARRUS	0.109
NC	LINCOLN	0.1
SC	FLORENCE	0.098
CT	WINDHAM	0.063
WA	WHATCOM	0.056
VA	SHENANDOAH	0.054
OH	LAWRENCE	0.053
SC	LAURENS	0.036
MN	OLMSTED	0.023
NC	BUNCOMBE	0.013

This table shows the synthetic control weights for Pepsi Cola trends of number of new products using data aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes only the master brand Pepsi Cola.

Table 2.10: Synthetic control weights (above 0.01), Dr Pepper (The Coca-Cola Company vertical integration) trend of the number of new products

State	County	Weight
AL	LEE	0.193
SC	CHESTERFIELD	0.071
MN	OLMSTED	0.063
VA	FAUQUIER	0.051
TX	GRAYSON	0.033
MN	GOODHUE	0.031
LA	CALCASIEU	0.025
GA	DOUGHERTY	0.016
IL	KNOX	0.015
MI	MONTCALM	0.011

This table shows the synthetic control weights for Dr Pepper trends of number of new products using the data from markets that are affected by the Coca-Cola vertical integration and markets that are not affected by any vertical integrations, and data is aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes only the master brand Dr Pepper.

Table 2.11: Synthetic control weights (above 0.01), Dr Pepper (PepsiCo vertical integration) trend of the number of new products

State	County	Weight
GA	CATOOSA	0.305
NC	LINCOLN	0.19
GA	DOUGHERTY	0.172
NC	DUPLIN	0.124
VA	ALBEMARLE	0.114
MN	OLMSTED	0.038
MN	RICE	0.03
CT	WINDHAM	0.028

This table shows the synthetic control weights for Dr Pepper trends of number of new products using the data from markets that are affected by the PepsiCo vertical integration and markets that are not affected by any vertical integrations, and data is aggregated at quarter level. It includes counties that have weights greater than 0.01. The data includes only the master brand Dr Pepper.

Table 2.12: Synthetic control method: The effect of vertical integration on log prices

	Coca-Cola	Pepsi Cola	Dr.Pepper (Coca-Cola VI)	Dr.Pepper (PepsiCo VI)
VI	-0.0068***	-0.0143***	0.0025	0.0068***
s.e.	(0.0015)	(0.0016)	(0.0022)	(0.0028)
N	12140	17323	11180	13564
R-square	0.813	0.718	0.786	0.617
adj. R-square	0.803	0.702	0.774	0.596
Month FE	Yes	Yes	Yes	Yes
Market FE	Yes	Yes	Yes	Yes
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1				

The table shows the results of synthetic control method analysis using data aggregated at quarter level. Standard errors are clustered at the county level. The data includes only the master brands Coca-Cola, Pepsi Cola, and Dr Pepper. For the Coca-Cola vertical integration, it leads to 0.68% price decrease for Coca-Cola products, and 0.25% price increase for Dr Pepper products. For the PepsiCo vertical integration, it leads to 1.43% price decrease for Pepsi Cola products, and 0.68% price increase for Dr Pepper products.

Table 2.13: Synthetic control method: The effect of vertical integration on number of new products

	Coca-Cola	Pepsi Cola	Dr.Pepper (Coca-Cola VI)	Dr.Pepper (PepsiCo VI)
VI	0.2314***	0.2731***	-0.2168***	-0.1428**
s.e.	(0.0555)	(0.0733)	(0.0427)	(0.0622)
N	16380	12820	11520	6140
R-square	0.322	0.469	0.485	0.587
adj. R-square	0.286	0.440	0.457	0.564
Month FE	Yes	Yes	Yes	Yes
Market FE	Yes	Yes	Yes	Yes
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1				

This table shows the results of synthetic control method analysis using data aggregated at quarter level. Standard errors are clustered at the county level. The data includes only the master brands Coca-Cola, Pepsi Cola, and Dr Pepper.

For the Coca-Cola vertical integration, it leads to 0.23 more new products introduced to markets that are affected by vertical integration than markets that are not affected by vertical integration every quarter. This number translates to 0.92 more new products annually. The average number of new Coca-Cola products introduced to a market annually is 8, and the vertical integration leads to 12% more new Coca-Cola products. This vertical integration leads to 0.22 fewer new Dr Pepper products introduced to markets that are affected by this vertical integration than markets that are not affected by vertical integration every quarter. This number translates to 0.88 fewer new products annually. The average number of new Dr Pepper products introduced to a market annually is 6, and the vertical integration leads to 15% fewer new Dr Pepper products.

For the PepsiCo vertical integration, it leads to 0.27 more new Pepsi Cola products introduced to markets that are affected by vertical integration than markets that are not affected by vertical integration every quarter. This number translates to 1.08 more new products annually. The average number of new Pepsi Cola products introduced to a market annually is 9, and the vertical integration leads to 12% more new Pepsi Cola products. This vertical integration leads to 0.14 fewer new Dr Pepper products introduced to markets that are affected by this vertical integration than markets that are not affected by vertical integration every quarter. This number translates to 0.56 fewer new products annually, i.e. it leads to 9% fewer new Dr Pepper products.

Table 2.14: Difference-in-difference method:
The effect of vertical integration on log prices

	Coca-Cola	Pepsi Cola	Dr.Pepper (Coca-Cola VI)	Dr.Pepper (PepsiCo VI)
VI	-0.0102***	-0.0219***	-0.0009	0.0071***
s.e.	(0.0019)	(0.0027)	(0.0026)	(0.0021)
N	2411033	2178463	738350	904907
R-square	0.967	0.958	0.962	0.961
adj. R-square	0.967	0.958	0.962	0.961
Month FE	Yes	Yes	Yes	Yes
Market FE	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1				

The table shows the results of difference-in-difference analysis using data aggregated at month level. Standard errors are clustered at the county level. The data includes only the master brands Coca-Cola, Pepsi Cola, and Dr Pepper. For the Coca-Cola vertical integration, it leads to 1.02% price decrease for Coca-Cola products, and 0.09% price decrease for Dr Pepper products. For the PepsiCo vertical integration, it leads to 2.19% price decrease for Pepsi Cola products, and 0.71% price increase for Dr Pepper products.

Table 2.15: Difference-in-difference method:
The effect of vertical integration on number of new products

	Coca-Cola	Pepsi Cola	Dr.Pepper (Coca-Cola VI)	Dr.Pepper (PepsiCo VI)
VI	0.0858***	0.0712***	-0.0671***	-0.0572***
s.e.	(0.0239)	(0.0248)	(0.0184)	(0.0183)
N	52440	52440	34560	40740
R-square	0.255	0.480	0.367	0.345
adj. R-square	0.241	0.471	0.356	0.333
Month FE	Yes	Yes	Yes	Yes
Market FE	Yes	Yes	Yes	Yes
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1				

The table shows the results of difference-in-difference analysis using data aggregated at month level. Standard errors are clustered at the county level. The data includes only the master brands Coca-Cola, Pepsi Cola, and Dr Pepper.

For the Coca-Cola vertical integration, it leads to 0.086 more new products introduced to markets that are affected by vertical integration than markets that are not affected by vertical integration every month. This number translates to 1.03 more new products annually. The average number of new Coca-Cola products introduced to a market annually is 8, and the vertical integration leads to 13% more new Coca-Cola products. This vertical integration leads to 0.067 fewer new Dr Pepper products introduced to markets that are affected by this vertical integration than markets that are not affected by vertical integration every month. This number translates to 0.80 fewer new products annually. The average number of new Dr Pepper products introduced to a market annually is 6, and the vertical integration leads to 13% fewer new Dr Pepper products.

For the PepsiCo vertical integration, it leads to 0.071 more new Pepsi Cola products introduced to markets that are affected by vertical integration than markets that are not affected by vertical integration every month. This number translates to 0.86 more new products annually. The average number of new Pepsi Cola products introduced to a market annually is 9, and the vertical integration leads to 10% more new Pepsi Cola products. This vertical integration leads to 0.057 fewer new Dr Pepper products introduced to markets that are affected by this vertical integration than markets that are not affected by vertical integration every month. This number translates to 0.68 fewer new products annually, i.e. it leads to 11% fewer new Dr Pepper products.

Table 2.16: Robustness check
Difference-in-difference method on neighboring markets:
The effect of vertical integration on log prices

	Coca-Cola	Pepsi Cola	Dr.Pepper (Coca-Cola VI)	Dr.Pepper (PepsiCo VI)
VI	-0.0060	-0.0058	0.0124*	0.0072*
s.e.	(0.0046)	(0.0064)	(0.0067)	(0.0041)
N	292842	376116	91723	136520
R-square	0.966	0.955	0.968	0.962
adj. R-square	0.966	0.955	0.967	0.962
Month FE	Yes	Yes	Yes	Yes
Market FE	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes
Robust standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

The table shows the results of difference-in-difference analysis using the subsample of neighboring markets. Data is aggregated at month level. Standard errors are clustered at the county level. The data includes only the master brands Coca-Cola, Pepsi Cola, and Dr Pepper. For the Coca-Cola vertical integration, it leads to 0.6% price decrease for Coca-Cola products, and 1.24% price increase for Dr Pepper products. For the PepsiCo vertical integration, it leads to 0.58% price decrease for Pepsi Cola products, and 0.72% price increase for Dr Pepper products.

Table 2.17: Robustness check
Difference-in-difference method on neighboring markets:
The effect of vertical integration on number of new products

	Coca-Cola	Pepsi Cola	Dr.Pepper (Coca-Cola VI)	Dr.Pepper (PepsiCo VI)
VI	0.0513	0.0878	-0.0768	-0.0771**
s.e.	(0.0544)	(0.0569)	(0.0505)	(0.0386)
N	6420	8760	4320	6240
R-square	0.225	0.481	0.382	0.362
adj. R-square	0.205	0.469	0.363	0.345
Month FE	Yes	Yes	Yes	Yes
Market FE	Yes	Yes	Yes	Yes
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1				

The table shows the results of difference-in-difference analysis using the subsample of neighboring markets. Data is aggregated at month level. Standard errors are clustered at the county level. The data includes only the master brands Coca-Cola, Pepsi Cola, and Dr Pepper.

For the Coca-Cola vertical integration, it leads to 0.051 more new products introduced to markets that are affected by vertical integration than markets that are not affected by vertical integration every month. This number translates to 0.61 more new products annually. The average number of new Coca-Cola products introduced to a market annually is 8, and the vertical integration leads to 8% more new Coca-Cola products. This vertical integration leads to 0.077 fewer new Dr Pepper products introduced to markets that are affected by this vertical integration than markets that are not affected by vertical integration every month. This number translates to 0.92 fewer new products annually. The average number of new Dr Pepper products introduced to a market annually is 6, and the vertical integration leads to 15% fewer new Dr Pepper products.

For the PepsiCo vertical integration, it leads to 0.088 more new Pepsi Cola products introduced to markets that are affected by vertical integration than markets that are not affected by vertical integration every month. This number translates to 1.06 more new products annually. The average number of new Pepsi Cola products introduced to a market annually is 9, and the vertical integration leads to 12% more new Pepsi Cola products. This vertical integration leads to 0.077 fewer new Dr Pepper products introduced to markets that are affected by this vertical integration than markets that are not affected by vertical integration every month. This number translates to 0.93 fewer new products annually, i.e. it leads to 15% fewer new Dr Pepper products.

Chapter 3

Detailed Analysis of The New Product Introduction, and The Policy Implications

3.1 Introduction

In chapter one and chapter two, I study the effects of vertical integration. Specifically, I quantify how the vertical integration affects the prices and the new product introduction process for the vertically integrated company, and how the vertical integration affects the prices and the new product introduction process for the competitor of the vertically integrated company. Results show that vertical integration leads to the lower price and more new products for the vertically integrated company, and leads to higher price and fewer new products for the competitor of the vertically integrated company.

In this chapter, I study more about these new products and about how vertical integration affects new product introduction. First, I find out the new characteristics in each new product. For all new products introduced before vertical integration, I draw the distribution of the new characteristics, and I do the same for all new products introduced after vertical

integration. I then study how vertical integration affects the distribution of new characteristics. Second, I further document the market presence of new products, and summarize interesting stylized facts in new products' market presence. Third, I study the new product roll-out process before and after vertical integration.

Lastly, I discuss the policy implications of the results in these chapters. These results on the effects of vertical integration have important policy implications. The effect of vertical integration on new product introduction has not drawn much attention in vertical merger reviews and evaluations. The results of this research show that the effect of vertical integration on new product introduction should be emphasized in anti-trust policies and their enforcement. This policy implication is very important, especially when many recent high-profile merger cases are vertical integrations, such as the AT&T and Time Warner merger. And recent development of anti-trust policies echoes the results of this research.

3.2 New characteristics in new products

As discussed in the data section, products are defined as the unique combination of brand-flavor-calorie level-container type-size-multiple in a unit of product. Calorie level are either regular or diet. Size refers to the size of a single container, such as 12 fluid ounce. Multiple in a unit of product refers to how many single containers are there in one single unit of product, such as 12 cans. For example, a product is: Coca-Cola Coke (Brand) - Cola (Flavor) - Regular (Calorie level) - Aluminum Can (Container type) - 12 fluid ounce (Size) - 12 (Multiple in a unit of product). This product is a case of 12 can 12 fluid ounces Coca-Cola Coke.

The order of these six product characteristics is important: going from brand down to multiple, the characteristic becomes less innovative. The following is a simple example which illustrates the importance of this order. Consider one new product A and two existing products B and C. Among the six product characteristics, A differs from B in Size and in

Multiple, and A differs from C in Flavor. Then, the new characteristics in product A are Size and Multiple. This example shows that, first, which characteristics are new in a new product is determined by the order of these six product characteristics that are used to define a product, and second, there might be more than one new characteristics in a new product.

I recognize the importance of this order and utilize it to find out the new characteristics in a new product. For the new products of all the carbonated soft-drink master brands of the Coca-Cola Company, I find out the new characteristics in each new product, and for all the new products that are introduced before vertical integration, I plot the distribution of new characteristics; for all the new products that are introduced after vertical integration, I also plot the distribution of new characteristics. The distributions are shown in Figure 3.1. I do the same analysis for the new products of all the carbonated soft-drink master brands of PepsiCo, and the distributions are shown in Figure 3.2.

As shown in Figure 3.1, for the new products of The Coca-Cola Company, after vertical integration, the distribution of new characteristics in new products shifts from container type, size and multiple to brand, flavor and calorie level, which means the new characteristic shifts from less innovative to more innovative characteristics, i.e. new products introduced after vertical integration are more innovative. As discussed in the industry background, upstream company produces concentrate and syrup, and the changes in brand and flavor require changes in concentrate and syrup and are more innovative. As a result, the introduction of these changes may require market testing, promotion and marketing campaign, etc. This involves negotiation and signing new contracts before vertical integration, and after vertical integration, this process is much easier. On the other hand, the changes in characteristics such as size and multiple happen at downstream bottler level, and such changes are easier than changes in characteristics such as brand and flavor. Vertical integration also makes these changes easier, but to an extent less than that in brand, flavor and calorie level. Therefore, after vertical integration, in the distribution of new characteristics, there is a shift from less innovative characteristics to more innovative characteristics. This is consistent with

the theoretical predictions that vertical integration makes new product introduction easier for the vertically integrated company.

For the new products of PepsiCo, there is a similar pattern to that for the new products of The Coca-Cola Company. As shown in Figure 3.2, after vertical integration, the distribution of new characteristics in new products shifts from container type and multiple to brand and calorie level, that means the new characteristics shift from less innovative to more innovative characteristics, i.e. new products introduced after vertical integration are more innovative. This is consistent with the theoretical predictions that vertical integration makes new product introduction easier for the vertically integrated company.

Furthermore, I study the new products of three master brands, Coca-Cola, Pepsi Cola and Dr Pepper to show the effects of vertical integration on the competitor. The results are shown in Figure 3.3-3.5. These figures are different from Figure 3.1 and 3.2. Figure 3.1 and 3.2 use data from all the carbonated soft-drink master brands of The Coca-Cola Company and PepsiCo, whereas Figure 3.3-3.5 use data from only three master brands, Coca-Cola, Pepsi Cola and Dr Pepper. For the new characteristics distribution of Coca-Cola and Pepsi Cola new products, the results are similar to that of the Coca-Cola Company and PepsiCo new products. For Dr Pepper, to be more conservative, I consider all new products introduced after the Coca-Cola vertical integration (i.e. October 2010) as "after vertical integration", and consider all new products introduced before the Coca-Cola vertical integration as "before vertical integration". In this way, the new products introduced between the PepsiCo vertical integration (February 2010) and the Coca-Cola vertical integration (October 2010) is treated as "before vertical integration". As shown in Figure 3.5, after vertical integration, the distribution of new characteristics in new products shifts from brand and flavor to container type, size and multiple, which means the new characteristic shifts from more innovative to less innovative characteristics, i.e. new products introduced after vertical integration are less innovative. As discussed in the industry background, after the vertical integration, the integrated companies, i.e. The Coca-Cola Company and PepsiCo, control the downstream

of Dr Pepper, and they have incentive to impede the new product introduction process for Dr Pepper, especially the new products that are more innovative. Therefore, new Dr Pepper products introduced after vertical integration are less innovative. The result is similar if February 2010 is used as time of vertical integration instead of October 2010.

3.3 Market presence of products

In addition to the distribution of new characteristics in new products, I also study how the vertical integration affects the market presence of products. I study all the new products of the Coca-Cola Company and PepsiCo, i.e. including all the carbonated soft-drink master brands of the Coca-Cola Company and PepsiCo, such as Coca-Cola, Seagram's, Pepsi Cola, and Mountain Dew, etc.

To do this, for each new product in each time period, I document which markets have the product, and count the total number of such markets. Among the markets that have the product, I count the number of markets that are affected by vertical integration and the number of markets that are not affected by vertical integration. As a result, I know three statistics for each product in each month: the number of markets that have this product, how many of these markets are affected by vertical integration, and how many of these markets are not affected by vertical integration. I plot the market presence curve over time for each new product and see how vertical integration affects the market presence.

As an example, Figure 3.6 shows the market presence of a product from The Coca-Cola Company: the brand is Fresca, the flavor is orange/citrus caffeine free ("ORG CITR CF"), the product is diet drink (DT) in plastic bottle (NBP), with size of 67.6 fl oz and 1 bottle package. Horizontal axis is month, and vertical axis is the number of markets. The red vertical line represents the time of vertical integration. The three statistics for the product are plotted in the graph: the number of markets that have this product, how many of these markets are affected by vertical integration, and how many of these markets are not affected

by vertical integration.

I plot such graphs for all products in the data. I have three observations from these market presence curves. First, many new products are introduced right after vertical integration, and furthermore, they are introduced to markets that are vertically integrated. For example, for The Coca-Cola Company, three new products are introduced in the three-month period right before the vertical integration, and seven new products are introduced in the three-month period right after the vertical integration; for PepsiCo, five new products are introduced in the three-month period right before the vertical integration, and fifteen new products are introduced in the three-month period right after the vertical integration. This is consistent with that vertical integration eliminates the costly and time-consuming negotiation process and thus makes new product introduction much more easier. Second, some products that already existed on some markets at the time of vertical integration existed on more markets right after vertical integration, and this increase in market presence is driven by markets that are vertically integrated: more markets that are vertically integrated started to carry these products right after vertical integration. This observation is consistent with that vertical integration makes new product introduction much more easier and product offering more flexible. Third, some products that already existed on some markets at the time of vertical integration existed on many more markets starting at some time point after vertical integration, and this increase in market presence is driven by markets that are vertically integrated: more markets that are vertically integrated started to carry these products at some time point after vertical integration. This observation shows that the effect of vertical integration is long-lasting, rather than short-term and just right after vertical integration.

3.4 Roll-out process

For a new product, I know the market presence of this product in each month, and this allows me to draw a map that shows the market presence in each month. I study all the new

products of The Coca-Cola Company and PepsiCo, i.e. including all the carbonated soft-drink master brands of The Coca-Cola Company and PepsiCo, such as Coca-Cola, Seagram's, Pepsi Cola, and Mountain Dew, etc. I draw such maps for each new product in each month, and I present two typical products as examples: one product introduced before vertical integration and one product introduced after vertical integration.

The new product introduced before vertical integrations is a product from The Coca-Cola Company: the brand is Fresca, the flavor is orange/citrus caffeine free ("ORG CITR CF"), the product is diet drink (DT) in plastic bottle (NBP), with size of 67.6 fl oz and 1 bottle package. The new characteristic in this new product is flavor. As shown in Figure 3.6, the product started on both markets that are affected by vertical integration and markets that are not affected by vertical integration. The product rolled out gradually. Figure 3.7 shows the geographical presence of this new product. In June 2008, the product first appeared in Birmingham, AL, and two months later, the product rolled out to other nearby markets in Alabama. In May and June 2019, the product appeared in Pennsylvania, New Jersey, and Florida, and then gradually rolled out to other states. Around September 2010, the product roll-out process almost finished. The whole roll-out process takes about two years, and the roll-out happened slowly and happened on both markets that are and are not affected by vertical integration. Geographically, the roll-out process started in a few markets that are clustered together, and the roll-out to other parts of the country is slow.

As another example, the new product introduced after vertical integration is a product from The Coca-Cola Company: the brand is Seagram's, the flavor is a complicated lemon caffeine free flavor ("SK S-M KY LM CF"), the product is diet drink (DT) in aluminum can (CN), with size of 12 fl oz and 12 cans in one package. The new characteristic in this new product is flavor. As shown in Figure 3.8, the product started mainly on markets that are affected by vertical integrations. The product rolled out quickly. Figure 3.9 shows the geographical presence of this new product. In January 2012, the product first appeared simultaneously in several markets, including California, Oregon, Washington, Nevada, Arizona,

Texas and Illinois. Around June/July 2012, the product roll-out process almost finished. The whole roll-out process takes about half year, and the roll-out happened very fast and this is driven by the fast roll-out on markets that are affected by vertical integration. Geographically, the roll-out process started in many markets in many states, and the roll-out to other parts of the country is fast.

These two examples show the difference in new product roll-out process before and after vertical integration. Before vertical integration, new products are introduced to markets that are and are not affected by vertical integrations, and this also shows that these two types of markets are similar, if not the same, before vertical integration, and the roll-out happened slowly and happened on both markets that are and are not affected by vertical integration. After vertical integration, new products are introduced mainly to markets that are affected by vertical integration, and the roll-out happened very fast and this is driven by the fast roll-out on markets that are affected by vertical integration. This observation is consistent with the prediction: vertical integration makes new product introduction easier. Without the costly and time-consuming negotiations, the new product can roll out really fast.

Furthermore, in Figure 3.10 and Figure 3.11, I show the roll-out process of all new products of The Coca-Cola Company and PepsiCo. Figure 3.10 shows the roll-out process for all new products of The Coca-Cola Company. During the roll-out process of a new product, when the number of markets that have this new product reaches, for example, 10% of the 874 markets in the sample (88 markets) for the first time, I calculate how many of these 88 markets are vertically integrated markets and calculate the percentage of vertically integrated markets, i.e. VI market presence as percentage of total market presence. I do this for the percentages from 0% to 50%, with an increment of 10%, of the 874 markets. (A new product always reaches 0% of the 874 markets *when* the product is introduced.) I do this for all new products of The Coca-Cola Company that are introduced before the vertical integration, and calculate the average of VI market percentage *when* they are introduced (0%). I further calculate the average of VI market percentage when they roll out to 10% of

total markets, etc. The results are shown in blue in the graph. I do the same for all new products of The Coca-Cola Company that are introduced after the vertical integration. The results are shown in orange in the graph.

Among the 874 markets in the sample, 596 markets are vertically integrated, i.e. 68% of the markets are vertically integrated (red horizontal line in the graph). As shown in the graph, before vertical integration, *when* the products are introduced to markets (blue bar at 0%), about 61% of these are the markets are affected by the vertical integration. As the new products rolling out to more and more markets, the percentage goes up and converges to 68%. After vertical integration, *when* the products are introduced to markets (orange bar at 0%), about 84% of these are the markets are affected by the vertical integration. As the new products rolling out to more and more markets, the percentage goes down and converges to 68%. This shows that after vertical integration, new products are introduced to more vertically integrated markets at the early stage of roll-out, and as the new products rolling out to more and more markets, they exist evenly on both vertically integrated and non vertically integrated markets.

Similarly, Figure 3.11 shows the roll-out process for all new products of PepsiCo. Among the 874 markets in the sample, 604 markets are vertically integrated, i.e. 69% of the markets are vertically integrated (red horizontal line in the graph). As shown in the graph, before vertical integration, *when* the products are introduced to markets (blue bar at 0%), about 60% of these are the markets are affected by the vertical integration. As the new products rolling out to more and more markets, the percentage goes up and converges to 69%. After vertical integration, *when* the products are introduced to markets (orange bar at 0%), about 87% of these are the markets are affected by the vertical integration. As the new products rolling out to more and more markets, the percentage goes down but still remains high, around 80%. (It actually converges to 69% when the products are rolling out to 85%-95% of the 874 markets.) This shows that after vertical integration, new products are introduced to more vertically integrated markets during the roll-out process, and as the new products

rolling out to most of the markets (85% -95%), they exist evenly on both vertically integrated and non vertically integrated markets.

3.5 Policy implications

Vertical integration does not only have effects on own price (and possible foreclosure effect on competitors), but also have effects on new product introduction and on the flexibility of product offering. Vertical integration makes new product introduction easier for the vertically integrated company, and as shown in chapter one, more new products are introduced to markets, the new products introduced after vertical integration are more innovative and the roll-out process is faster. And yet, at the same time, vertical integration makes new product introduction more difficult for the vertically integrated company's competitor, and as shown in chapter two, fewer new products are introduced to markets, and the new products introduced after vertical integration are less innovative. In anti-trust policy and its enforcement, the focuses have generally been the price effect and the possible foreclosure, and the effect of vertical integration on new product introduction has not drawn much attention in vertical merger reviews and evaluations. It should be taken into account for vertical merger reviews and in anti-trust policies.

This perspective and results of this research can be applied to several recent high-profile vertical integrations. For example, the merger between AT&T and Time Warner is a vertical merger in essence. The Time Warner is content provider and is upstream company, and the content is carried and broad-casted by AT&T's network and AT&T is downstream company. After the vertical integration, new TV programs and TV shows from Time Warner can be tested and introduced more easily, and yet for other content providers, new TV programs and TV shows would be more difficult to be introduced through AT&T's network. More generally, there is a wave of vertical integrations in entertainment industry, and after these mergers, more new TV shows are broad-casted. This suggest that the effect on the vertically

integrated company dominates the effect on the vertically integrated company's competitor. The effect of vertical integration on new product introduction should also be considered in anti-trust policies and their enforcement.

Latest development in the anti-trust policies echoes the results in this research. As a first example, Department of Justice and Federal Trade Commission released a draft of Vertical Merger Guidelines on January 10, 2020, and in this draft, it is emphasized that *A single [vertically integrated] firm ... may be able to streamline production, inventory management, or distribution, or create innovative products in ways that would have been hard to achieve though arms length contracts.* As a second example, in the movie industry, the Paramount Consent Decrees of 1948 prohibit vertical mergers between upstream movie studios and downstream movie theaters. In November 2019, Department of Justice filed motion to terminate the decrees, and Assistant AG Makan Delrahim of the DOJ Antitrust Division says that *"These decrees ... may actually harm American consumers by standing in the way of innovative business models for the exhibition of America's great creative films."* The recent development in the anti-trust policies echoes the results of the vertical integration's effects on the vertically integrated company. Furthermore, the possible anticompetitive effects on the competitor should also be taken into account.

3.6 Conclusion

In this chapter, I study the new products in detail, and discuss the policy implications of the research results. I study the new characteristics in new products, the market presence of new products and the new product roll-out process. For the new products of the vertically integrate company, after vertical integration, the distribution of new characteristics in new products shifts from less innovative characteristics such as size and multiple to more innovative characteristics such as brand and flavor. The new products introduced after vertical integration are more innovative, i.e. the new characteristics in new products are the

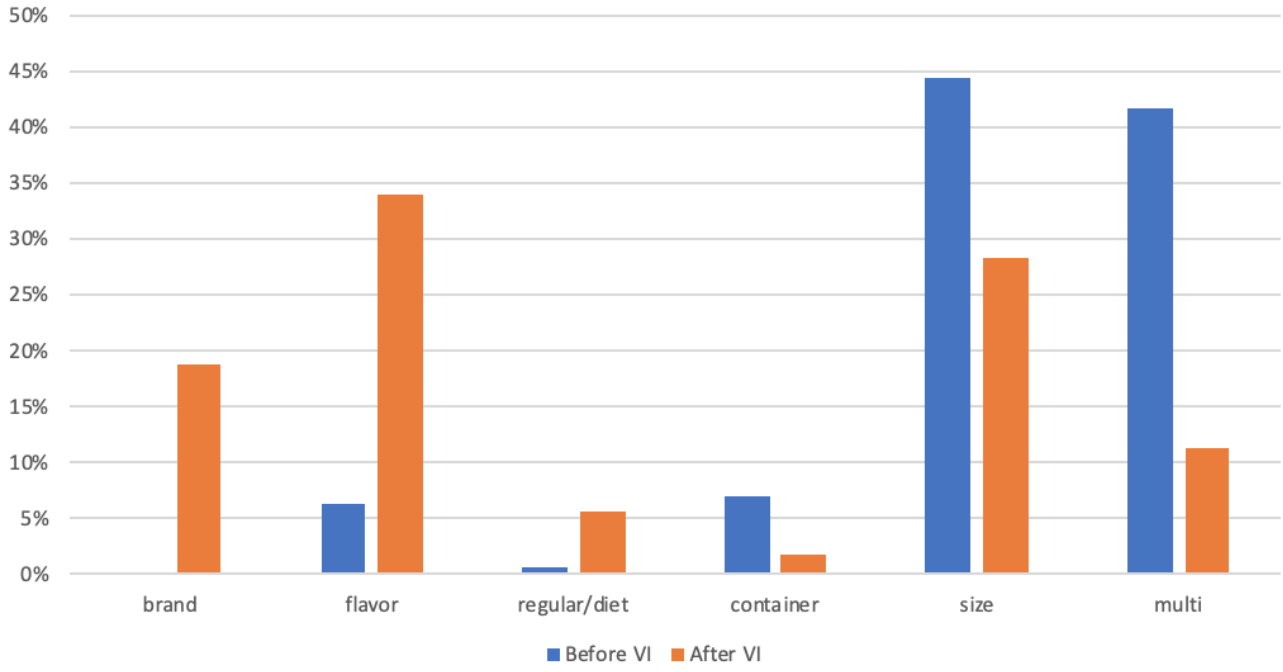
characteristics that are more innovative. For the new products of the vertically integrated company's competitor, after vertical integration, the distribution of new characteristics in new products shifts from more innovative characteristics such as brand and flavor to less innovative characteristics such as size and multiple. The new products introduced after vertical integration are less innovative, i.e. the new characteristics in new products are the characteristics that are less innovative. This is consistent with that vertical integration makes new product introduction more easier for the vertically integrated company and more innovative products can be tested and introduced to markets more easily, and yet it makes new product introduction more difficult for the vertically integrated company's competitor and fewer innovative products can be tested and introduced to markets.

Furthermore, for the new products of the vertically integrated company, the analysis of products' market presence shows that many new products are introduced right after vertical integration, and for many products that existed on some markets at the time of vertical integration, many more markets started to carry these products after vertical integration, and this happens not only right after vertical integration, but can also happen at some time after vertical integration, i.e. the effect of vertical integration is long-lasting. All these market presence changes are driven by markets that are vertically integrated. Lastly, the new product can roll-out very fast after vertical integration and this is driven by the fast roll-out on markets that are vertically integrated.

These results on the effects of vertical integration have important policy implications. Vertical integration leads to price decrease for products of the vertically integrated company, but leads to price increase for products of the vertically integrated company's competitor. More importantly, vertical integration makes new product introduction more easy and leads to product proliferation for the vertically integrated company and makes it more difficult for the vertically integrated company's competitor. This effect of vertical integration on new product introduction has not drawn much attention in vertical merger reviews and evaluations. The results of this paper show that the effect of vertical integration on new

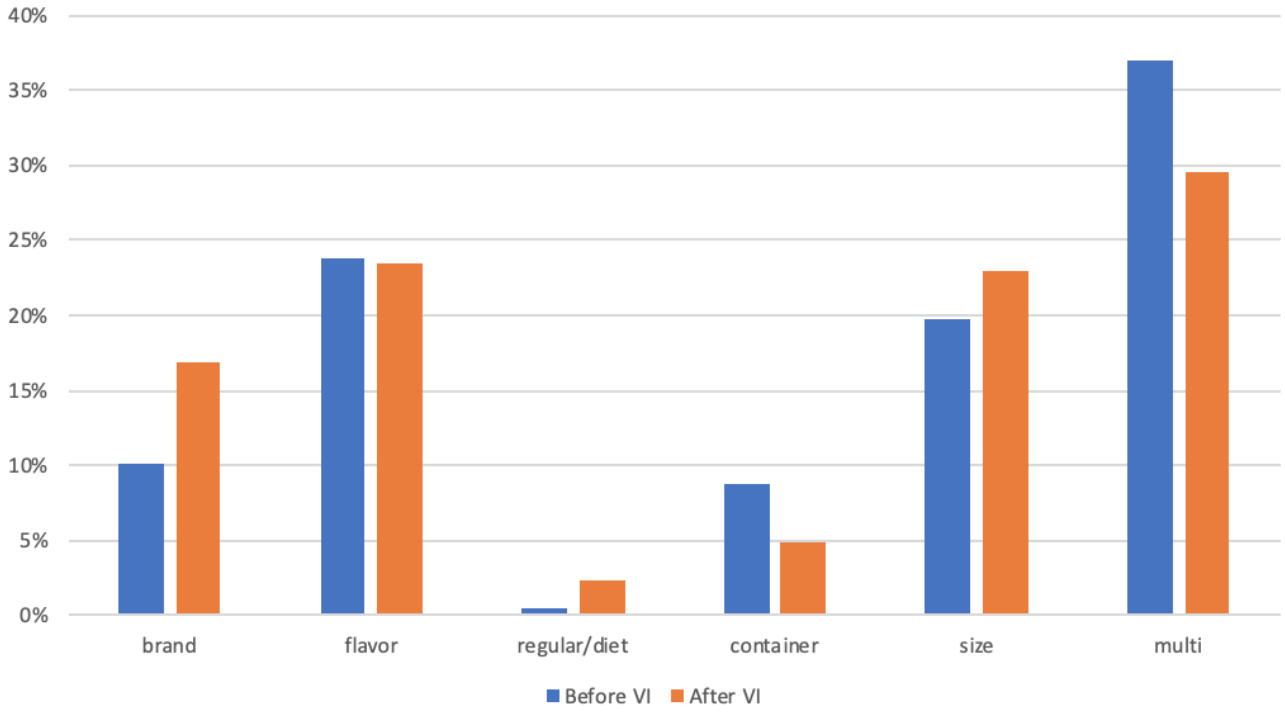
product introduction should be emphasized in anti-trust policies and their enforcement. And recent development of anti-trust policies echoes the results of this research.

Figure 3.1: Distribution of new characteristics in new products: The Coca-Cola Company



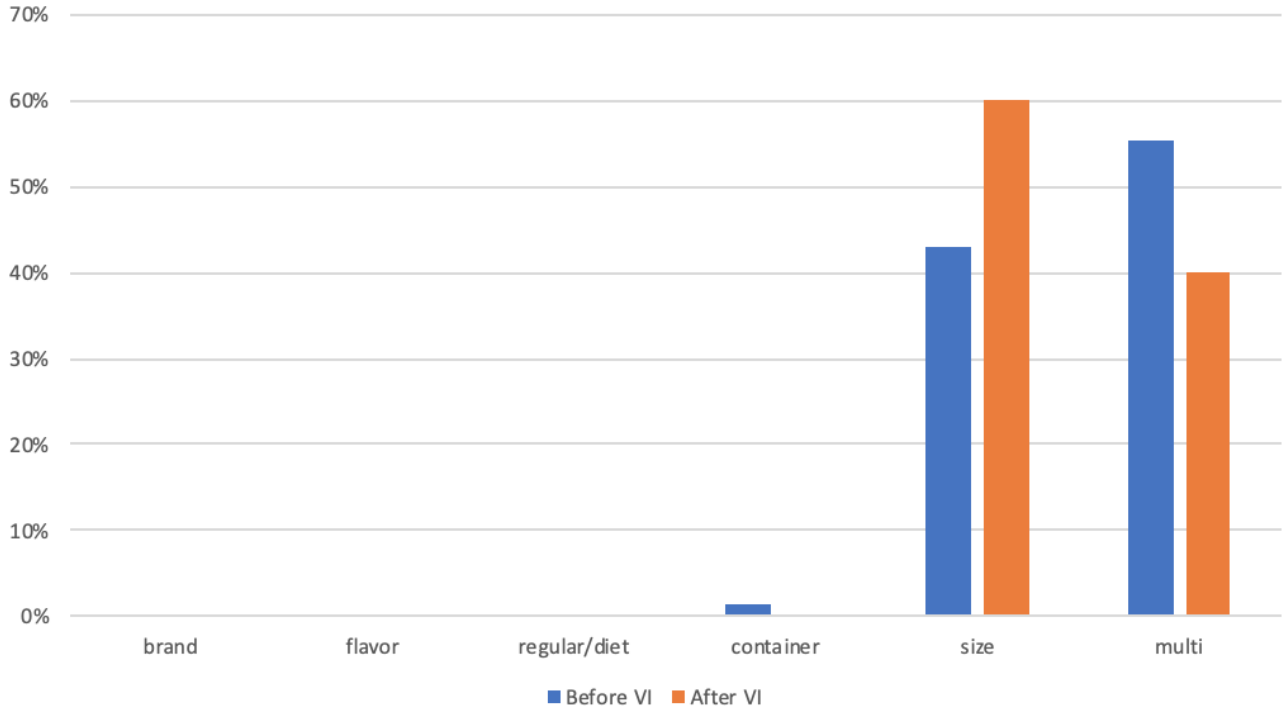
This graph shows the distribution of new characteristics in new products of the Coca-Cola Company. The data includes all carbonated soft drink master brands of The Coca-Cola Company, such as Coca-Cola, Seagram's, etc. Specifically, for each new product, I find the new characteristic(s) in the new product. For all the new products of The Coca-Cola Company that are introduced before vertical integration, I count the number of each characteristic, and the distribution of six characteristics is shown in blue bars. For all the new products of The Coca-Cola Company that are introduced after vertical integration, I count the number of each characteristic, and the distribution of six characteristics is shown in orange bars. For the six product characteristics, going from brand down to multiple, the characteristic becomes less innovative. After vertical integration, the distribution of new characteristics in new products shifts from container type, size and multiple to brand, flavor and calorie level, which means the new characteristics shift from less innovative to more innovative characteristics, i.e. new products introduced after vertical integration are more innovative.

Figure 3.2: Distribution of new characteristics in new products: PepsiCo



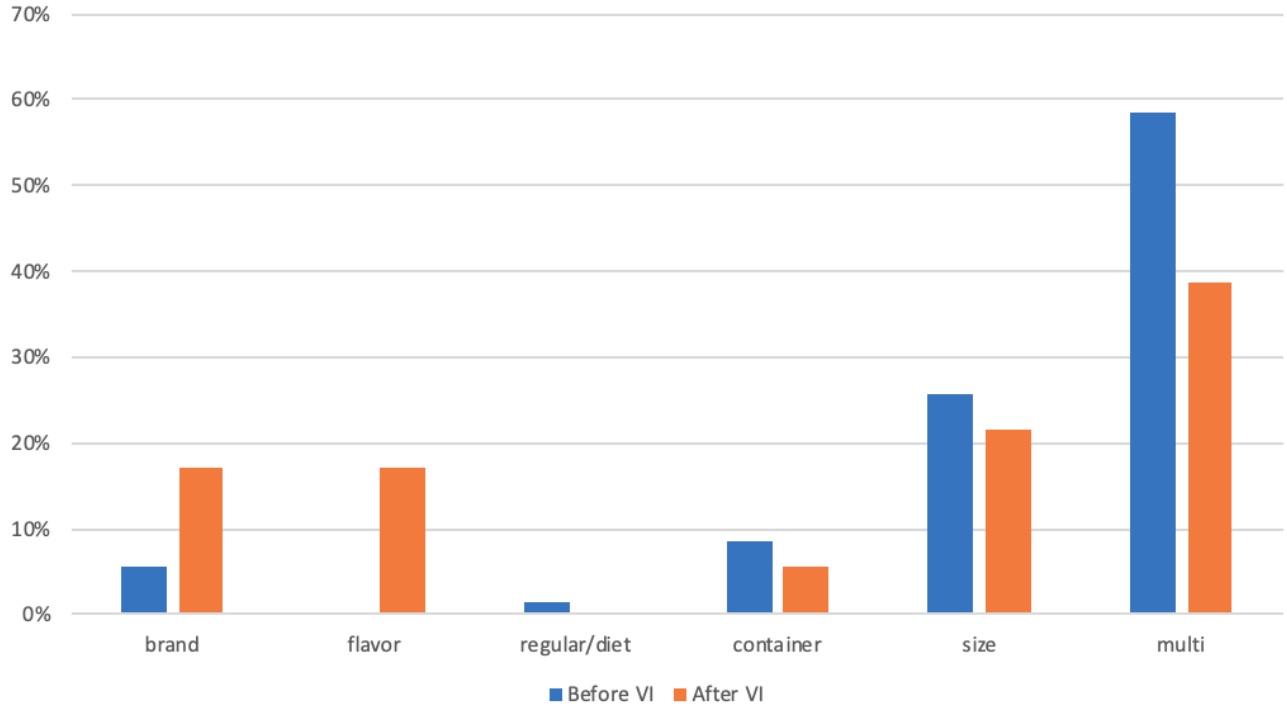
This graph shows the distribution of new characteristics in new products of the PepsiCo. The data includes all carbonated soft drink master brands of PepsiCo, such as Pepsi Cola, Mountain Dew, etc. Specifically, for each new product, I find the new characteristic(s) in the new product. For all the new products of the PepsiCo that are introduced before vertical integration, I count the number of each characteristic, and the distribution of six characteristics is shown in blue bars. For all the new products of the PepsiCo that are introduced after vertical integration, I count the number of each characteristic, and the distribution of six characteristics is shown in orange bars. For the six product characteristics, going from brand down to multiple, the characteristic becomes less innovative. After vertical integration, the distribution of new characteristics in new products shifts from container type and multiple to brand and calorie level, which means the new characteristics shift from less innovative to more innovative characteristics, i.e. new products introduced after vertical integration are more innovative.

Figure 3.3: Distribution of new characteristics in new products: Coca-Cola



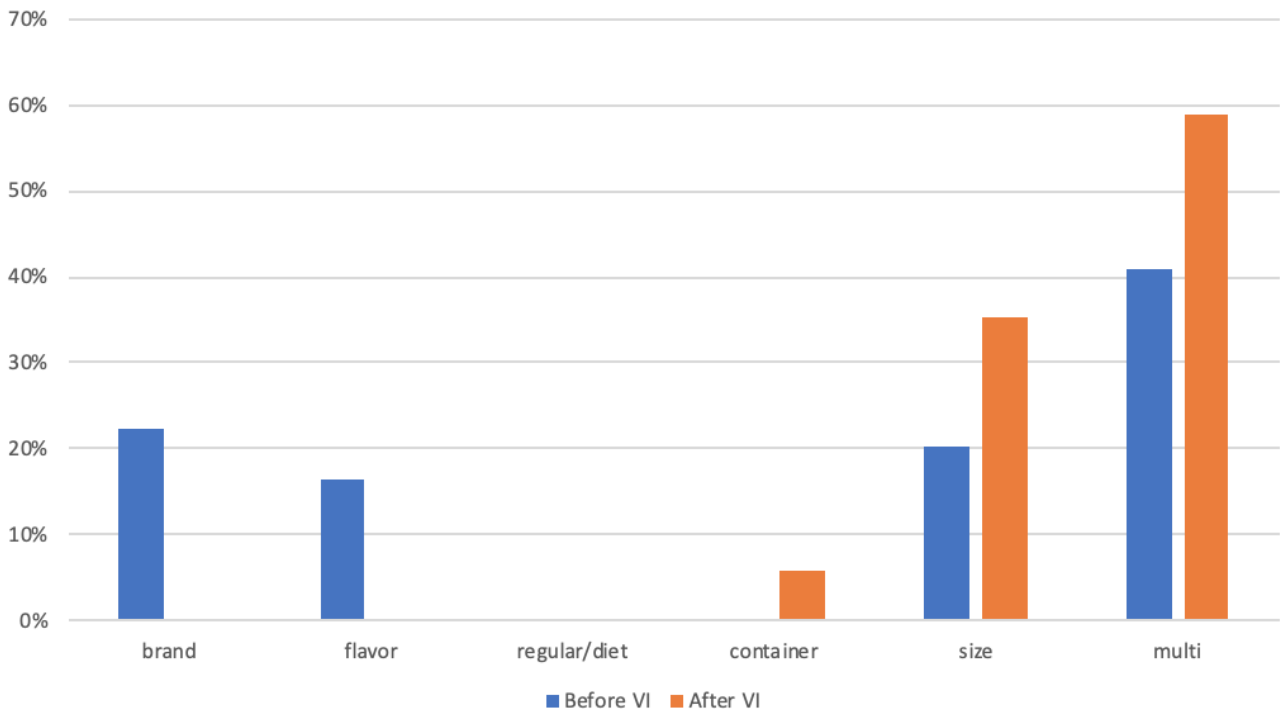
This graph shows the distribution of new characteristics in new Coca-Cola products. The data includes only the master brand Coca-Cola. Specifically, for each new product, I find the new characteristic(s) in the new product. For all the new Coca-Cola products that are introduced before vertical integration, I count the number of each characteristic, and the distribution of six characteristics is shown in blue bars. For all the new Coca-Cola products that are introduced after vertical integration, I count the number of each characteristic, and the distribution of six characteristics is shown in orange bars. For the six product characteristics, going from brand down to multiple, the characteristic becomes less innovative. After vertical integration, the distribution of new characteristics in new products shifts from multiple to size, which means the new characteristics shift from less innovative to more innovative characteristics, i.e. new products introduced after vertical integration are more innovative.

Figure 3.4: Distribution of new characteristics in new products: Pepsi Cola



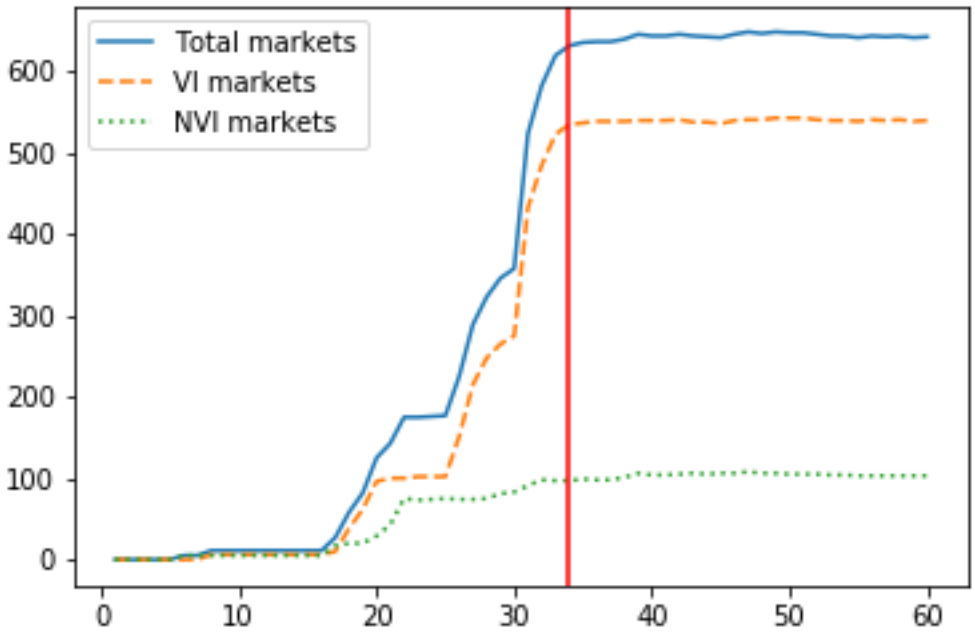
This graph shows the distribution of new characteristics in new Pepsi Cola products. The data includes only the master brand Pepsi Cola. Specifically, for each new product, I find the new characteristic(s) in the new product. For all the new Pepsi Cola products that are introduced before vertical integration, I count the number of each characteristic, and the distribution of six characteristics is shown in blue bars. For all the new Pepsi Cola products that are introduced after vertical integration, I count the number of each characteristic, and the distribution of six characteristics is shown in orange bars. For the six product characteristics, going from brand down to multiple, the characteristic becomes less innovative. After vertical integration, the distribution of new characteristics in new products shifts from container type, size and multiple to brand and flavor, which means the new characteristics shift from less innovative to more innovative characteristics, i.e. new products introduced after vertical integration are more innovative.

Figure 3.5: Distribution of new characteristics in new products: Dr Pepper



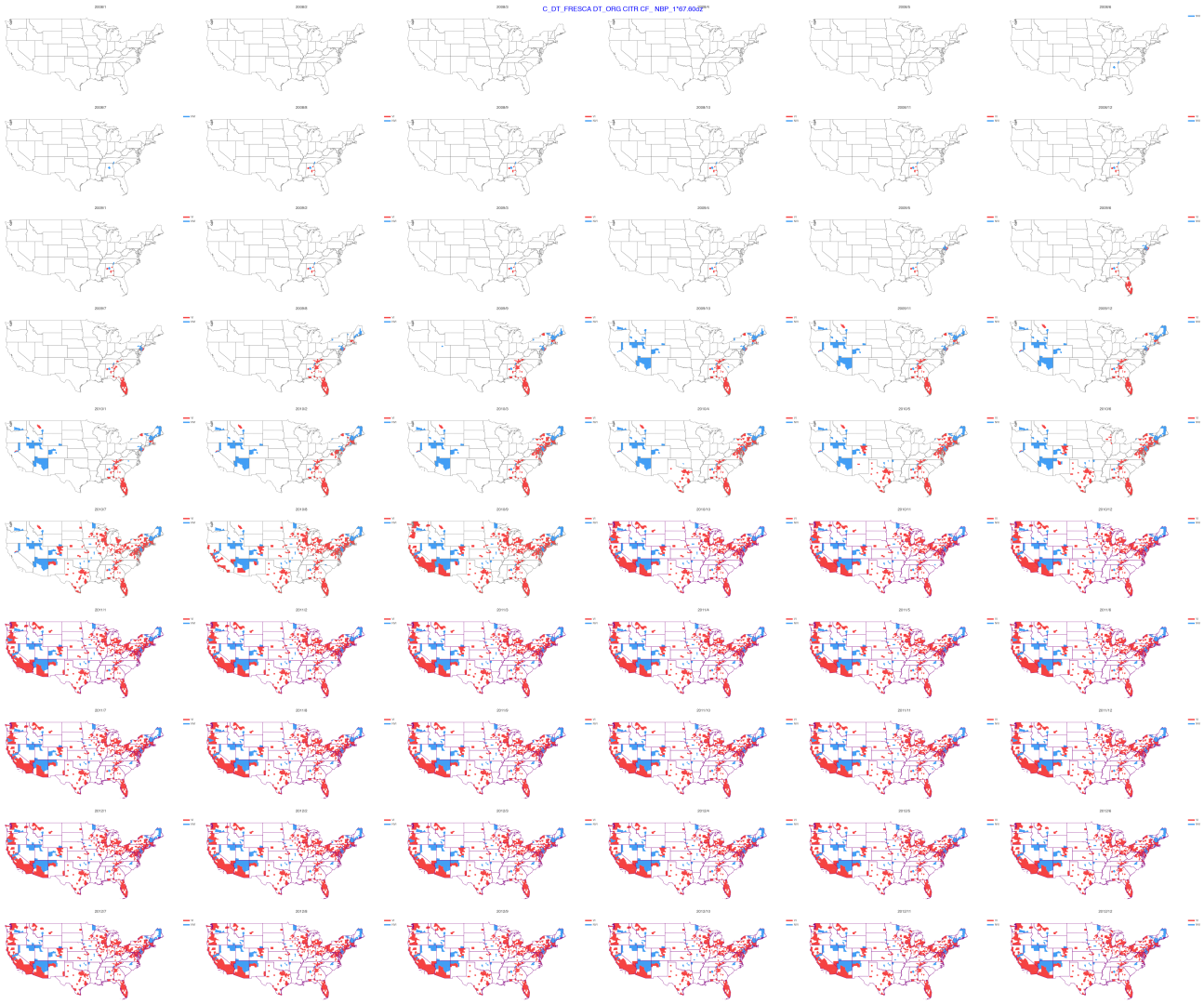
This graph shows the distribution of new characteristics in new Dr Pepper products. The data includes only the master brand Dr Pepper. Specifically, for each new product, I find the new characteristic(s) in the new product. For all the new Dr Pepper products that are introduced before the Coca-Cola vertical integration (October 2010), I count the number of each characteristic, and the distribution of six characteristics is shown in blue bars. For all the new Dr Pepper products that are introduced after the Coca-Cola vertical integration (October 2010), I count the number of each characteristic, and the distribution of six characteristics is shown in orange bars. For the six product characteristics, going from brand down to multiple, the characteristic becomes less innovative. After vertical integration, the distribution of new characteristics in new products shifts from brand and flavor to container type, size and multiple, which means the new characteristics shift from more innovative to less innovative characteristics, i.e. new products introduced after vertical integration are less innovative. The distribution is similar if February 2010 (the PepsiCo vertical integration) is used as time of vertical integration instead of October 2010.

Figure 3.6: Market presence of a sample new product that is introduced before vertical integration



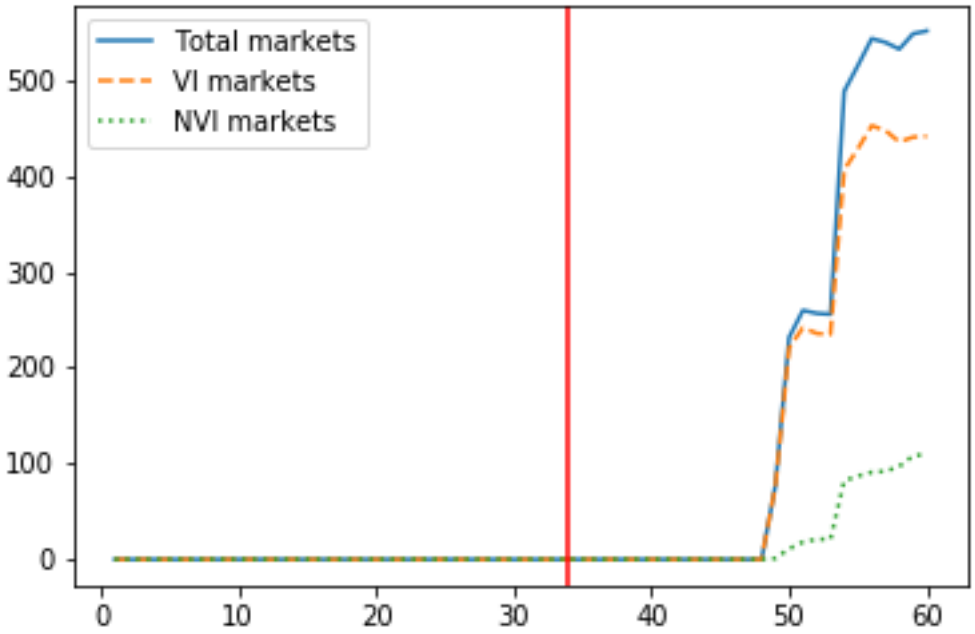
This product is The Coca-Cola Company's Fresca brand ("FRESCA") orange citrus caffeine free flavor ("ORG CITR CF") diet drink ("DT") in non-reusable plastic bottle ("NBP") with size of 67.60 fl oz and 1 bottle per package. The new characteristic is flavor. Horizontal axis is month, vertical axis is the number of markets. The red vertical line represents the time of vertical integration. The solid blue curve shows the total number of markets that have this product in each month; the dashed orange curve shows the number of markets that are affected by vertical integration and that have this product in each month; and the dashed green curve shows the number of markets that are not affected by vertical integration and that have this product in each month.

Figure 3.7: Roll-out process of the sample new product in Figure 3.6 that is introduced before vertical integration.



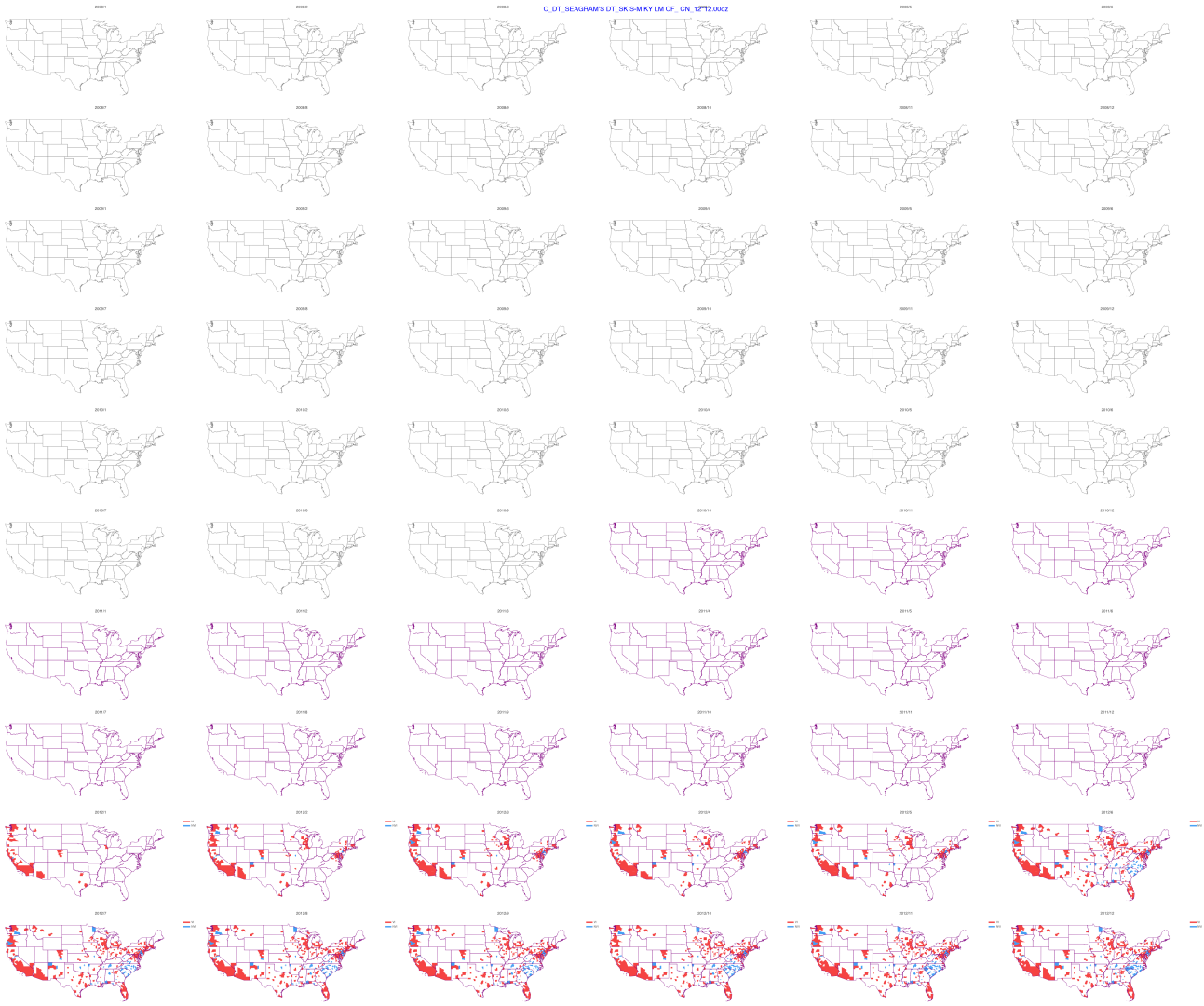
60 maps represent 60 months: first row is 2008/01-2008/06, and second row is 2008/07-2008/12, etc. In each month, markets that have this product are shown in color. For a market that has the product, it is shown in red if it is affected by the vertical integration in 2010/10; it is shown in blue if it is not affected by the vertical integration in 2010/10. Maps with gray state lines are before the vertical integration, and maps with purple state lines are after the vertical integration. The new product was introduced before vertical integration on both markets that are and are not affected by vertical integration. The product rolled out gradually. In 2008/06, the product first appeared in Birmingham, AL, and two months later, the products rolled out to other nearby markets in Alabama. In May/June 2019, the product appeared in Pennsylvania, New Jersey, and Florida, and then gradually rolled out to other states. Around 2010/09, the product roll-out process almost finished. The whole roll-out process takes about two years, and the roll-out happened slowly and happened on both markets that are and are not affected by vertical integration. Geographically, the roll-out process started in a few markets that are clustered together, and the roll-out to other parts of the country is slow.

Figure 3.8: Market presence of a sample new product that is introduced after vertical integration



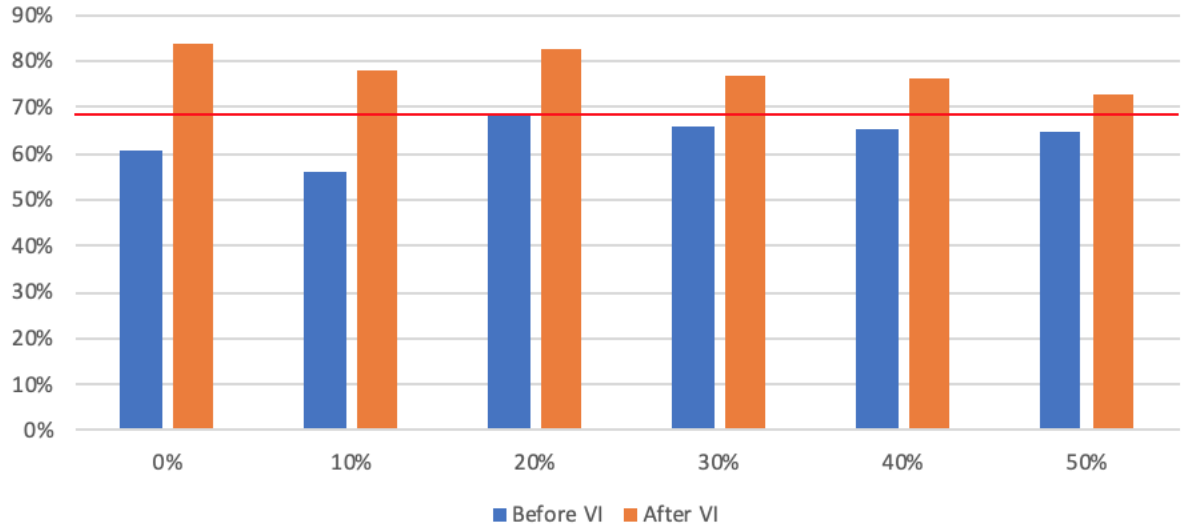
This product is The Coca-Cola Company's Seagram's brand ("SEAGRAM'S") diet drink ("DT") with a complicated lemon caffeine free flavor ("SK S-M KY LM CF") in aluminum cans ("CN") with size of 12 fl oz and 12 cans per package. The new characteristic is flavor. Horizontal axis is month, vertical axis is the number of markets. The red vertical line represents the time of vertical integration. The solid blue curve shows the total number of markets that have this product in each month; the dashed orange curve shows the number of markets that are affected by vertical integration and that have this product in each month; and the dashed green curve shows the number of markets that are not affected by vertical integration and that have this product in each month.

Figure 3.9: Roll-out process of the sample new product in Figure 3.8 that is introduced after vertical integration.



60 maps represent 60 months: first row is 2008/01-2008/06, and second row is 2008/07-2008/12, etc. In each month, markets that have this product are shown in color. For a market that has the product, it is shown in red if it is affected by the vertical integration in 2010/10; it is shown in blue if it is not affected by the vertical integration in 2010/10. Maps with gray state lines are before the vertical integration, and maps with purple state lines are after the vertical integration. The new product was introduced after vertical integration, and the product started mainly on markets that are affected by vertical integration. The product rolled out quickly. In 2012/01, the product first appeared simultaneously in several markets, including California, Oregon, Washington, Nevada, Arizona, Texas and Illinois. Around June/July 2012, the product roll-out process almost finished. The whole roll-out process takes about half year, and the roll-out happened very fast and this is driven by the fast roll-out on markets that are affected by vertical integration. Geographically, the roll-out process started in many markets in many states, and the roll-out to other parts of the country is fast.

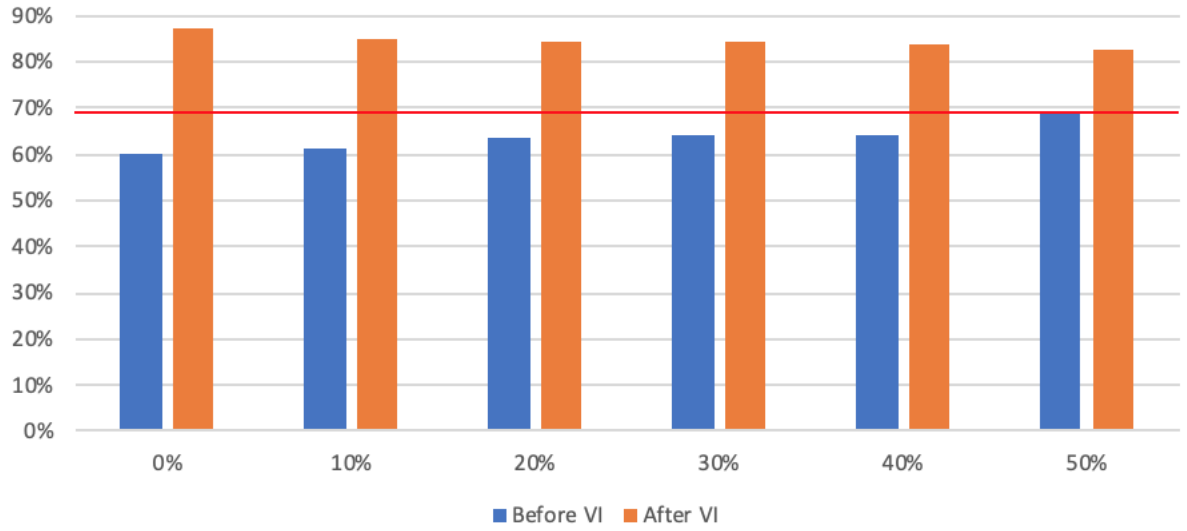
Figure 3.10: New products roll-out, and VI market presence as percentage of total market presence: The Coca-Cola Company



This graph shows the roll-out process for all new products of the Coca-Cola Company. The data includes all carbonated soft drink master brands of The Coca-Cola Company, such as Coca-Cola, Seagram's, etc. During the roll-out process of a new product, when the number of markets that have this new product reaches, for example, 10% of the 874 markets in the sample (88 markets) for the first time, I calculate how many of these 88 markets are VI markets and calculate the percentage of VI markets, i.e. VI market presence as percentage of total market presence. I do this for the percentages from 0% to 50%, with an increment of 10%, of the 874 markets. (A new product always reaches 0% of the 874 markets *when* the product is introduced.) I do this for all new products of The Coca-Cola Company that are introduced before the vertical integration, and calculate the average of VI market percentage *when* they are introduced (0%). I further calculate the average of VI market percentage when they roll out to 10% of total markets, etc. The results are shown in blue. I do the same for all new products of The Coca-Cola Company that are introduced after the vertical integration. The results are shown in orange.

Among the 874 markets in the sample, 596 markets are vertically integrated, i.e. 68% of the markets are vertically integrated (red horizontal line). As shown in the graph, before vertical integration, *when* the products are introduced to markets (blue bar at 0%), about 61% of these are the markets are affected by the vertical integration. As the new products rolling out to more and more markets, the percentage goes up and converges to 68%. After vertical integration, *when* the products are introduced to markets (orange bar at 0%), about 84% of these are the markets are affected by the vertical integration. As the new products rolling out to more and more markets, the percentage goes down and converges to 68%. This shows that after vertical integration, new products are introduced to more VI markets at the early stage of roll-out, and as the new products rolling out to more and more markets, they exist evenly on both VI and non-VI markets.

Figure 3.11: New products roll-out, and VI market presence as percentage of total market presence: PepsiCo



This graph shows the roll-out process for all new products of PepsiCo. The data includes all carbonated soft drink master brands of PepsiCo, such as Pepsi Cola, Mountain Dew, etc. During the roll-out process of a new product, when the number of markets that have this new product reaches, for example, 10% of the 874 markets in the sample (88 markets) for the first time, I calculate how many of these 88 markets are VI markets and calculate the percentage of VI markets, i.e. VI market presence as percentage of total market presence. I do this for the percentages from 0% to 50%, with an increment of 10%, of the 874 markets. (A new product always reaches 0% of the 874 markets *when* the product is introduced.) I do this for all new products of PepsiCo that are introduced before the vertical integration, and calculate the average of VI market percentage *when* they are introduced (0%). I further calculate the average of VI market percentage when they roll out to 10% of total markets, etc. The results are shown in blue. I do the same for all new products of PepsiCo that are introduced after the vertical integration. The results are shown in orange.

Among the 874 markets in the sample, 604 markets are vertically integrated, i.e. 69% of the markets are vertically integrated (red horizontal line). As shown in the graph, before vertical integration, *when* the products are introduced to markets (blue bar at 0%), about 60% of these are the markets are affected by the vertical integration. As the new products rolling out to more and more markets, the percentage goes up and converges to 69%. After vertical integration, *when* the products are introduced to markets (orange bar at 0%), about 87% of these are the markets are affected by the vertical integration. As the new products rolling out to more and more markets, the percentage goes down but still remains high, around 80%. (It actually converges to 69% when the products are rolling out to 85%-95% of the 874 markets.) This shows that after vertical integration, new products are introduced to more VI markets during the roll-out process, and as the new products rolling out to most of the markets (85% -95%), they exist evenly on both VI and non-VI markets.

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