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Why do some new products fail? Evidence from the entry and exit of Vanilla Coke

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Why Do Some New Products Fail? Evidence from the Entry and Exit of Vanilla Coke

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Why Do Some New Products Fail? Evidence from the Entry and Exit of Vanilla Coke*

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August 21, 2021

Abstract

The analysis of new product introduction using discrete-choice demand models has focused on successful products (e.g. the minivan) and their welfare impacts. Instead, we apply this approach to unsuccessful products to provide insight into the reasons for their failure. Our case study is the introduction and subsequent exit of Coca Cola's Vanilla Coke. Using IRI scanner data we estimate demand and supply and simulate counterfactual scenarios in which Vanilla Coke was not introduced. We then estimate Coca Cola's profit gains from the new brand and find they would not cover fixed costs. We analyze the importance of (i) overall demand for soft drinks, (ii) private label presence, (iii) rival promotion, and (iv) consumer preferences for explaining Vanilla Coke's failure, by investigating what the levels of each would have had to be for Vanilla Coke to at least cover its fixed costs. We then investigate the extent to which Coca Cola may have misjudged the levels for these variables by looking at their pre-introduction values. We find Coca Cola did anticipate part of rival reactions that made survival harder, but the actual changes were even beyond its anticipation and contributed to Vanilla Coke's exit.

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1 Introduction

Introducing new brands or product lines is a common marketing strategy for attracting consumers' attention and claiming more shelf space from rivals. However, with many new brands appearing on the market each year, the average failure rate is around 35% across different industries (Urban and Hauser, 1993). The riskiness of new product introduction may result from changing market variables that coincide with the introduction of the new product or the cannibalization of existing products belonging to the company. It can be difficult for the firm to predict whether the new brand can create a market-expansion effect and the way in which rival firms may take actions against the new brand. Uncertainty about market demand, private label presence, and rival promotion, not to mention consumer preferences, can make it harder for the new brand to survive. The new brand can also negatively affect shares of other own-firm brands and lead to reduced profits from them. Altogether, these may explain why firms introduce some new products, which end up later exiting the market.

The objective of this paper is to study a new brand that was eventually discontinued shortly after its introduction and to investigate the reasons for its failure. We apply the discrete-choice demand estimation techniques that have been developed to quantify welfare effects from new products. Existing papers have investigated the introduction of successful new products, e.g., Hausman (1996), Petrin (2002), Hausman and Leonard (2002), Nevo (2003), Goolsbee and Petrin (2004), Giacomo (2008) and Choi et al. (2013). By contrast, we apply the same type of analysis to estimate the firm's profit gains from a brand that does not last. Estimates of variable profits are compared with fixed costs so that we can understand why a product was discontinued. Moreover, by examining the impact of market conditions such as rivals' marketing behavior, we identify factors explaining why unsuccessful products were not profitable. These factors are informative as to the firm's potential misjudgement of the environment and whether the the new brand can survive.

To address these questions, we study Coca Cola's introduction of Vanilla Coke into

the U.S. soft drinks industry in May 2002. After a strong start, Vanilla Coke lasted just three and a half years before being discontinued at the end of 2005. A number of factors make the soft drink industry ideal for our study. It is a well-developed industry with several long-established brands that have stable market shares. At the same time, firms constantly introduce new products to attract consumers, and some of them, including Vanilla Coke, wind up being unsuccessful in the long run.

To answer our questions of interest, we set up a structural model with a nested logit setting on the demand side and a Bertrand-Nash equilibrium on the supply side.[1] We then use scanner data from Information Resources, Inc. (IRI) to estimate the model. This market-level data set contains information on prices, volumes, and promotional activities of soft drink brands sold in grocery stores from various retail chains over 50 U.S. metropolitan areas between May 2002 and December 2005. We also obtain information on the nutritional content of major brands from their manufacturers' websites.

In a first step, we use the model estimates to recover marginal costs and compute Coca Cola's profit gains from Vanilla Coke by simulating a counterfactual in which we suppose it was never introduced. We consider not only the profits it earns directly from sales of Vanilla Coke, but also the losses it incurs by selling fewer units of its other brands – a *cannibalization* effect. In a second step, we analyze the importance of (i) overall demand for soft drinks, (ii) private label presence, and (iii) rival promotion, for explaining the failure of Vanilla Coke. We determine what the levels of these market variables would have had to be for Vanilla Coke to cover its fixed costs. Data on the fixed costs of establishing and maintaining a new brand of soft drink are not available and so as a crude proxy for fixed costs, we use annual media expenditures data from Brandweek. These reflect the amount of advertising spending through media platforms such as TV, newspaper, spot cable, radio, etc., and they do not vary directly with sales. We think of these as representing a lower bound on fixed costs. In a final step, we investigate the extent to which Coca Cola may have misjudged the levels for

[1] As a robustness check, we also estimate the random coefficient logit demand model and our main result remains unchanged.

the three variables by looking at their values in the period before introduction.

Our findings suggest that Coca Cola's profit gains from the introduction of Vanilla Coke did not even cover its media expenditures (much less other fixed costs) during its stay on the market, and so it is no surprise that it ultimately exited. We estimate the direct profit from Vanilla Coke, from 2002 to 2004 to be $51.753 million and the estimated cannibalization effect on other brands from Coca Cola is -$10.717 million. So the net profit gain from the introduction is only $41.036 million, which is less than the media expenditures of $47.132 million incurred during this period. Turning to the explanations for why it entered and did not manage to survive, we find that, compared to the levels observed in the data, survival would have required (i) larger overall market sizes, (ii) diminished importance of the outside good (private label brands), and/or (iii) higher/lower rival prices/display advertisement. We also find that the levels of rival prices and displays necessary for profitability lie between the pre-introduction levels and the post-introduction levels. In other words, Coca Cola anticipated a reaction on the part of its rivals to the introduction of Vanilla Coke, but the actual response was beyond its forecast. These results help explain why Coca Cola introduced this brand in the first place and why it failed to generate enough profitability eventually. Lastly, we find that Coca Cola's difficulty in predicting changes in consumer preferences also contributed to Vanilla Coke's failure.

Our paper is closely related to the research on firm dynamics, namely product and firm entry and exit. Firms derive value from new brands, which in turn affects firms' pricing decisions (Goldfarb et al., 2009). Borkovsky et al. (2017) develop a dynamic model that describes the evolution of brand value and highlights the challenges of building and sustaining brands. Whether the introduction of new brands can succeed also depends on firms' access to distribution breadth and product innovation (Ataman et al., 2008). For instance, Mukherjee and Kadiyali (2018) find that studios take box office revenues into account when deciding on new DVD releases. In terms of product failure, Webb (2016) suggests that firms' irrational commitment results from their lack of knowledge in technology trends, marketing and their

own capabilities. Our results provide new evidence that when introducing new brands, firms are not perfectly rational in that unexpected changes in market conditions are not fully anticipated by firms. A different approach from ours is to employ a dynamic model that takes into account demand uncertainty. Hitsch (2006) develops such a model where the firm gradually learns about product profitability. He then takes the model estimates to match the high exit rate of new products in the ready-to-eat cereal industry. Other papers that follow include Dixit and Chintagunta (2007) and Shen (2014). Yang (2020) also finds evidence that uncertainty about the profitability of entry into local retail markets can be mitigated by learning. While we do not characterize firms' dynamic behavior, our approach still has some advantages. It can easily incorporate a realistic oligopoly setting on the supply side, unlike models of demand uncertainty that typically treat only one firm due to computation burden. In our static setting, we include time fixed effects in the demand estimation, which can capture changes in consumer tastes over time. We also allow firms to incorporate these changes and re-optimize their profits in each period.

Another approach to study entry and exit is firms' endogenous product choice, which has been incorporated into structural demand models in papers like Draganska et al. (2009), Fan (2013), and Wollmann (2018). Stavins (1995) mentions that new entrants are forced to locate in the part of product space that is already crowded with incumbents, such that they are less likely to survive. Eizenberg (2014) finds firms endogenously choose what products to be offered and eliminated in the personal computer market when demand is highly segmented. Berry et al. (2016) model endogenous horizontal and vertical differentiation and explain excessive entry in local radio markets. Fan and Yang (2020) find the U.S. smartphone market has too few products when addressing the endogeneity of product offerings. Our approach does not take into account endogenous product choice, which is more relevant to analysis of the optimal number of products or firms in a market. However, our structural model allows us to estimate welfare changes from an additional product and compare them in different stages of the introduction.

Our paper is also related to research on soft drinks and other consumer packaged beverages. Existing papers mainly explore firm conduct or vertical relationships in these industries. Gasmi et al. (1992) find evidence of some collusive behavior in advertising between Coca Cola and PepsiCo, the two major players, but limited evidence of pricing collusion. Golan et al. (2000) provide semiparametric estimations of oligopoly strategies of Coca Cola and PepsiCo and indicate they have limited market power. Dhar et al. (2005) find statistical evidence that supports conjectural variation models like Bertrand or Stackelberg in characterizing pricing behavior of the two major players. Miller and Weinberg (2017) study joint ventures in the beer category and find they may facilitate price coordination after the merger. Dubé (2004) proposes a demand framework to handle the behavior of multiple products purchases that are commonly found in this market. Applications of this framework to merger analysis indicate substantial welfare loss from the proposed merger between Coca Cola and Dr. Pepper (Dubé, 2005). There are also papers that analyze vertical relationships and contracts between manufacturers, bottlers, and retailers (e.g., Berto Villas-Boas, 2007; Luco and Marshall, 2020). By analyzing the case of Vanilla Coke, we provide new evidence for this industry on effects of new brands.

On a final note, our paper is also related to the work on cannibalization. Holmes (2011) shows cannibalization can result from high store density, but that economies of density can nonetheless justify locating stores in close proximity. Igami and Yang (2016) find hamburger shops belonging to the same chain compete more intensely with each other than with shops of different chains. They suggest it is important to consider the trade-off between cannibalization on existing products and preemption motives. We do not model firms' initial entry since the brands in this industry were established long ago. But we do find that Vanilla Coke creates a cannibalization effect on Coca Cola's major brands and the company's overall shares did not grow after the introduction.

The rest of the paper is organized as follows. Section 2 provides background information on the US soft drinks industry and the introduction of Vanilla Coke. In section 3, we

present the structural model of demand and supply. Section 4 describes the data and some processing procedures. We outline the estimation methods and results in section 5. Section 6 contains the profit analysis and robustness checks. Finally, section 7 concludes the paper.

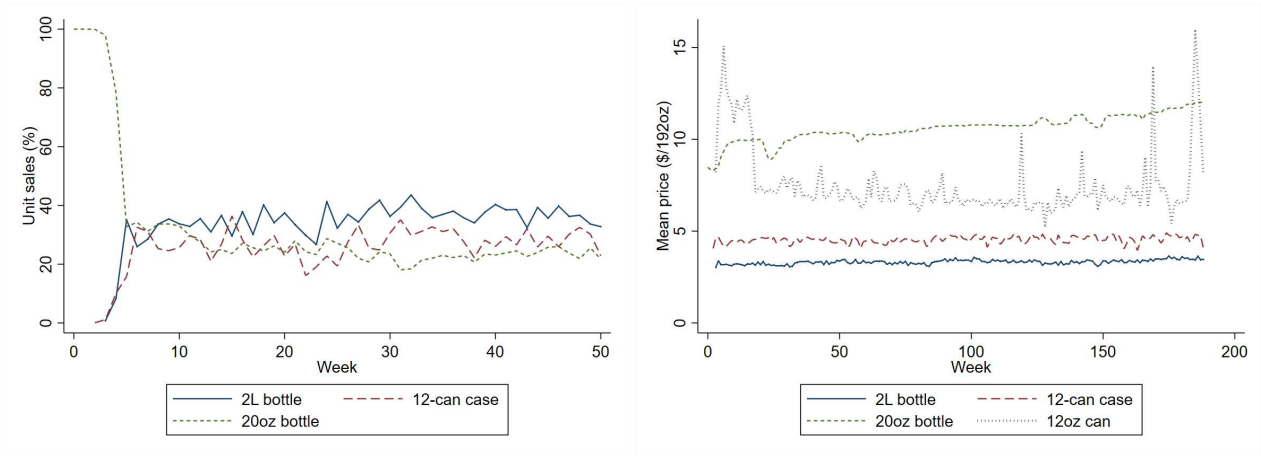
2 The Soft Drink Industry and the Introduction of Vanilla Coke

The U.S. has one of the world's largest soft drink markets. It accounted for 73.84% of the total revenue in the non-alcoholic drinks sector in 2018 (Statista, 2019b). The industry is dominated by three major players, Coca Cola, PepsiCo, and Cadbury Schweppes. Market shares of the top two companies accounted for 68.2% in 2018 and the 3-firm concentration ratio is 86.1% (Statista, 2019a). These firms operate well-known brands such as Coke, Pepsi and Sprite which consistently occupy a large share of the market. Firms constantly release new brands or brand extensions into the market to claim more shelf space. New products may give rise to smaller shares of rival firms, creating a business-stealing effect characterized in Mankiw and Whinston (1986). Following the trend of single flavor-focused soft drink innovation, Coca Cola introduced Vanilla Coke in May 2002 to the U.S. market.

Our analysis of the introduction of Vanilla Coke is based on the Information Resources, Inc. (IRI) scanner data set that has been used in many academic papers. We provide more information on the data set in Section 4 below, but for now note that it is a market-level data set containing sales information from about 1,500 grocery stores from different retail chains across 50 US cities or regions. Using these data we can see that within five weeks of its official introduction 90.79% of the grocery stores and 97.83% of the retail chains in the data set started to sell Vanilla Coke. Figure 1(a) displays major package sizes' percentage unit sales over time. Initially the brand was only available in one package size, the 20oz bottle. Larger sizes started to appear in some stores in weeks 2 and 3. They gradually picked up more unit sales and a decline for the 20oz bottle occurred in week 5.

Figure 1: Unit Sales and Mean Prices of Vanilla Coke by Package Size over Time

(a) (b)



Note: This figure displays different package sizes' unit sales and average prices in each week. On the horizontal axis, week 0 represents the official week of Vanilla Coke's introduction.

Table 1: Sales of Vanilla Coke by Year

Year	Sales volume	Dollar sales
2002	2,150,108.80	$9,171,063.00
2003	1,856,243.30	$7,560,955.50
2004	912,411.20	$3,755,283.90
2005	544,331.30	$2,183,959.70

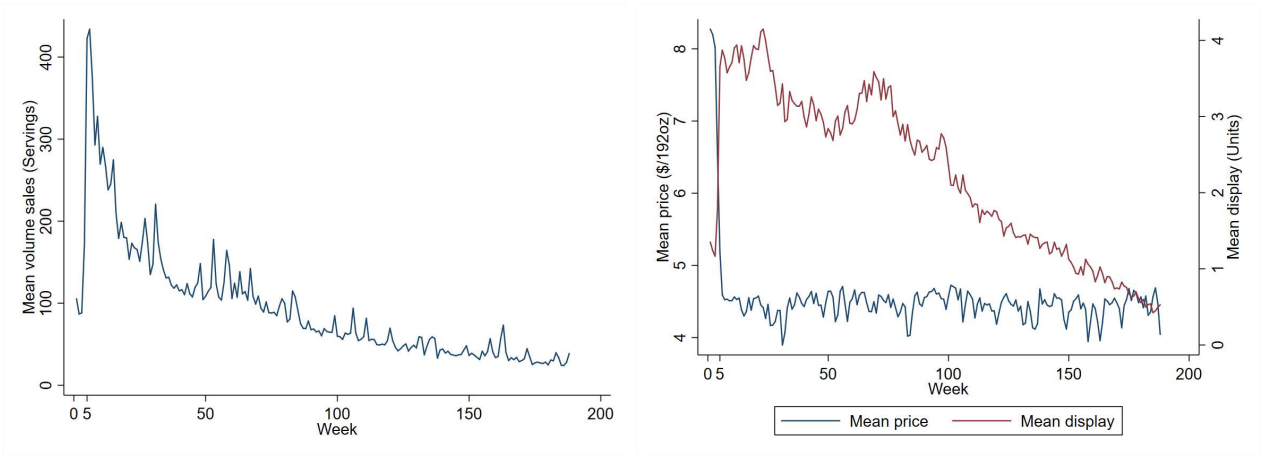
Note: Sales volume shows the number of servings sold (1 serving=192oz). These numbers are based on data from all grocery stores across 50 markets.

After week 5, each of the 2L bottle and the 12-can case accounted for approximately 35% of Vanilla Coke sales, while the 20oz bottle only accounted for 22%. Figure 1(b) plots average prices across stores for the four most popular sizes. The 20oz bottle is priced much higher than the 2L bottle or the 12-can case, and prices are rather stable for each size over time except for the 12oz can. As a result, in the first five weeks, consumers actually faced higher prices than later because only the expensive 20oz bottle was available in most stores.

Figure 2(a) shows the average sales of Vanilla Coke were quite high shortly after it became available nationally. In the twelve months following its introduction, Vanilla Coke sold a total of nearly 2.9 million servings at the stores in our sample, with total dollar sales

Figure 2: Mean Sales, Price, and Display of Vanilla Coke over Time

(a) (b)



Note: This figure plots the average sales volume, prices, and displays across all chains in each week. Week 0 represents the official week of Vanilla Coke's introduction. 1 serving=192oz.

of around $12.2 million. IRI ranked it first among top new brands introduced in the food sector during 2002-2003. However, Vanilla Coke experienced a decline in sales afterwards and was discontinued by 2005. We can see a downward trend in sales after the initial increase in Figure 2(a). Further confirmation is provided in Table 1, which presents sales volume and dollar sales for Vanilla Coke by year in our data set. Roughly 2 million servings were sold in each of 2002 and 2003, but in the following two years sales volume fell dramatically and in 2005 only 0.5 million servings were sold. Consumers seemed to appreciate this flavor innovation at first, but returned to brands with classic flavors shortly after. The decline in sales of Vanilla Coke does not appear to be related to decisions made by Coca Cola to price differently or to display Vanilla Coke less aggressively than it did in the initial weeks. In Figure 2(b), the average levels of displays were still high around week 50, but the sales of Vanilla Coke had already started to decline. Display promotions began to significantly decrease only around week 75. Prices remained fairly constant throughout, albeit with some fluctuations.[2]

[2]Not surprisingly given what we saw in Figure 1(b), a huge decline in mean price occurred around week 5. Figure 2(b) also reveals a huge increase in the average number of units of display promotions in week

3 Model

To quantify the welfare effects from Vanilla Coke's introduction, in this section we outline a structural model of both the demand and supply sides of the soft drinks industry.

3.1 Demand

On the demand side, we assume a nested logit structure to characterize consumers' utility for differentiated products. To be specific, suppose there are J products in the market that are indexed by j and that belong to M nests, which are indexed by m. The market size, or the number of consumers, is N. Let i index consumers and t index time periods. Consumer i's indirect utility from purchasing product j in period t is given by

$$u_{ijt} = \underbrace{\alpha p_{jt} + \boldsymbol{X}_{jt}\boldsymbol{\beta} + \xi_{jt}}_{\delta_{jt}} + \zeta_{imt} + (1-\sigma)\epsilon_{ijt}, i = 1, ..., N; j = 0, ..., J; m = 0, ..., M, \qquad (1)$$

where p_{jt} denotes the price of product j in period t, $\boldsymbol{X}_{jt} = (x^1_{jt}, ..., x^L_{jt})$ is a $1 \times L$ vector of observed product characteristics, and ξ_{jt} is the unobserved (by the econometrician) product characteristic. Here $j = 0$ denotes the outside good. The first part in (1), δ_{jt}, represents the product-specific mean utility level that does not vary across consumers. The second part, $\zeta_{imt} + (1-\sigma)\epsilon_{ijt}$, is the individual deviation, which consists of two terms. The term ζ_{imt} denotes the preference for goods in nest m. We assume three nests: one for the outside good, one for cola brands, and one for non-cola brands. The term $(1-\sigma)\epsilon_{ijt}$ denotes the idiosyncratic shock, where σ is a parameter that captures correlation among brands within the same nest. When σ is close to 1, consumers stay within their nests; when it is close to 0, the model reduces to a simple logit demand setting.

To derive market share functions, we assume both ϵ_{ijt} and $\zeta_{imt} + (1-\sigma)\epsilon_{ijt}$ follow a type I extreme value distribution. Then, as shown in McFadden (1981), the demand for

5. This is because retail chains usually display large cases rather than a single bottle and large packages became more common in week 5.

product j at time t is given by

$$s_{jt} = \frac{\exp[\delta_{jt}/(1-\sigma)]}{D_{mt}^{\sigma} \sum_m D_{mt}^{1-\sigma}}, \tag{2}$$

where $D_{mt} = \sum_{k \in m} \exp[\delta_{kt}/(1-\sigma)]$. In this specification, the mean utility from the outside good is normalized to zero. Also, demand only depends on product characteristics and prices so the wealth effects are abstracted away. One argument for this is that such effects are very small for consumption goods like soft drinks. With some more algebra, we obtain the following linear estimating function:

$$\log(s_{jt}) - \log(s_{0t}) = \alpha p_{jt} + \boldsymbol{X}_{jt}\boldsymbol{\beta} + \sigma \log(s_{jmt}) + \xi_{jt}, \tag{3}$$

where s_{jmt} denotes product j's market share within its nest in time t. The parameters to be estimated are denoted as $\boldsymbol{\theta} = [\alpha, \boldsymbol{\beta}, \sigma]'$.

3.2 Supply

On the supply side, we assume an oligopolistic structure in which firms interact non-cooperatively, since previous studies (Gasmi et al., 1992; Dhar et al., 2005) have found little evidence of collusion in the soft drink industry. Suppose there are F firms in the short run that compete in a price-setting game. Each firm f operates some subset J_f of the J products. In each period, they choose prices to maximize their profits given rival prices. Their profit maximization problem is given by

$$\max_{p_{jt},\ j \in J_f} \Pi_{ft} = \sum_{j \in J_f} (p_{jt} - mc_{jt}) s_{jt}(\boldsymbol{p_t}), \tag{4}$$

where mc_{jt} denotes the (constant) short-run marginal cost of producing j in period t and $\boldsymbol{p_t}$ denotes the $J \times 1$ vector of prices in t.

As in the main specification in Miller and Weinberg (2017), this simple structure for

marginal costs also incorporates retailers' markups and abstracts from vertical relationships between retailers and manufacturers. In other words, retailers are assumed to behave non-strategically with a fixed markup rule, which is reasonable if they do not compete with each other on the basis of a single category.

With the existence of a pure-strategy Bertrand-Nash equilibrium, the set of first order conditions for firm f can be obtained as the following:

$$\frac{\partial \Pi_{ft}}{\partial p_{jt}} = s_{jt}(\boldsymbol{p_t}) + \sum_{k \in J_f} (p_{kt} - mc_{kt}) \frac{\partial s_{kt}(\boldsymbol{p_t})}{\partial p_{jt}} = 0. \tag{5}$$

Let $\boldsymbol{\Omega_F}$ be the $J \times J$ ownership matrix. The typical element (j, k) of $\boldsymbol{\Omega_F}$ is equal to 1 if a firm f produces both products j and k, and is otherwise equal to 0. Also, let $\boldsymbol{\Lambda}_t$ be the $J \times J$ matrix for derivatives of market shares in period t with elements

$$\boldsymbol{\Lambda}_t^{jk} = \frac{\partial s_{jt}(\boldsymbol{p_t})}{\partial p_{kt}}. \tag{6}$$

Then we can rewrite the system in (5) in matrix form as:

$$\boldsymbol{s}_t(\boldsymbol{p_t}) + (\boldsymbol{\Omega_F} \odot \boldsymbol{\Lambda}_t)(\boldsymbol{p_t} - \boldsymbol{mc}_t) = 0, \tag{7}$$

where $\odot$ denotes element by element multiplication, and $\boldsymbol{s_t}$ and $\boldsymbol{mc}_t$ are the $J \times 1$ vectors for shares and marginal costs respectively. Equation (7) connects demand estimates with the supply side. It is used to obtain marginal cost estimates with the actual data, and also to simulate the counterfactual and obtain new equilibrium prices from removing Vanilla Coke.

4 Data

4.1 Description

As mentioned above, market-level information for the carbonated beverages category is retrieved from the IRI dataset and we supplement this with nutrition information for individual brands from firms' websites. The sample period starts January 2001 and ends December 2005. We label the period from May 2002 to December 2005 as the post-introduction period and use this range of data to estimate the demand model and compute profit gains from the introduction. The period before May 2002 is labelled as the pre-introduction period. We use data from this range to infer changes in market variables and Coca Cola's anticipation of these changes.

The data include information on prices, volumes, and promotional activities at the store-week-product level. As mentioned in the Introduction, the IRI data do not contain information on the fixed costs of establishing and maintaining a new soft drink brand. Therefore, as a crude proxy for fixed costs, we use data available from Brandweek. This publication contains the annual media expenditures of America's top 2000 brands as tallied by TNS Media Intelligence. The numbers represent spending on advertisement in a quantifiable manner across TNS' 20 media classifications such as TV, print media, spot cable, radio, etc. Importantly, in-store display advertising is not included as part of these expenditures, and so we naturally consider these two forms of publicity as separate. As a result these expenditures do not vary directly with sales, and so we believe that it is reasonable to think of these as representing a lower bound for the fixed costs associated with establishing and maintaining a brand in the soft drink industry.

In the IRI market-level data, products are defined by Universal Product Code (UPC) and each brand can have several UPC's that differ in package sizes. To reduce computational burden, we aggregate observations to the brand level by converting package sizes to equivalent servings. We define a serving to be 192oz. Products with bonus packs are dropped to reduce

measurement error because their actual prices do not coincide with the label prices that consumers perceive. To further simplify our analysis, we follow Dubé (2005) to only consider brands that have at least 1% of the aggregate volume share in the data and that have non-zero shares in any period. This yields 16 inside brands from three major firms, namely Coca Cola, PepsiCo and Cadbury Schweppes. For the outside option, we follow the approach in Miller and Weinberg (2017) and define a market size for each market/period as 50% greater than the total observed servings in the data. Then the outside option is equal to the market size minus the observed servings of 16 inside brands. This definition captures consumer demand for other fringe soft drinks brands, soft drinks sold outside of grocery stores, and non-carbonated beverages such as iced tea and juice. Market shares for the outside option are around 57%, which suggests that in our estimation consumers can easily find substitutes for the inside brands.

Next, following Miller and Weinberg (2017), we aim to aggregate the data from the store-week level to the market-quarter level to reduce computational burden. A quarter is defined as 12 weeks. Markets are defined in the IRI data set. They are geographic units defined as an agglomeration of counties, usually covering a major metropolitan area (Bronnenberg et al., 2008). There are in total 50 markets. More than 1,500 grocery stores from these markets are drawn from IRI's national sample of stores and they belong to different retail chains that are either regional or national. The marketing variables in our estimation are price and minor display. We focus on minor display, which excludes lobby and end-aisle displays, since this variable has the largest impact on demand when we estimate equation (3) with different measures of display promotions and other product characteristics. After the aggregation, the unadjusted price is defined as total dollar sales over total servings sold. To capture the extra impact of package availability in the first five weeks (discussed in Section 2), we further change prices during this period to be weighted by unit sales. In this way we are able to capture the unusually high prices that consumers actually perceived in the initial periods. As a robustness check, we also estimate our model without including

Table 2: Variance Decomposition of Price and Minor Display

	Price		Minor display	
	(a)	(b)	(a)	(b)
Brand/Week	8.57	74.65%	2.14	23.46%
Chain/Week	0.29	2.53%	1.98	21.78%
Market/Week	0.13	1.14%	1.63	17.90%
Residual	2.57	22.37%	6.21	68.18%
Total	11.49	100.00%	9.10	100.00%

Note: Column (a) of each variable denotes variances and column (b) denotes percentages of the total variances.

data from the first five weeks. Demand estimates are similar, while profit gains naturally become slightly smaller because of the shorter sample period. The unadjusted minor display variable is defined as the average units of display promotions each brand has across all chains within a market in a given period.

It is important to note that the aggregation loses information on chains when we calculate the unadjusted values. Unadjusted price and minor display are a mixture of brand, chain and market effects, but chains are no longer identified and only information on brand and market remains. To see how chain effects matter, Table 2 reports the variance decomposition for the marketing variables with data at the chain-week level. For price, the chain/week effects only account for 2.53% of the total variation. For minor display, however, they explain 21.78% of the variation. Thus, different retail chains charge prices that are relatively similar yet they offer display promotions very differently, holding other factors the same. The unadjusted variables reflect both consumer tastes for brands and tastes for retail chains. But what we really need is to trace demand for different brands, which cannot be accomplished only using the unadjusted data.

To avoid such estimation errors, we take a two-way fixed effects approach and remove the chain effects. Using data at the chain-quarter level, we run the following regression

$$y_{jcrt} = \gamma_{jct} + \omega_{jrt} + e_{jcrt}, \tag{8}$$

where y_{jcrt} is the outcome variable of interest, either price or minor display, for brand j from chain c in market r during time t. γ_{jct} represents the brand/chain/quarter fixed effect while ω_{jrt} represents the brand/market/quarter fixed effect. After the regression, we replace estimated γ's with the $\hat{\gamma}$ from a representative chain (i.e. the nationally-operating chain with the highest sales). Thus, the adjusted variable of interest is defined as

$$\hat{y}_{jrt} = \hat{\gamma}_{j1t} + \hat{\omega}_{jrt}, \tag{9}$$

where $\hat{\gamma}_{j1t}$ is the brand/chain/quarter fixed effect for the representative chain. In Table 3, we present summary statistics for price and minor display among the inside brands. On average prices become smaller and minor display becomes higher for most brands after the adjustment. This implies that the representative chain offers lower prices and has more display promotions compared with other chains.[3]

Another concern regarding the estimation is that when dealing with a high-frequency data set (in this case weekly data), a static model cannot take into account consumers' stockpiling behavior, which could result in biased estimates in price elasticities. Although applying a dynamic framework as in Hendel and Nevo (2006) can address this problem, it is computationally burdensome to estimate. Following Miller and Weinberg (2017), we take the alternative approach to aggregate observations to the quarter level. It can reduce some bias because the impact of stockpiling behavior gets smaller when the data have low frequency. It also provides an alternative interpretation of the discrete choice model. Consumers are unlikely to purchase only one unit of one brand at a time. To justify the model specification, we can refer to the subscript i in the utility function as not only different consumers but also the same consumer purchasing different brands that are then aggregated over the time period. The problem can then be interpreted as deciding which brand to consume

[3]We also estimate the demand model and compute firms' profit gains with the unadjusted values. Results are shown in Appendix A. Estimates of the price coefficient get larger in absolute value, implying that markups become lower. Firms' profit gains also become lower. So our estimates with adjusted values do not underestimate the profit gains.

Table 3: Averages of Price and Minor Display

Brand	Price ($/192oz)		Minor display (Units)	
	(a)	(b)	(a)	(b)
Coca Cola				
COKE CLASSIC	3.93	3.45	44	107
DIET COKE	4.00	3.30	40	100
SPRITE	3.95	3.15	39	96
CAFFEINE FREE DIET COKE	3.87	3.03	23	64
VANILLA COKE	4.28	3.61	10	33
PepsiCo				
PEPSI	3.74	3.07	40	84
DIET PEPSI	3.85	3.23	39	91
MOUNTAIN DEW	4.00	3.23	36	76
CAFFEINE FREE DIET PEPSI	3.70	3.02	19	53
CAFFEINE FREE PEPSI	3.64	3.05	7	18
DIET MOUNTAIN DEW	3.95	3.25	15	41
Cadbury Schweppes				
DR PEPPER	4.11	3.33	29	82
7 UP	3.80	3.17	19	47
A & W	3.94	3.21	19	63
DIET DR PEPPER	4.12	3.25	17	48
CANADA DRY	4.65	3.96	22	50

Note: Column (a) of each variable denotes unadjusted values and column (b) denotes adjusted values. Averages are taken across all market and quarter combinations.

at each consumption occasion and we assume that different brands cannot be consumed simultaneously.

We also include other product characteristics in the demand model following Dubé (2005). These are shown in Table 4. Calories distinguish diet brands from regular brands. The sugar content is reflected in the level of calories as well. Caffeine level is another key to consumer choices as some consumers prefer caffeine-free products. Caramel color and citric acid are key ingredients that often appear in soft drinks. Vanilla Coke has similar characteristics to Coke Classic and Pepsi, the two regular cola brands. It contains 150 calories per 12oz and has a caffeine level of 34mg/12oz. There is no citric acid in Vanilla Coke, but it does have caramel color.

Table 4: Product Characteristics for Inside Brands

Brand	Calories	Caffeine	Citric acid	Caramel color
Coca Cola				
COKE CLASSIC	0.14	0.34	0	1
DIET COKE	0	0.46	1	1
SPRITE	0.14	0	1	0
CAFFEINE FREE DIET COKE	0	0	1	1
VANILLA COKE	0.15	0.34	0	1
PepsiCo				
PEPSI	0.15	0.38	1	1
DIET PEPSI	0	0.35	1	1
MOUNTAIN DEW	0.17	0.54	1	0
CAFFEINE FREE DIET PEPSI	0	0	1	1
CAFFEINE FREE PEPSI	0.15	0	1	1
DIET MOUNTAIN DEW	0	0.54	1	0
Cadbury Schweppes				
DR PEPPER	0.15	0.41	0	1
7 UP	0.14	0	1	0
A & W	0.17	0	0	1
DIET DR PEPPER	0	0.41	0	1
CANADA DRY	0.14	0	1	1

Note: Calories show the calorie level per 12oz scaled by 1000. Caffeine denotes the caffeine level in terms of 100mg per 12oz. Citric acid is equal to 1 if the brand contains citric acid and 0 otherwise. Caramel color is equal to 1 if the brand contains caramel color and 0 otherwise.

4.2 Volume Shares

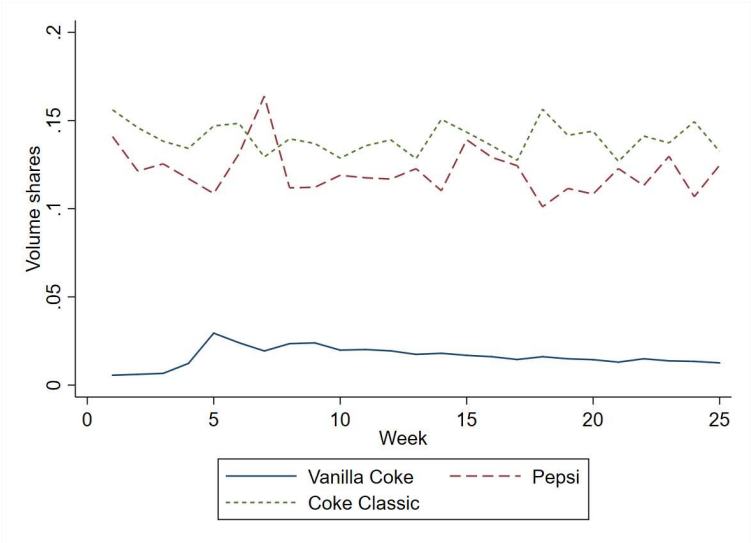
To see the market performance of Vanilla Coke and other major brands, we plot their volume shares in Figure 3 based on observed volume sales in the data. Panel (a) shows that shares of Vanilla Coke increased remarkably within the first 5 weeks and peaked in the fifth week. From 0.56% to 2.95%, the increase in its volume shares is about 2.39%. Meanwhile, shares of Coke Classic and Pepsi dropped by approximately 2% and 3%, respectively. There is an abnormal increase in Pepsi's market share around week 7, which is likely due to its reaction to the introduction of Vanilla Coke. After large package sizes of Vanilla Coke became available in most stores starting in week 5, PepsiCo lowered the prices of its regular cola brand, Pepsi, and increased its promotions in weeks 6 and 7.[4] As a result, Pepsi's market

[4]In Appendix B, we report regression results that show the Pepsi brand has significant price decreases and promotion increases in week 6 and 7 compared with other weeks in the same year.

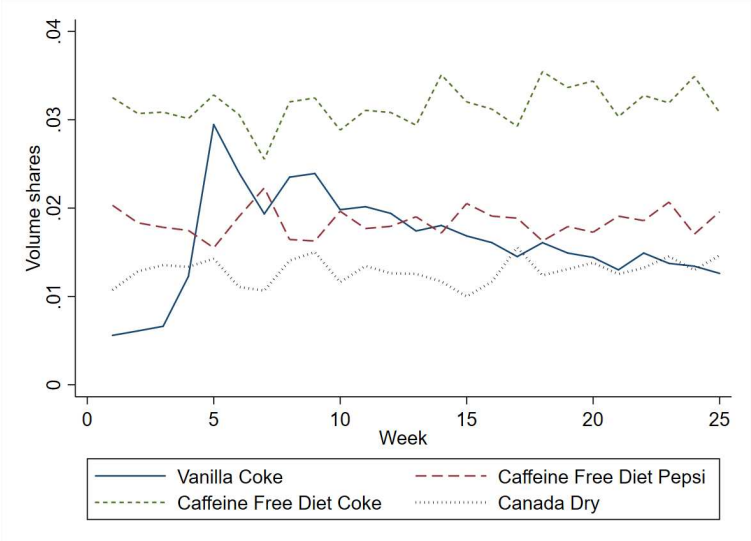
share increased dramatically during week 7. From Panel (b), we see that shares of caffeine free diet cola brands declined as well but their changes were less than 0.5%, much smaller than those of Coke Classic and Pepsi. We can also see that non-cola brands such as Canada Dry were almost completely unaffected. Hence, within a short period after its introduction, Vanilla Coke mainly stole market shares from regular cola brands like Coke Classic and Pepsi. Also, compared with those owned by Coca Cola, the cola brands owned by PepsiCo experienced much deeper declines.

Figure 3: Post-Introduction Volume Shares of Some Inside Brands

(a)



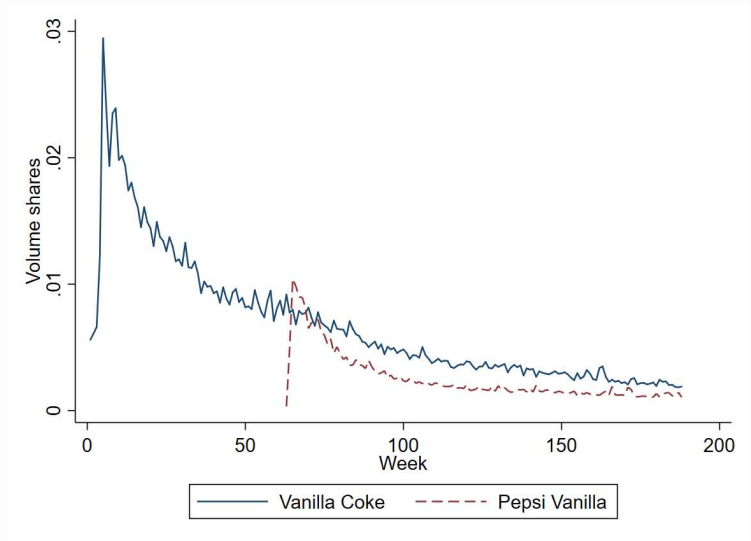
(b)



Note: Volume shares are defined within the total observed volumes across all markets in the data set. The horizontal axis shows the numbers of weeks after the introduction. Week 0 represents the official week when Vanilla Coke was introduced.

A small increase in the market share of Vanilla Coke also occurred around the ninth week. Then it decreased gradually to just above 1%. Such a dramatic change in market share is unlike anything experienced by other long-established brands. For example, Canada Dry has volume shares that are also around 1%, but its shares fluctuate much less than those of

Figure 4: Volume Shares of Vanilla Coke and Pepsi Vanilla



Note: Weekly volume shares are defined within the total observed volumes across all markets in the data set. The horizontal axis shows the numbers of weeks after Vanilla Coke introduction.

Vanilla Coke. Similarly, shares of Caffeine Free Diet Coke are roughly 3%, which is near the maximum level of Vanilla Coke, but they stayed roughly constant at that level throughout our sample period. Therefore, the figures suggest that Vanilla Coke gained popularity among consumers within a short period, but interest in this new brand died down afterwards.

Lastly, it is important to point out that PepsiCo also introduced a similar cola product with vanilla flavor a little more than a year after the introduction of Vanilla Coke. Named Pepsi Vanilla, this new brand was intended to compete head-on with Vanilla Coke. Figure 4 compares market shares of the two brands over time. Pepsi Vanilla entered the market in week 63 (after the introduction of Vanilla coke), and its market share rose to be just above 1% within two weeks, which was slightly higher than Vanilla Coke's already depressed share at the time. However, the decline in share was much steeper for Pepsi Vanilla than it was for Vanilla Coke, and very quickly it had lower share than its rival. Its aggregate share in the whole sample period is not even large enough to be included as an inside brand according to our definition. Overall, Pepsi Vanilla's market performance was poor and its impact rather

negligible.

The pattern of volume shares in Figure 4 is not uncommon for unsuccessful soft drinks brands. In Appendix C, we plot the evolution of shares for several new brands that were introduced around the same time and ended up being subsequently discontinued. Similar to Vanilla Coke and Pepsi Vanilla, their market shares went up in the initial introduction period, but later on they declined dramatically. Therefore, our findings below could be relevant for analyzing a wider set of products that fail.

5 Estimation and Results

We take equation (3) to the data and estimate the demand parameters with an IV GMM approach. Endogeneity in (3) is two-fold. The marketing variables including price and minor display are endogenous, and so is the within-nest market share. We instrument the latter with the number of brands per nest, which is a common choice from the literature of nested logit estimation. For endogenous price and display, we consider two sets of instruments. The first is a cost-shifter that follows the approach of Berry et al. (1999). This type of instruments is valid under the standard assumption that the product characteristics are mean-independent of the unobserved product characteristics. It is computed by imposing equilibrium conditions from the supply side to construct cross-equation restrictions. To be specific, we first obtain an initial estimate $\hat{\boldsymbol{\theta}}$ using cruder instruments. In our application, we use the Hausman instruments (Hausman, 1996) defined as the average price or display across other markets in t. We then construct exogenous estimates $\hat{\boldsymbol{\delta}}$ and $\hat{\boldsymbol{mc}}$ from $\hat{\boldsymbol{\theta}}$. Finally, we solve the first order conditions from the supply for predicted prices $\hat{\boldsymbol{p}}$ as a function of the above estimates. This estimated price variable serves as the exogenous cost shifter.

The second set comprises a number of differentiation instruments in the spirit of Gandhi and Houde (2020). These instruments capture how demand for brands is influenced by the degree of differentiation among all brands. We construct the quadratic version that

has the following formula:

$$
\begin{aligned}
Z_{jkt}^{Other} &= \sum_{k \in J_f \setminus \{j\}} d_{jktl}^2, \\
Z_{jkt}^{Rival} &= \sum_{k \notin J_f} d_{jktl}^2,
\end{aligned}
\tag{10}
$$

where d_{jktl} is the difference between products j and k in terms of characteristic l in t. Z_{jkt}^{Other} captures the sums of quadratic differences between other own-firm brands, and Z_{jkt}^{Rival} represents those between rival-firm brands. In our application, to avoid collinearity, we use all four exogenous characteristics in Z_{jkt}^{Other} and employ calories and caffeine level in Z_{jkt}^{Rival}. We also include a number of fixed effects to improve the fit of the demand model. These are market/quarter fixed effects and firm fixed effects. The market/quarter fixed effects capture changes in consumer tastes over time and across markets. The firm fixed effects are included to address the concern of brand preferences. For example, for cola drinkers, the brand choice between Coke Classic and Pepsi is actually the same as the manufacturer choice between Coca Cola and PepsiCo.

Table 5 shows the demand estimates using data from the full sample period. The price coefficients are negative and significant, and their absolute values become larger as we move from OLS logit to IV nested logit. Coefficients on display are positive, indicating that consumer demand will increase when the brand is on display promotion. The estimated σ is 0.614, significantly different from zero. So the nested logit setting fits the data better than a simple logit setting. Other parameter estimates are significant as well. The Sargan-Hansen J-test for over-identification reports statistics with very small p-values, so all instruments are valid in our specification.

With estimates from column (3) in Table 5, we back out marginal costs from equation (7). Table 6 presents the median estimated price elasticities, marginal costs and markups. Own-price elasticities range from -3.20 to -2.13. Brands with higher prices usually have higher elasticities. Vanilla Coke has a median price of \$3.59 per 192oz and its estimated elasticity is -3.02, both larger than Coke and Pepsi. Marginal costs are between \$1.04 and \$2.25 per

Table 5: Demand Estimates for the Soft Drinks Industry

	Logit		Nested logit
	(1) OLS	(2) IV GMM	(3) IV GMM
Price	-0.298	-0.811	-0.851
	(0.015)	(0.034)	(0.035)
Minor display	1.230	2.443	0.903
	(0.018)	(0.064)	(0.055)
Caffeine	1.611	1.096	0.407
	(0.044)	(0.058)	(0.032)
Calories	2.098	1.923	0.799
	(0.115)	(0.145)	(0.070)
Citric acid	0.711	0.528	0.291
	(0.025)	(0.036)	(0.017)
Caramel color	0.567	0.475	0.613
	(0.020)	(0.025)	(0.011)
σ			0.614
			(0.019)
Market/Quarter	×	×	×
Firm	×	×	×
J-test		354.541	802.204
J-test (p-value)		0.000	0.000
R^2	0.476	0.208	0.859
Obs.	12800	12800	12800

Note: Robust standard errors are reported in parentheses. For comparison, the price coefficient for nested logit is the adjusted price parameter, $\alpha/(1-\sigma)$, and its standard error is calculated by the delta method.

192oz. They are fairly comparable with other estimates from the literature, e.g., Dubé (2005) estimates costs of between \$1.12-\$3.68 per 192oz. Estimated mark-ups are approximately 40-60% and are close to those in Dubé (2005). Coca Cola and PepsiCo generally have higher margins than Cadbury Schweppes, implying a pricing advantage of the top two companies.

To confirm the robustness of our results we estimate alternative specifications of the demand model. Instead of product characteristics and firm fixed effects, we include brand-year fixed effects in our nested logit setting. Also, we estimate a random coefficient logit model with either product characteristics or brand-year fixed effects. These alternative specifications produce slightly different point estimates of the demand parameters, but they do not change our main results regarding profit gains. We return to provide more details on this in the next section.

Table 6: Own-Price Elasticities, Marginal Costs and Mark-Ups (Median)

	Price ($/192oz)	Own-price elasticity	MC ($/192oz)	PCM (%)
Coca Cola				
COKE CLASSIC	3.41	-2.29	1.38	58.26
DIET COKE	3.36	-2.46	1.28	60.53
SPRITE	3.17	-2.31	1.63	48.32
CAFFEINE FREE DIET COKE	3.06	-2.47	1.04	65.69
VANILLA COKE	3.59	-3.02	1.55	56.20
PepsiCo				
PEPSI	3.06	-2.13	1.24	59.34
DIET PEPSI	3.24	-2.49	1.41	55.95
MOUNTAIN DEW	3.22	-2.27	1.57	50.68
CAFFEINE FREE DIET PEPSI	3.04	-2.50	1.21	59.56
CAFFEINE FREE PEPSI	3.07	-2.56	1.23	58.85
DIET MOUNTAIN DEW	3.21	-2.59	1.56	51.30
Cadbury Schweppes				
DR PEPPER	3.32	-2.52	1.61	51.60
7 UP	3.14	-2.55	1.42	54.40
A & W	3.25	-2.61	1.54	53.21
DIET DR PEPPER	3.24	-2.61	1.49	53.47
CANADA DRY	3.98	-3.20	2.25	43.86

Note: MC denotes the estimated marginal costs. PCM denotes the estimated price-cost margins, which are defined as $(p - mc)/p$. The median is computed across all markets and time periods.

6 Profit Analysis

6.1 Profit gains from Vanilla Coke (Baseline)

We estimate profit gains to Coca Cola from the introduction of Vanilla Coke by simulating a counterfactual where Vanilla Coke was never introduced and other elements like the ownership matrix and marginal costs were unchanged. Simulated prices are calculated using equation (7), and they reflect what the prices of other inside brands would have been had Vanilla Coke not entered the market. Then we calculate the profit gain for Coca Cola, which is equal to the difference between the actual and the simulated profits across all

Table 7: Observed and Simulated Prices and Mark-Ups (Median)

	Price ($/192oz)		PCM (%)	
	(a)	(b)	(a)	(b)
Coca Cola				
COKE CLASSIC	3.41	3.40	58.26	58.13
DIET COKE	3.36	3.35	60.53	60.46
SPRITE	3.17	3.17	48.32	48.27
CAFFEINE FREE DIET COKE	3.06	3.05	65.69	65.64
VANILLA COKE	3.59		56.20	
PepsiCo				
PEPSI	3.06	3.07	59.34	59.38
DIET PEPSI	3.24	3.25	55.95	56.01
MOUNTAIN DEW	3.22	3.22	50.68	50.68
CAFFEINE FREE DIET PEPSI	3.04	3.04	59.56	59.69
CAFFEINE FREE PEPSI	3.07	3.08	58.85	58.91
DIET MOUNTAIN DEW	3.21	3.21	51.30	51.31
Cadbury Schweppes				
DR PEPPER	3.32	3.32	51.60	51.60
7 UP	3.14	3.14	54.40	54.40
A & W	3.25	3.25	53.21	53.21
DIET DR PEPPER	3.24	3.24	53.47	53.47
CANADA DRY	3.98	3.98	43.86	43.86

Note: Column (a) of each variable denotes the observed values and column (b) denotes the simulated values. Medians are taken across all market and quarter combinations.

markets and periods. This is given by

$$\Delta\Pi_f = \sum_t (\Pi^1_{ft} - \Pi^0_{ft}), \tag{11}$$

where the superscript 1 denotes Coca Cola's profit computed from the observed prices and 0 denotes that from the simulated prices. This profit gain captures the total profit impact of the introduction, which includes the cannibalization of other own-firm brands. The pure cannibalization effect is given by

$$\Delta\Pi'_f = \sum_t (\Pi'^1_{ft} - \Pi'^0_{ft}) = \sum_t (\sum_{j=1}^{J_f-1} (p^1_{jt} - mc_{jt}) s_{jt}(\boldsymbol{p_t}^1) - \sum_{j=1}^{J_f-1} (p^0_{jt} - mc_{jt}) s_{jt}(\boldsymbol{p_t}^0)), \tag{12}$$

where the number of potentially cannibalized brands is $J_f - 1$.

In Table 7 we compare the observed and simulated prices and mark-ups in order to

Table 8: Changes in Firms' Profits in Full Period (Million Dollars)

Profit changes	Outside option	
	(1)	(2)
Coca Cola	5.794	6.015
PepsiCo	-2.495	-2.135
Cadbury Schweppes	-0.206	-0.029
Total	3.062	3.851

Note: Column (1) assumes the market size is 50% more than the observed size in the data. Column (2) assumes the market size is proportional to the population.

quantify the effect of Vanilla Coke's introduction on firms' pricing strategies. Brands owned by Coca Cola slightly increase their prices upon introduction. Markups increase for all of their other inside products. Most brands from PepsiCo would be negatively affected, with decreased margins. Brands from Cadbury Schweppes would be largely unaffected. Thus, Vanilla Coke's existence would provide Coca Cola with some pricing advantage and enable it to charge higher prices for major brands it owns. Facing this challenge, PepsiCo would be adversely affected and have to lower some prices. Cadbury Schweppes, by contrast, would experience little change.

Column (1) of Table 8 reports estimated changes in firms' profits due to the introduction of Vanilla Coke with data from the full sample. The market size used to aggregate the results is 1.5 times the total observed servings in each market/quarter, which has a median value of 1.38 million. The total profit gain is \$3.062 million, with the majority going to Coca Cola. Among the three firms, Coca Cola experiences a profit gain because of its pricing advantage. Profits of the other two companies would decline. PepsiCo's profit would decrease by \$2.495 million and Cadbury Schweppes' profit would drop by \$0.206 million. So the new brand could influence competition between firms, leading to increased profits for the introducing firm and decreased profits for rivals.

As one robustness check, we try another definition of the outside option following Nevo (2001). The idea is to define a market size that is proportional to the population. For each market, we compute the total servings by multiplying the USDA (U.S. Department of

Agriculture) average estimate of per capita consumption of soft drinks between 2002-2003 by the metropolitan area's population from the US census. The per capita consumption is about 46.5 gallons per year, which is equivalent to 7.13 servings every 12 weeks. This definition gives a median estimate of market sizes that is about 11 million. From column (2) in Table 8, we see profit changes are slightly larger than those in column (1) due to larger market sizes. Otherwise the results are comparable in both definitions. In the analysis that follows analysis, we concentrate on the first definition of the outside option. The outside option occupies almost 99% of the total market according to the second definition, a level that seems unrealistic in terms of consumer substitution patterns.

Regardless of definition, some of Coca Cola's fringe brands are included in the outside option and do not appear in our calculation of Coca Cola's total profits. If consumers switch to these brands, it will create an additional cannibalization effect and lower the profit gains that we calculate from introducing Vanilla Coke. As such, the profit changes in our paper provide an upper bound for how much Coca Cola could benefit from the new brand.

Since Vanilla Coke eventually exited the market, it is important to estimate how profit gains evolved over time to understand the reasons for its exit. As the shares of Vanilla Coke fell steadily after its initial increase, results can be quite different when we split up the post-introduction period into different years. To this end, we re-estimate the demand model and marginal costs and compute changes in profit for each year. Panel A of Table 9 shows the results. Due to re-estimation of the parameters, the sum of profit changes from 2002 to 2005 in Panel A is not equal to the changes in Table 8 using the full period. Also, estimates of 2002 are based on the post-introduction data of 36 weeks while the other three years have full-year data. The profit gain for Coca Cola declines over time, which is consistent with the fact that sales of Vanilla Coke shrank over time. The negative impact on PepsiCo and Cadbury Schweppes would become smaller as well. Hence, the major profit gain from Vanilla Coke appears within a short period of its introduction.

To see the decline in profits even more clearly, we calculate *scaled* profit changes

Table 9: Changes in Firms' Profits Year by Year (Million Dollars)

Panel A: With Actual Time Length				
	Year 2002	Year 2003	Year 2004	Year 2005
Coca Cola	3.615	2.940	1.252	0.973
PepsiCo	-0.613	-0.506	-0.212	-0.162
Cadbury Schweppes	-0.218	-0.167	-0.073	-0.055
Total	2.784	2.267	0.968	0.756
Panel B: With Scaled Time Length				
	Year 2002	Year 2003	Year 2004	Year 2005
Coca Cola	18.073	10.176	4.335	3.368
PepsiCo	-3.064	-1.751	-0.733	-0.560
Cadbury Schweppes	-1.089	-0.578	-0.252	-0.191
Total	13.920	7.847	3.351	2.617

Note: Estimates in Panel A are calculated using the actual time length for each year. In Panel B, estimates are scaled up so that they reflect the full time period.

for each year to make them comparable with those in Table 8. In Panel B of Table 9, each column now has a time length equivalent to the full period, i.e., around three and a half years. It is worth noticing that when data in 2002 were projected onto the remaining years, the total profit increase would be $13.920 million, much larger than the $3.062 million estimate from the full period. By comparison, data from 2005 only predicted a profit gain of $2.617 million. These scaled values further confirm that Vanilla Coke's main benefit to Coca Cola occurred in the first year. If Vanilla Coke had been able to maintain its strong initial market performance after the first year, it could have generated much larger profit gains. The sizeable difference in impact between the first year and the last year suggests a deterioration in Vanilla Coke's profitability.

The profit gains from Vanilla Coke remain positive in these estimates despite the downward trend. However, if we consider fixed costs that are not captured in our supply model, these profit gains may be too small. Aaker (1990) mentions that the costs of introducing a new brand can be very large, ranging from $50 million to well over $100 million. One of these costs may be advertising. Coca Cola's annual reports in 2002-2003 show that advertising expenses account for almost one third of its total selling expenses. In the following analysis, We use the annual media expenditure from Brandweek as a proxy for fixed

Table 10: Profit Gains and Media Expenses from Vanilla Coke (Million Dollars)

Year	Total profit gain	Direct profit Gain	Canniba-lization	Media expense
2002	19.365	24.569	-5.204	22.679
2003	15.460	19.425	-3.965	13.656
2004	6.973	8.714	-1.741	10.797
2005	5.656	7.045	-1.389	N/A
2002-2004	41.036	51.753	-10.717	47.132

Note: The total profit gain is a sum of the direct profit gain, which is the profit of Vanilla Coke itself, and the cannibalization effect, which is the profit change of other own-firm brands. Data on media expenses are retrieved from Brandweek. The entry for Vanilla Coke in 2005 is missing because Vanilla Coke was no longer one of America's top 2,000 brands.

costs. The justification for treating media expenditures as fixed is that firms incur these expenses through advertising platforms like TV and they do not vary directly with sales or with in-store display promotions.[5] Of course there are other types of fixed costs as well, and so media expenditure provides an approximation of the lower bound of fixed costs.

Since our estimated profits are only based on sales in grocery stores in 50 metropolitan areas, we convert them so that they can represent the entire U.S. market just like the media expenditure data. Specifically, we calculated the ratio of soft drinks consumption of the U.S. population over the assumed market size in our estimation for each year. The former is simply the per capita soft drinks consumption times the U.S. population. We then use the ratio to scale up the profit estimates to the national level.

Table 10 compares Vanilla Coke's profit gains and media expenditures over time. The total profit gains from Vanilla Coke are lower than the media expenses except in 2003. For instance, Vanilla Coke would generate a total profit gain of $19.365 million in 2002, but its media expense was $22.679 million. This is extremely large compared to other years, implying that Coca Cola spent a lot on advertising this new brand right after its introduction. It is also possible that firms incur advertising costs considering future profitability of a product. Thus, in the last line of Table 10, we also report the results when data from 2002 to 2004 are merged together. The total profit gains over these years are still below the total media

[5] In the robustness section below we discuss the inclusion of media expenditures on the demand side.

expenses. Therefore, Vanilla Coke failed to generate enough profit to cover the advertising costs.

Vanilla Coke also creates a negative impact on profits from other major brands owned by Coca Cola. For instance, their profits would decrease by $5.204 million in 2002. This negative effect arises despite the fact that Coca Cola was able to charge higher prices and it comes from the fact that Vanilla Coke crowds out demand for these brands. The loss becomes smaller later as Vanilla Coke stole less market share from these brands.

Validation test: As a validation test, we also estimate the profit changes of introducing Coke Classic, another major brand from Coca Cola.[6] Unlike Vanilla Coke, Coke Classic would not generate declining profit gains during the full period. Instead, they would fluctuate over time. Hence, the decreasing profit gain from Vanilla Coke is not due to any deteriorated performance of the Coca Cola company over time. Moreover, profit gains from Coke Classic always greatly exceed its media expenses. In 2002, for example, Coke Classic generates a total profit gain of $268.916 million while its media expense was only $94.523 million. Therefore, the comparison of profit estimates and media expenses is consistent with the fact that Coke Classic is a successful product on the market.

Robustness: To check whether our demand setting affects profit gains estimates, we apply different model specifications. Nevo (2000) suggests using brand fixed effects whenever possible. Similarly, we try controlling for brand-year fixed effects and dropping product characteristics. Results shown in Appendix E suggest the profit gains are still below media expenditures for most years in this case.

One might also be concerned that we do not include media expenses on the demand side. To investigate the impact of doing so we consider a specification in which we control for brand-year fixed effects in the demand model since media expenses vary by brand and year. Results are reported in Appendix E. Estimated profit gains are slightly larger than the baseline estimates except in 2002, but the result that they are below the media expenditures

[6] Detailed estimates are provided in Appendix D.

remains for most years.

Finally, we also estimate the random coefficient logit model with product characteristics or brand-year fixed effects. We use the family income level from the Public Use Microdata Sample (PUMS) in 2005 as household demographics. The PUMS data are linked to the IRI markets by matching the census tracts in the two data sets. In our estimation, we draw 100 households in each market and the income variable is standardized. Results are reported in Appendix F. The estimated profit gains remain lower than the media expenses in most years in either specification of the random coefficient logit model, which is consistent with our estimation results from the baseline nested logit model.

7 Impact of Market Variables on Profit Gains

Our baseline estimates suggest that the new brand was not profitable in most years of its existence. The next step in our analysis is to study the conditions under which Vanilla Coke might have generated sufficient profits for Coca Cola to cover its fixed costs, thereby possibly remaining in the market. Our focus is on three main variables. We start by examining the role of market size before turning to the importance of the outside brands and finally the response of rivals. For each of these variables we compute the levels that would have been *required* in order for Coca Cola to break even and the cannibalization effects under these levels. Since the required levels are different from the actual levels, we then examine whether Coca Cola might have had reason to anticipate that the required levels would be achieved. To do so we compare the required levels to the levels and/or growth rates from the pre-introduction period. This comparison enables us to infer whether, before introducing Vanilla Coke, Coca Cola correctly anticipated the future changes in market variables.

Lastly we investigate the extent to which an inability to correctly forecast consumer preferences contributed to Vanilla Coke's failure. We present the evolution of consumer tastes for Vanilla Coke and test whether changing consumer tastes can increase Vanilla

Coke's future profits and thereby cover its media expenses.

7.1 Levels of the market variables required for profitability

We define the required levels for each of the market variables to be those that would have allowed Coca Cola to generate just enough profit gains to cover the fixed costs associated with Vanilla Coke (proxied for by media expenditures on this brand). The market variables that we consider include (i) the overall market size for soft drinks, (ii) the shares for outside brands, and (iii) prices and display promotions from rival brands. To estimate these required levels, we simulate the changes in market variables through counterfactuals in which Coca Cola's net profit gain from Vanilla Coke is targeted at the level of its media expenditure. For the overall market size experiment, we increase the post-introduction total servings size by a certain ratio. Then Coca Cola's profit gain is calculated by comparing the post-introduction variables and the pre-introduction variables simulated to match its media expenditures. For outside shares, the counterfactual allows all inside brands to change their shares by the same ratio. For rivals' behavior, in the counterfactual, all rival brands are forced to increase their prices or decrease their displays by the same ratio. These ratios are altered in iterations until the resulting profit estimates from Vanilla Coke match its media expenses. We construct these counterfactuals and search for values of the required changes for (i) 2002, (ii) 2004, and (iii) the whole time period from 2002 to 2004. Results are reported in Table 11.

Market size: Market size would need to increase by 0.64% in 2002 or 0.65% in 2004. Taking 2002-2004 as an example, the actual total servings in our data set are around 4.92 million, so Coca Cola would have required 4.94 million servings in the 50 markets to break even. Compared with the percentage changes in 2002 and 2004, the change for the whole period from 2002 to 2004 is smaller. This is consistent with the fact that in 2003 the profit from our baseline estimation is a little higher than the media expense and compensates for the losses in 2002 and 2004.

Table 11: Estimates on the Required Changes in Market Variables

	2002	2003	2004	2002-2004
Media expenses (Target profit)	22.679	13.656	10.797	47.132
Baseline profit	19.365	15.460	6.973	41.036
Change in Market Size	0.64%	0%	0.65%	0.34%
Change in Inside Shares	0.64%	0%	0.65%	0.34%
Change in Rivals' Display	-3.08%	0%	-2.16%	-0.85%
Change in Rivals' Price	1.49%	0%	1.38%	0.75%
Change in Own Brands' Display	0.68%	0%	0.50%	0.21%
Change in Vanilla Coke's Display	19.14%	0%	63.58%	12.46%

Note: Media expenses and baseline profit are in terms of million dollars. Changes in different variables reflect the percentage changes from the observed level.

Market shares of inside brands: Shares of the inside brands would have had to increase by the same ratios as for market size in the two years. Results are identical in these two scenarios because profits are linear in market size and shares. Inside brands owned by Coca Cola had average market shares of 20.66% across the 50 markets in 2002, and so it would have needed an average share of 20.79% to produce just enough profit gains and cover the media expenditures.

Rival firms' pricing and marketing strategies: In terms of rivals' behavior, hitting the target profit for Vanilla Coke would have required that rival brands reduce displays by 3.08% or increase prices by 1.49% in 2002. Similar results hold for 2004. In 2002 the average number of displays by rival brands is 19.95 units and the average price is $3.85, and so the required levels would be an average display of 19.33 units and an average price of $3.91 for all rival brands. These levels reflect the fact that if rivals had offered fewer displays or higher prices, it would have been easier for Vanilla Coke to survive due to weaker competition.

Other own-firm brands' marketing strategies: Apart from changing the three variables mentioned above, We also consider a counterfactual where displays of Coca Cola's other own-firm brands change. To operationalize this experiment we suppose that all of Coca Cola's brands other than Vanilla Coke are spun off and produced by another firm, and then

we use the same approach as for the rival brands counterfactuals, including this new firm as an additional rival. The target is still for the net profit gain from the introduction being to equal media expenditures. It is important to note that we keep the target level of media expenditures unchanged despite the fact that we are allowing the number of displays to be different. This is reasonable because the costs associated with in-store display promotions are not included in the Brandweek media expenditures, which, as mentioned above, only include advertising spending on TV, radio, etc. From Table 11 we can see that the spun-out brands (Own Brands) would have had to increase their displays by 0.68% in 2002 and 0.50% in 2004. The sign of these changes is the opposite of those from the experiment involving rival brands, because the net profit gain also takes into account the impact on profits from own-firm brands and Vanilla Coke inevitably affects their profits through cannibalization. Finally, we consider the case where displays of Vanilla Coke itself change. From the last line of Table 11 we have that Vanilla Coke's display would have had to increase by 19.14% in 2002 and 63.58% in 2004, much larger than changes in own-brands' displays. This is intuitive as Vanilla Coke occupies a much smaller share of the market than all other own brands.

Summary: In summary, the levels of overall market size and inside shares required for Coca Cola to break even from the introduction of Vanilla Coke were larger than the actual levels. The required rivals' displays would be smaller and the required prices of rival brands would be higher than the actual average rival prices.

7.2 Anticipation of market variables and profitability

We have just seen that the levels of the market variables required for profitability are different from the actual levels. These required levels may reflect Coca Cola's expectations regarding the environment at the time of introduction. Our next step is to investigate whether Coca Cola might have had reason to anticipate that the required levels would be achieved. Our focus is on the levels and/or growth rates from the pre-introduction period (as defined in Section 4.1). This comparison enables us to infer whether and to what

Table 12: Tests on Changes in Observed Market Size

	Total servings	
	(1)	(2)
Indicator: post introduction	261.144	500.496
	(357.344)	(362.646)
Constant	83630.825***	83457.755***
	(302.018)	(307.098)
Market	×	×
Month	×	
Quarter		×
R^2	0.886	0.880
Obs.	13000	13000

Note: The regressions use data at the market-week level. One serving is 192oz. Standard errors are shown in parentheses. *** denotes the 0.1% significance level.

extent, before introducing Vanilla Coke, Coca Cola correctly anticipated the future changes in market variables. In what follows we present such a comparison for market size, outside brands, and rivals' pricing and marketing strategies.

Market size: When making its decision to introduce Vanilla Coke, Coca Cola should have considered the overall size of the market for soft drinks. We first test whether the pre-introduction market size is different from the actual level. We regress the total servings on an indicator of the post-introduction period using data at the market-week level and include month or quarter dummies to control for the seasonality in soft drink demand. Results are presented in Table 12. The coefficient on the indicator for the post-introduction period is not significant, suggesting that the market size barely changed following the introduction of Vanilla Coke.

Coca Cola's expectations could also be based on the growth rates of market size in the pre-introduction period. We investigate this by regressing market size on a quarterly time variable, the coefficient of which should be significant when there is growth or decline over time. In Table 13, we report results with aggregate data from only the pre-introduction period. The coefficients are not significant, implying that there is no quarterly growth detected. Therefore, no significant evidence supports the conjecture that the overall market size could have increased following the introduction of the new brand. Coca Cola's expectation of a

Table 13: Tests on Quarterly Growth of Market Size in Pre-Period

	Total servings	
	(1)	(2)
Quarter	-5822.618	-5822.618
	(20683.642)	(2997.714)
Constant	974903.890***	974903.890***
	(80551.214)	(11674.418)
Market		×
R^2	0.000	0.982
Obs.	300	300

Note: The regressions use aggregate data at the market-quarter level from the pre-introduction periods. Standard errors are shown in parentheses. *** denotes the 0.1% significance level.

larger market size seems to have been unreasonable. It mistakenly believed that the overall demand for soft drinks would grow over time or that the introduction of Vanilla Coke might stimulate consumer interest, thereby expanding the existing size of the soft drink market. However, it turns out that Vanilla Coke did not create such a market expansion effect and that consumers were not stimulated to buy more soft drinks following the introduction of this new product. They simply experimented with the new brand upon introduction before then returning to existing major brands.

Market shares of outside brands: Coca Cola's expectation that inside shares would be larger may be derived from the possibility that Vanilla Coke would attract demand away from fringe brands that make up the outside option, thereby expanding its total market share. We investigate whether this did in fact occur by regressing market shares on the post-introduction indicator and controlling for market and month fixed effects. In Table 14, results are reported for the three major firms and private-label brands. These brands are often owned by stores or retail chains and offer similar soft drink products, and they are a major component of the outside brands.

Compared with the pre-introduction level, private labels experience a significant increase in market share of about 1.21% after the introduction of Vanilla Coke. Importantly, throughout our post-introduction sample period, the average price of private labels keeps

Table 14: Tests on Changes in Major Players' Market Shares

	Percentage			
	Coca Cola	PepsiCo	Cadbury Schweppes	Private label
Indicator: post introduction	-0.383*	-0.198	-0.384***	1.205***
	(0.171)	(0.161)	(0.070)	(0.069)
Constant	36.874***	32.672***	16.924***	10.217***
	(0.146)	(0.138)	(0.060)	(0.059)
Market	×	×	×	×
Month	×	×	×	×
R^2	0.442	0.578	0.678	0.770
Obs.	13000	13000	13000	12958

Note: Robust standard errors are shown in parentheses. ***, **, and * denote the 0.1%, 1%, and 5% significance level, respectively.

Table 15: Tests on Quarterly Growth of Private Shares in Pre-Period

	Shares of Private Label	
	(1)	(2)
Quarter	-0.001	-0.001
	(0.002)	(0.001)
Constant	0.097***	0.097***
	(0.008)	(0.002)
Market		×
R^2	0.001	0.949
Obs.	300	300

Note: The regressions use data of private label brands at the market-quarter level from the pre-introduction periods. Standard errors are shown in parentheses. *** denotes the 0.1% significance level.

decreasing until 2005. Meanwhile they offer more and more display promotions over the years. As a result, their market shares increased at the expense of inside brands, except in 2002 when Vanilla Coke first entered the market.[7] By contrast, Coca Cola's total market shares decreased by 0.38% after Vanilla Coke's introduction. The change in PepsiCo's market shares is not significant. And Cadbury Schweppes experienced a significant decline in market shares of about 0.38%. These results suggest that, not only did outside shares not fall after the introduction of Vanilla Coke, but in fact they expanded, the opposite of what Coca Cola may have expected.

[7]In Appendix G, we report regression results showing how price, display and shares of private labels evolve over time.

Table 16: Changes in Average Price and Display of Rival Brands

	2002	2003	2004	2005
Price ($/192oz)				
PEPSI	-0.05	N/A	0.09	0.18
DIET PEPSI	-0.07	-0.04	0.05	0.16
MOUNTAIN DEW	-0.12	-0.08	N/A	0.17
CAFFEINE FREE DIET PEPSI	-0.14	-0.16	-0.08	0.04
CAFFEINE FREE PEPSI	-0.14	-0.15	-0.12	-0.06
DIET MOUNTAIN DEW	-0.16	-0.18	-0.10	N/A
DR PEPPER	-0.24	-0.16	-0.04	0.09
7 UP	-0.14	-0.12	N/A	0.15
A & W	-0.12	0.15	0.21	0.32
DIET DR PEPPER	-0.28	-0.20	-0.10	N/A
CANADA DRY	-0.07	N/A	0.09	0.10
Display (Units)				
PEPSI	3	4	13	12
DIET PEPSI	3	5	14	16
MOUNTAIN DEW	N/A	3	10	9
CAFFEINE FREE DIET PEPSI	3	4	11	14
CAFFEINE FREE PEPSI	1	N/A	-1	-2
DIET MOUNTAIN DEW	1	N/A	4	8
CADBURY SCHWEPPES P.L.C.				
DR PEPPER	N/A	5	7	7
7 UP	N/A	N/A	N/A	N/A
A & W	2	5	5	7
DIET DR PEPPER	N/A	3	6	9
CANADA DRY	6	9	10	11

Note: The table report changes in the level of price or display. Only changes that are significant at the 5% or smaller level are reported. Insignificant changes are denoted as N/A.

The importance of private-label brands may have been misjudged by Coca Cola because the changes in their shares were unexpected. To investigate this, we examine the growth rate of private shares in the pre-introduction period. In Table 15, we present results from a regression of shares of private labels on a quarterly time variable and market dummies using only data from the pre-period. No significant growth was detected based on these regressions. We conclude that Coca Cola did not expect the position of private labels to be growing in the market. Its anticipation about outside shares appears to have been in the wrong direction. It may have believed Vanilla Coke could steal market shares from outside brands, but in fact private labels stand out as more affordable options.

Rival firms' pricing and marketing strategies: Lastly, Coca Cola should also

Table 17: Tests on Quarterly Growth of Rival Brands in Pre-Periods

	Display		Price	
	(1)	(2)	(3)	(4)
Quarter	0.055	0.055	-0.025***	-0.025***
	(2.700)	(1.830)	(0.005)	(0.004)
Constant	346.159***	346.159***	3.926***	3.926***
	(10.514)	(7.128)	(0.019)	(0.015)
Market	×	×	×	×
Brand		×		×
R^2	0.329	0.693	0.319	0.584
Obs.	3300	3300	3300	3300

Note: The regressions use data at the brand-market-quarter level from the pre-introduction periods, and only inside brands from PepsiCo and Cadbury Schweppes are included. Standard errors are shown in parentheses. *** denotes the 0.1% significance level.

have forecast that its rivals would react via their pricing and display advertising. To investigate this, we first estimate for each rival brand the changes in prices and displays by regressing these variables on an indicator of the post-introduction period. Data are aggregated at the chain-quarter level to match the data structure in the demand estimation and chain fixed effects are included. We report the significant changes in Table 16 for each year. In 2002-2003, most rival brands decreased prices compared with the pre-introduction period. By contrast, in 2004, some rival brands further reduced their prices while some had price increases. Finally in 2005, most brands experienced higher prices than the pre-introduction period. As for display promotions, most rival brands offered more display promotions than they did before the introduction. Therefore, at least between 2002 and 2004, rival firms reduced prices and increased displays as a reaction to Vanilla Coke's appearance.

We also test potential growth (or decline) in displays (or prices) within the pre-introduction period. Data are constructed at the brand-market-quarter level and only inside brands from PepsiCo and Cadbury Schweppes are included. We regress prices or displays on a quarterly time variable with controls on market and/or brand fixed effects. In Table 17, results indicate that while there was no significant growth in display, prices of rival brands did experience significant decreases throughout the pre-introduction period.

We then use year 2002 as an example to evaluate Coca Cola's expectations about

rivals' pricing and display strategies. As a simplification, we focus on the average price or display of all rival brands across markets and quarters. The pre-introduction level of display promotions is 17.97 units. From our estimates in Section 7.1, the required level of 19.33 units lies between this pre-introduction level and the actual level of 19.95 units. Therefore, Coca Cola had anticipated part of the potential increase in rival displays following the introduction although its prediction was still below the realizations.

Turning to prices, in the last quarter of the pre-introduction period, the average price was \$3.937. Based on the estimated quarterly decline of \$0.025 (in Table 17), the predicted price after the introduction should be \$3.912 without consideration of rivals' reactions to the new brand. The required level of \$3.910 lies between this prediction and the actual level of \$3.853. In other words, it had predicted the decline in rival prices using pre-period information and part of the further decline due to rivals' reaction to Vanilla Coke. Nevertheless, the actual level was even beyond its predictions.

The above comparison of different market variables indicates that Coca Cola did not correctly anticipate the overall market size and outside shares, but it did predict part of its rivals' pricing and marketing strategies. Based on the partially correct anticipation, it had overestimated the future profitability of introducing Vanilla Coke. In the post-introduction period, the nearly unchanged market size, unexpected growth of private labels, and unexpected price decrease and display increase by rivals together made it more difficult for Vanilla Coke to survive. Hoping that its expectations regarding the market variables were correct, Coca Cola introduced Vanilla Coke in the first place, but it did not fulfill its targeted profit level given the intense market conditions and ended up existing the market.

7.3 Market variables and cannibalization

We also investigate how cannibalization effects will change when the market variables are adjusted to their required levels. In Table 18, we compare cannibalization in different scenarios. A larger market size, larger inside shares, higher prices and lower displays of

Table 18: Estimates of Cannibalization Effects in Counterfactuals (Million Dollars)

	2002	2004	2002-2004
Baseline	-5.204	-1.741	-10.717
Change in Market size	-2.047	2.027	-4.795
Change in Inside shares	-2.047	2.027	-4.795
Change in Rivals' display	-2.039	2.030	-4.772
Change in Rivals' price	-2.051	2.025	-4.803
Change in Other Own Brands' Display	-2.481	1.873	-5.954
Chnage in Vanilla Coke's Display	-6.088	-2.711	-12.292

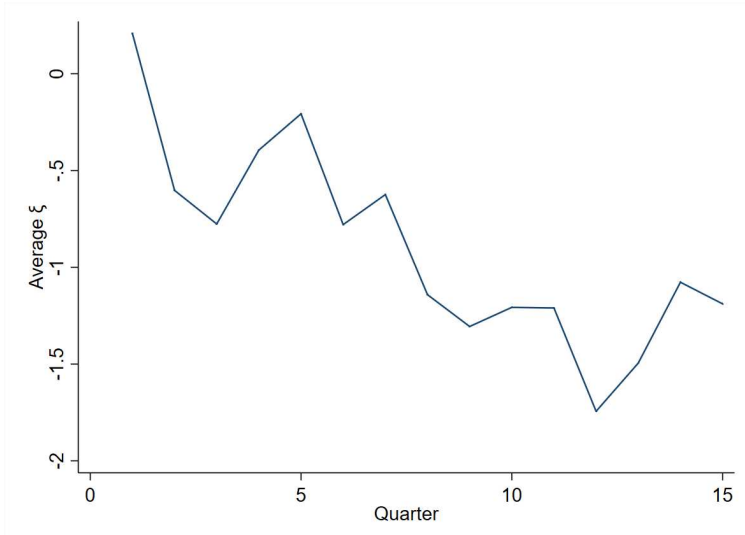
Note: Media expenses and baseline profit are in terms of million dollars. Changes in different variables reflect the percentage changes from the observed level.

rival brands, and higher displays of own brands would have less negative impacts on the cannibalization effect. These changes in market variables allow Coca Cola to re-optimize over all its inside brands, so other own brands can also benefit. In the case where displays of Vanilla Coke itself increased, the cannibalization effect would be more negative since such an increase would only benefit the new brand and other own brands would become less competitive.

7.4 Consumer tastes and profitability

Apart from the market variables already discussed, consumer tastes can also play a role in affecting the profitability of Vanilla Coke. Borkovsky et al. (2017), for example, find that consumers derive less values from brands over time and that the depreciation rate of such values affect how much firms can derive from the brands. In Figure 4, we see sales that are high when a new product is launched because consumers are eager to try it. But as the novelty of the new product dies away, only some consumers stick with it while others slowly switch back to the established products. This can be seen more clearly when we plot the average estimates of Vanilla Coke's ξ_{jt} term, which measures unobserved consumer tastes. In Figure 5, we see that consumer tastes for Vanilla Coke experience an initial increase followed by a persistent decline. It can be very difficult for firms to predict such an evolution of consumer tastes because the elevated sales they witness around the initial launch period can

Figure 5: Mean Estimates of Unobserved Taste (ξ) for Vanilla Coke over Time



Note: Average values are taken across all markets in the same time period. The horizontal axis shows the numbers of quarters after Vanilla Coke introduction.

Table 19: Profit Gains from Vanilla Coke with Constant ξ (Million Dollars)

Year	Total profit gain		Media expenses
	Baseline	Constant ξ	
2004	6.973	14.596	10.797
2002-2004	41.036	53.813	47.132

misleadingly suggest that the new product will be successful.

To investigate the extent to which difficulty in forecasting future tastes contributed to Vanilla Coke's failure, we consider what would have happened had consumer tastes remained constant at the level they were at when PepsiCo introduced its rival product, Pepsi Vanilla. We conjecture that, at this point in time, it might still have been reasonable for Coca Cola to believe that a vanilla-flavored cola would succeed, since otherwise PepsiCo should not have bothered to launch Pepsi Vanilla. We then simulate the new equilibrium for all subsequent periods with ξ_{jt} in each market being at the assumed level and calculate the profit gain. Since the introduction of Pepsi Vanilla occurred in 2003, we conduct this exercise for the year 2004 and the entire period from 2002 to 2004. The assumed values of ξ_{jt} are computed from the demand estimates for the two time ranges, respectively. Table 19 reports the results.

Compared with baseline estimates, the total profit gains from Vanilla Coke would become larger if consumer tastes could stay constant after Pepsi Vanilla's introduction. And they would be enough to cover the media expenses. This implies that Coca Cola's anticipation of consumer tastes made it mistakenly believe that Vanilla Coke would still be profitable in the near future. The incorrect forecast based on the initial popularity contributes to the failure of Vanilla Coke.

8 Conclusion

In this paper, we investigate reasons for the introduction and exit of Vanilla Coke in the U.S. soft drinks industry. We estimate a nested logit demand system with a Bertrand-Nash equilibrium on the supply side. Then we apply the structural estimates to conduct counterfactual analysis to quantify the profit changes from the new brand over time. Our estimation results show that Vanilla Coke would generate positive but declining profit gains for Coca Cola, and these profit gains could not cover large fixed costs. The low profitability of Vanilla Coke is affected by limited market demand for soft drinks, private label presence, and rivals' reaction in price and display promotions. It failed to create a market-expansion effect to attract more consumers in the long run, which may not have been predicted by Coca Cola. Before it introduced the brand, the company had anticipated some reaction on the part of its rivals, but the actual changes were even more intense, which contributed to the exit of Vanilla Coke. We also find Vanilla Coke would create a cannibalization effect on Coca Cola's other major brands, causing them suffer reduced profits as a result of the introduction. Such an impact would be mitigated when we allow market variables such as inside shares and rivals' price or displays to change in order to increase the profitability of Vanilla Coke.

Some caveats about our results still exist. The comparison of profit estimates and media expenditure is rather conservative; with detailed data on fixed costs the estimation

could be improved. Furthermore, our static model does not take into account firms' learning process about demand uncertainty. We do not model previous entry strategies of firms and their endogenous choice of product characteristics. Future research can be done along these lines.

On a final note, after discontinuing Vanilla Coke in 2005, Coca Cola introduced a similar product called Black Cherry Vanilla Coke in 2006. This product did not last long due to very low sales and exited the market in 2007. Meanwhile Coca Cola brought back Vanilla Coke to the US market in May 2007. During this re-introduction period, although its market share increased to a peak value of around 0.3% within the first eight weeks, it declined again to only 0.1% afterwards. As a comparison, its market share toward the end of 2005 was around 0.2%. Also, Vanille Cooke no longer figured amongst Brandweek's top 2000 brands with the largest media expenditures after 2007. The last brand on this list spends on average $9.8 million per year, which implies that Coca Cola devoted even less than this amount to advertising Vanilla Coke. Due to data limitations, we are not able to analyze Vanilla Coke's performance after 2007. Nevertheless, we can still infer from its low market share and small media expenditures that Coca Cola took a different strategy on this brand when bringing it back. The second time around it treated Vanilla Coke as one of its many fringe soft drink products, spending little on media expenditures and sustaining low market share.

References

[1] D. Aaker. Brand extensions: The good, the bad, and the ugly. *MIT Sloan Management Review*, 31(4):47, 1990.

[2] M. B. Ataman, C. F. Mela, and H. J. Van Heerde. Building brands. *Marketing Science*, 27(6):1036–1054, 2008.

[3] S. Berry, A. Eizenberg, and J. Waldfogel. Optimal product variety in radio markets. *The Rand journal of economics*, 47(3):463–497, 2016.

[4] S. Berry, J. Levinsohn, and A. Pakes. Voluntary export restraints on automobiles: Evaluating a trade policy. *American Economic Review*, 89(3):400–430, 1999.

[5] S. Berto Villas-Boas. Vertical relationships between manufacturers and retailers: Inference with limited data. *The Review of Economic Studies*, 74(2):625–652, 2007.

[6] R. N. Borkovsky, A. Goldfarb, A. M. Haviv, and S. Moorthy. Measuring and understanding brand value in a dynamic model of brand management. *Marketing Science*, 36(4):471–499, 2017.

[7] B. J. Bronnenberg, M. W. Kruger, and C. F. Mela. Database paper—The IRI Marketing Data Set. *Marketing Science*, 27(4):745–748, 2008.

[8] H.-J. Choi, M. K. Wohlgenant, and X. Zheng. Household-Level Welfare Effects of Organic Milk Introduction. *American Journal of Agricultural Economics*, 95(4):1009–1028, 06 2013.

[9] T. Dhar, J.-P. Chavas, R. W. Cotterill, and B. W. Gould. An econometric analysis of brand-Level strategic pricing between Coca-Cola Company and PepsiCo. *Journal of Economics & Management Strategy*, 14(4):905–931, 2005.

[10] A. Dixit and P. K. Chintagunta. Learning and exit behavior of new entrant discount airlines from city-pair markets. *Journal of Marketing*, 71(2):150–168, 2007.

[11] M. Draganska, M. Mazzeo, and K. Seim. Beyond plain vanilla: Modeling joint product assortment and pricing decisions. *Quantitative Marketing and Economics*, 7(2):105–146, 2009.

[12] J.-P. Dubé. Multiple discreteness and product differentiation: Demand for carbonated soft drinks. *Marketing Science*, 23(1):66–81, 2004.

[13] J.-P. Dubé. Product differentiation and mergers in the carbonated soft drink industry. *Journal of Economics & Management Strategy*, 14(4):879–904, 2005.

[14] A. Eizenberg. Upstream innovation and product variety in the U.S. home PC market. *The Review of economic studies*, 81(3 (288)):1003–1045, 2014.

[15] Y. Fan. Ownership consolidation and product characteristics: A study of the US daily newspaper market. *The American economic review*, 103(5):1598–1628, 2013.

[16] Y. Fan and C. Yang. Competition, product proliferation, and welfare: A study of the US smartphone market. *American Economic Journal: Microeconomics*, 12(2):99–134, 2020.

[17] A. Gandhi and J.-F. Houde. Measuring substitution patterns in differentiated products industries. Technical report, National Bureau of Economic Research, 2020.

[18] F. Gasmi, J. Laffont, and Q. Vuong. Econometric analysis of collusive behavior in a soft-drink market. *Journal of Economics & Management Strategy*, 1(2):277–311, 1992.

[19] M. Giacomo. GMM estimation of a structural demand model for yogurt and the effects of the introduction of new brands. *Empirical Economics*, 34(3):537 – 565, 2008.

[20] A. Golan, L. S. Karp, and J. M. Perloff. Estimating Coke's and Pepsi's price and advertising strategies. *Journal of Business & Economic Statistics*, 18(4):398–409, 2000.

[21] A. Goldfarb, Q. Lu, and S. Moorthy. Measuring brand value in an equilibrium framework. *Marketing Science*, 28(1):69–86, 2009.

[22] A. Goolsbee and A. Petrin. The consumer gains from direct broadcast satellites and the competition with cable tv. *Econometrica*, 72(2):351–381, 2004.

[23] J. A. Hausman. Valuation of new goods under perfect and imperfect competition. In *The economics of new goods*, pages 207–248. University of Chicago Press, 1996.

[24] J. A. Hausman and G. K. Leonard. The competitive effects of a new product introduction: A case study. *The Journal of Industrial Economics*, 50(3):237–263, 2002.

[25] I. Hendel and A. Nevo. Measuring the implications of sales and consumer inventory behavior. *Econometrica*, 74(6):1637–1673, 2006.

[26] G. J. Hitsch. An empirical model of optimal dynamic product launch and exit under demand uncertainty. *Marketing Science*, 25(1):25–50, 2006.

[27] T. J. Holmes. The diffusion of Wal-Mart and economies of density. *Econometrica*, 79(1):253–302, 2011.

[28] M. Igami and N. Yang. Unobserved heterogeneity in dynamic games: Cannibalization and preemptive entry of hamburger chains in Canada. *Quantitative Economics*, 7(2):483–521, 2016.

[29] F. Luco and G. Marshall. The competitive impact of vertical integration by multiproduct firms. *American Economic Review*, 110(7):2041–64, 2020.

[30] N. G. Mankiw and M. D. Whinston. Free entry and social inefficiency. *The RAND Journal of Economics*, pages 48–58, 1986.

[31] D. McFadden. Econometric models of probabilistic choice. *Structural analysis of discrete data with econometric applications*, 198272, 1981.

[32] N. H. Miller and M. C. Weinberg. Understanding the price effects of the MillerCoors joint venture. *Econometrica*, 85(6):1763–1791, 2017.

[33] A. Mukherjee and V. Kadiyali. The competitive dynamics of new DVD releases. *Management Science*, 64(8):3536–3553, 2018.

[34] A. Nevo. Measuring market power in the ready-to-eat cereal industry. *Econometrica*, 69(2):307–342, 2001.

[35] A. Nevo. New products, quality changes, and welfare measures computed from estimated demand systems. *The Review of Economics and Statistics*, 85(2):266–275, 2003.

[36] A. Petrin. Quantifying the benefits of new products: The case of the minivan. *Journal of Political Economy*, 110(4):705–729, 2002.

[37] Q. Shen. A dynamic model of entry and exit in a growing industry. *Marketing Science*, 33(5):712–724, 2014.

[38] Statista. Non-alcoholic beverages and soft drinks in the United States. Dossier 10629, 2019.

[39] Statista. Non-alcoholic beverages and soft drinks worldwide. Dossier 10631, 2019.

[40] J. Stavins. Model entry and exit in a differentiated-product industry: The personal computer market. *The Review of Economics and Statistics*, pages 571–584, 1995.

[41] G. L. Urban and J. R. Hauser. *Design and marketing of new products* . Prentice-Hall, Englewood Cliffs, N.J., 2nd edition, 1993.

[42] J. R. Webb. Scrapping new product development efforts: when to keep going, when to fold. *Journal of Business Strategy*, 2016.

[43] T. G. Wollmann. Trucks without bailouts: Equilibrium product characteristics for commercial vehicles. *American Economic Review*, 108(6):1364–1406, 2018.

[44] N. Yang. Learning in retail entry. *International Journal of Research in Marketing*, 37(2):336–355, 2020.

Appendices

A Estimation Results with Unadjusted Values

Table A1: Demand Estimates for the Soft Drinks Industry (Unadjusted Price and Display)

	Logit		Nested logit
	(1) OLS	(2) IV GMM	(3) IV GMM
Price	-0.551	-0.907	-1.265
	(0.018)	(0.052)	(0.063)
Minor display	4.067	6.297	3.336
	(0.040)	(0.135)	(0.161)
Caffeine	1.180	0.649	0.455
	(0.039)	(0.064)	(0.038)
Calories	0.935	0.090	0.251
	(0.099)	(0.134)	(0.077)
Citric acid	0.453	0.142	0.205
	(0.022)	(0.034)	(0.020)
Caramel color	0.494	0.387	0.530
	(0.017)	(0.020)	(0.013)
σ			0.441
			(0.021)
Market/Quarter	×	×	×
Firm	×	×	×
R^2	0.623	0.502	0.829
Obs.	12800	12800	12800

Note: Robust standard errors are reported in parentheses. For comparison, the price coefficient for nested logit is the adjusted price parameter, $\alpha/(1-\sigma)$, and its standard error is calculated by the delta method.

Table A2: Changes in Firms' Profits (Million Dollars, Full Sample)

	(1) Adjusted	(2) Unadjusted
Coca Cola	5.794	4.060
PepsiCo	-2.495	-1.380
Cadbury Schweppes	-0.206	-0.175
Total	3.062	2.505

B Tests on Pepsi's Marketing Variables in Week 6 & 7

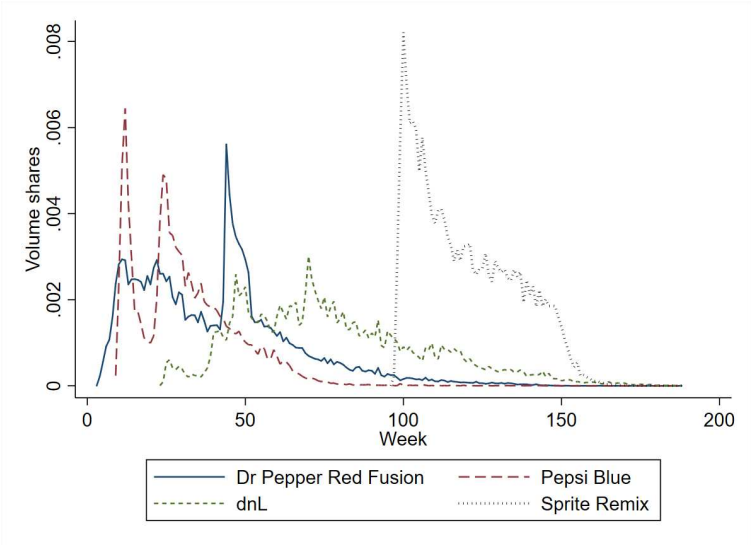
Table B1: Changes of Pepsi's Marketing Variables in Week 6 & 7

	Price	Display	Feature	Price reduction
Indicator: week 6 and 7	-0.342***	0.076***	0.313***	0.234***
	(0.014)	(0.016)	(0.024)	(0.019)
Constant	4.010***	2.203***	1.408***	1.952***
	(0.002)	(0.003)	(0.004)	(0.004)
Store	×	×	×	×
Quarter	×	×	×	×
R^2	0.468	0.599	0.295	0.371
Obs.	67308	67308	67308	67308

Note: Regressions in this table use the store-week level data in 2002. Robust standard errors are in parentheses. *** denotes the 0.1% significance level.

C Volume Shares of Unsuccessful Soft Drinks Brands

Figure C1: Volume Shares of Soft Drinks Brands that Fail



Note: Weekly volume shares are defined within the total observed volumes across all markets in the data set. The horizontal axis shows the numbers of weeks after Vanilla Coke introduction.

D Estimation Results of Coke Classic

Table D1: Profit Gains and Media Expenses from Coke Classic (Million Dollars)

Year	Total profit gain	Media expense
2002	268.916	94.523
2003	267.968	107.649
2004	214.941	123.363
2005	262.528	123.566

E Estimation Results with Brand-Year Fixed Effects

Table E1: Changes in Firms' Profits Year by Year (Million Dollars)

Panel A: Baseline				
	Year 2002	Year 2003	Year 2004	Year 2005
Coca Cola	3.615	2.940	1.252	0.973
PepsiCo	-0.613	-0.506	-0.212	-0.162
Cadbury Schweppes	-0.218	-0.167	-0.073	-0.055
Total	2.784	2.267	0.968	0.756
Panel B: With Brand-Year Fixed Effects				
	Year 2002	Year 2003	Year 2004	Year 2005
Coca Cola	3.398	3.529	1.627	1.000
PepsiCo	-0.576	-0.607	-0.275	-0.166
Cadbury Schweppes	-0.205	-0.201	-0.094	-0.057
Total	2.617	2.722	1.257	0.777

Note: Estimates in Panel A are calculated using the main specification with product characteristics. In Panel B, brand-year fixed effects are controlled and product characteristics are removed to avoid perfect collinearity.

Table E2: Profit Gains and Media Expenses from Vanilla Coke (Million Dollars)

	Total profit gain		Media expense
	Baseline	Brand-Year Fixed Effects	
2002	19.365	18.205	22.679
2003	15.460	18.560	13.656
2004	6.973	9.057	10.797
2005	5.656	5.812	N/A
2002-2004	41.036	47.852	47.132

F Estimation Results with Random Coefficient Logit Models

Table F1: Changes in Firms' Profits Year by Year (Million Dollars)

Panel A: With Product Characteristics				
	Year 2002	Year 2003	Year 2004	Year 2005
Coca Cola	2.634	1.898	1.032	0.663
PepsiCo	-1.011	-1.096	-0.368	-0.178
Cadbury Schweppes	-0.461	-0.490	-0.238	-0.194
Total	1.162	0.312	0.426	0.291
Panel B: With Brand-Year Fixed Effects				
	Year 2002	Year 2003	Year 2004	Year 2005
Coca Cola	3.855	3.004	1.610	1.036
PepsiCo	-1.002	-0.718	-0.323	-0.159
Cadbury Schweppes	-0.328	-0.248	-0.123	-0.109
Total	2.525	2.038	1.163	0.767

Note: To estimate random coefficients, the family income level from PUMS is included as household demographics. In Panel A, the linear characteristics also include market-quarter fixed effects, and the non-linear coefficients are estimated for all product characteristics. In Panel B, the linear characteristics include brand-year and market-quarter fixed effects, and the non-linear coefficients are estimated for price and display.

Table F2: Profit Gains and Media Expenses from Vanilla Coke (Million Dollars)

	Total profit gain		Media expense
	Product Characteristics	Brand-Year Fixed Effects	
2002	14.112	20.653	22.679
2003	9.979	15.797	13.656
2004	5.743	8.961	10.797
2005	3.856	6.020	N/A
2002-2004	30.545	46.428	47.132

Note: Estimates of total profit gains are obtained by random coefficient logit models with either product characteristics or brand-year fixed effects.

G Regression Results on Private Labels

Table G1: Changes in Price of Private Label over Time

	Price				
	(1)	(2)	(3)	(4)	(5)
	Jan 2001-Dec 2005	Jan 2001-Dec 2002	May 2002-Dec 2003	Jan 2003-Dec 2004	Jan 2004-Dec 2005
Indicator: post-introduction	-0.110***	-0.121***			
	(0.005)	(0.009)			
Indicator: year 2003			-0.018*		
			(0.007)		
Indicator: year 2004				-0.037***	
				(0.005)	
Indicator: year 2005					0.085***
					(0.005)
Constant	2.588***	2.593***	2.491***	2.473***	2.435***
	(0.005)	(0.005)	(0.006)	(0.004)	(0.004)
Month FE	×	×	×	×	×
Market FE	×	×	×	×	×
R^2	0.479	0.524	0.627	0.535	0.565
Obs.	12958	5200	4175	5158	5183

Note: Data are constructed at the market-week level. Robust standard errors are reported in parentheses. ***, **, and * denote the 0.1%, 1%, and 5% significance level, respectively.

Table G2: Changes in Display of Private Label over Time

	Display				
	(1)	(2)	(3)	(4)	(5)
	Jan 2001-Dec 2005	Jan 2001-Dec 2002	May 2002-Dec 2003	Jan 2003-Dec 2004	Jan 2004-Dec 2005
Indicator: post-introduction	25.563***	7.902***			
	(0.436)	(0.567)			
Indicator: year 2003			18.335***		
			(0.671)		
Indicator: year 2004				6.725***	
				(0.569)	
Indicator: year 2005					2.637***
					(0.633)
Constant	31.004***	31.119***	37.590***	54.770***	61.457***
	(0.347)	(0.259)	(0.477)	(0.394)	(0.428)
Month FE	×	×	×	×	×
Market FE	×	×	×	×	×
R^2	0.685	0.761	0.814	0.817	0.771
Obs.	12958	5200	4175	5158	5183

Note: Data are constructed at the market-week level. Robust standard errors are reported in parentheses. ***, **, and * denote the 0.1%, 1%, and 5% significance level, respectively.

Table G3: Changes in Shares of Private Label over Time

	Percentage shares				
	(1)	(2)	(3)	(4)	(5)
	Jan 2001-Dec 2005	Jan 2001-Dec 2002	May 2002-Dec 2003	Jan 2003-Dec 2004	Jan 2004-Dec 2005
Indicator: post-introduction	1.205***	-0.072			
	(0.069)	(0.109)			
Indicator: year 2003			0.565***		
			(0.107)		
Indicator: year 2004				1.060***	
				(0.083)	
Indicator: year 2005					-0.035
					(0.080)
Constant	10.217***	10.243***	10.358***	10.989***	12.021***
	(0.059)	(0.057)	(0.083)	(0.062)	(0.055)
Month FE	×	×	×	×	×
Market FE	×	×	×	×	×
R^2	0.770	0.792	0.810	0.823	0.826
Obs.	12958	5200	4175	5158	5183

Note: Data are constructed at the market-week level. Robust standard errors are reported in parentheses. ***, **, and * denote the 0.1%, 1%, and 5% significance level, respectively.