Effects of the Private-Label Invasion in Food Industries

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Using supermarket scanner data, we test a variety of hypotheses from trade journals about the invasion of private-label food products. According to conventional industry wisdom, name-brand firms defended their brands against new private-label products by lowering their prices, engaging in additional promotional activities, and increasingly differentiating their products. Our empirical evidence is inconsistent with these beliefs.

Key words: private label, entry, price, promotional activity, differentiation, supermarket.

When the share of private-label processed foods and beverages increases, brand-name firms' prices tend to rise and their promotional activities fall contrary to widely held beliefs about this industry. We use recent grocery scanner data to examine the effects of private-label entry on prices, promotional activities, and product diversification in thirty-two food and beverage industries.

Although the food industry trade journals and newspapers have extensively discussed the "invasion" of private-label products over the last decade, academics have largely ignored the effects of this entry on prices, advertising, and product diversification. A few researchers have discussed why firms produce private labels (Bontems, Dilhan, and Requillart; Galizzi, Venturini, and Boccaletti), why retailers sell them (Mills, 1995; Dhar and Hoch; Narasimhan and Wilcox), and why prices differ between private-label and branded goods (Conner and Peterson, Hinloopen and Martin).

The only academic papers that have explicitly examined the magnitude and speed of private-label penetration or the response of brand-name firms to such entry tend to support the conventional business wisdom. Rao and Mills (1999) derive optimal theoretical responses to the entry of private-label goods in stylized models, and conclude that name-brand firms should increase promotion and product diversification. The only previous empirical studies, Putsis and Cotterill and Putsis, that focus on brand proliferation and demand and market structure responses respectively, conclude that private-label penetration lowered the 1991–92 average price of national brands. Although this finding may have been accurate in the early 1990s when the "invasion" started, we find the opposite using more recent data.

In the first section we summarize the food industry's conventional wisdom about private-label products in a series of stylized facts. Although these stylized facts about the effects of entry are consistent with standard economic intuition, we describe in the section Economic Theory about Entry and Prices, four economic theories explaining why prices in noncompetitive markets may rise despite entry of new firms and products. In the section Data, we describe our grocery scanner data set covering thirty-two food and beverage industries. We discuss our empirical results and econometric methodology in the sections Evidence on the Private-Label Invasion and Evidence on Name-brand Responses respectively. In Summary and Conclusions, we summarize our findings and draw conclusions.

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Stylized Facts

By searching Lexis-Nexis files of newspaper articles and trade journals, we identified the received wisdom from the food and beverage industries. We summarize these common beliefs as stylized "facts". Although we report these claims here as though they were facts, we will show that many of them are not true today (even if they were true at the time the statements were made).

Private-Label Invasion

Discount brands were introduced into American supermarkets in the late 1970s (Janofsky). As one article stated, consumers long regarded such a product as "a cheap and nasty generic substitute for the real thing, rolled out by retailers during recessions and discarded once the economy picked up again" (The Economist). However, as that article notes, consumers changed their view when high-quality private-label products were introduced in the late 1980s and early 1990s.

The substantial quality improvement of private labels resulted from technological advances and production by name-brand firms. Technological advances allowed competitors to "come close" to replicating successful national brands (Kennedy). Additionally, some national brands started producing private-label versions of their name-brand products, often to employ the excess capacity in their plants. Examples include Campbell Soup (Vlasic pickles), Union Carbide (garbage bags), Hershey Foods (Ronzoni pasta), and Del Monte (canned fruits and vegetables) (Janofsky, Beckett). Other name-brand firms produced private-label brands in different categories from their own. For example, H. J. Heinz Company, the leading producer of ketchup, makes about 80% of the private-label soups sold in supermarkets (Beckett).

Consumers were becoming increasingly aware of private-label improvements as well. A Gallup Poll commissioned by the Private Label Manufacturers Association (PLMA) reported that consumers' store brand awareness rose from 86% in 1991 to 91% in 1995, and the percentage of consumers who regularly bought private-label brands increased from 77% to 83% (Responsive Database Services Inc.). Of consumers surveyed, 76% agreed that store brands were "brands just like national brands." Of consumers who had bought premium private label items, 90% rated the products equal to or better than national brands and planned to buy private-label products in the future (Doug, Palmer).

Supermarkets started prominently displaying house brands while dropping second-tier national brands in many categories (Janofsky). According to some reports, brands ranked third, fourth, or fifth were particularly hard hit.

Supermarket chains learned that private labels provided higher profits than national brands. According to Jonathan Ziegler, a retail-industry analyst at Sutro & Co., the gross margins on store brands may be 35% or more, versus an average of 25% on other products (Beckett). Supermarket profits also rise from carrying private-label brands because they create loyalty to a particular supermarket chain rather than to a national brand: Customers return to Safeway if they prefer the chain's Select brands.

Response of Name-Brand Firms to Private-Label Entry

Trade journals and newspaper articles reported many round-table discussions by industry executives in which they bemoaned the invasion of private-label products and discussed how they responded. In addition to lowering prices and engaging in promotional activities, these executives said that they engaged in brand building (Nijssen and Van Trijp) by increasingly differentiating their products. For example, when consumers started switching from Kellogg's to private-label cereals similar to popular Kellogg's brands (that sell at roughly half the price), Kellogg announced that it was issuing more coupons to make its prices more competitive with generic brands, improving its advertising, and further diversifying its products (MacDonald, 1998).

Price responses. Many national brand executives reported that the private-label invasion was killing brand loyalty, so that they had to cut prices to compete. This reasoning was given by Philip Morris when it cut its price for Marlboro cigarettes, Procter & Gamble when it reduced the price of Pampers diapers by a quarter, and Kraft General Foods when it lowered its cheese prices by 8% (Beckett, de Jonquieres and Tait). Many other firms reported that they lowered their prices indirectly by means of sales and discount coupons.

Promotional activities. Name-brand manufacturers reported increasing point-of-purchase promotional activities in response to the new competition.[1] The share of promotional budgets allocated to point-of-purchase expenditures and advertising were 73% and 27% in 1992, compared to 62% and 38% respectively in 1960 (Lenius). From 1980 to 1992, U.S. food manufacturers' spending on promotional schemes, such as money-off offers and coupons, rose from half to three-quarters of total marketing budgets, while advertising's share fell from 44% to 25% (de Jonquieres and Tait).

Differentiation. The executives contend that their brands are maintained through differentiation. According to Quaker Oats' CEO Robert S. Morrison, "Leading brands possess great long-term value only if they can evolve over time to respond to the tastes and needs of new generations" (Martin and Kubomura). Dale F. Morrison, president and CEO of Campbell Soup, said "We are making our brands more contemporary, more relevant and more convenient to consumers of all ages" (Martin and Kubomura). For instance, Campbell produced new soup varieties and packaging formats such as its ready-to-serve tomato soup in resealable plastic containers and Campbell's Soup To Go in microwaveable single-serve bowls.

One might think of constantly providing new products as a flagpole strategy: "Let's run it up the flagpole and see who salutes it." Products that are not accepted by consumers are quickly dropped.

In recent years, an average of 27% of General Mills' volume has come from products five years old or less (Martin and Kubomura). "Our fiscal 2000 plans call for higher levels of new product innovation across our U.S. businesses," reports Stephen Sanger, chairman and CEO of General Mills. To accelerate the flow of innovative and creative products, General Mills' operating divisions now focus at least 25% of total resources on new products and new business ideas. The company has recently introduced Sunrise certified organic cereal and Yoplait Go-Gurt, a portable yogurt snack in a flexible squeeze tube that is ready to eat refrigerated or frozen.

Many managers reported that they increased the rate at which they innovate in response to the challenge of private labels.[2] For example, firms introduced 16,143 products in 1991, including 12,398 food products and 3,745 nonfood products such as diapers and shampoo, which was 22% more than they introduced the previous year (Kennedy).

In summary, according to conventional wisdom, private-label products have been persistently and rapidly penetrating grocery markets since the late 1980s. This invasion has been at the expense of national brands, and second-tier national brands were particularly hard hit. Company executives and industry experts contend that name-brand firms responded to private-label entry in three ways: Firms lowered prices, engaged in more promotional activities, and further differentiated their products.

Economic Theories about Entry and Prices

All of these stylized facts appear to be reasonable. Indeed, economists usually assume that entry leads to more competition with lower prices and possibly more promotional activities and greater differentiation.[3] However, we will present evidence that many of the stylized facts are not currently true in processed food and beverage industries. In particular, private-label entry is correlated with increased name-brand prices and reduced promotional activities. We start our analysis by briefly noting that at least four economic theories allow for price increases in response to entry.

The simplest of these theoretical explanations involves quality. Manufacturers of name-brand products may raise the quality of their goods when faced with private-label entry. This response leads to higher name-brand product prices especially if it is more costly to produce higher quality goods.[4]

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[1] For example, Nelson and Hilke found that featuring by retailers can provide strategic advantages to a dominant coffee manufacturer in fending off a new entrant or smaller competitor that tries to expand.

[2] The number of new supermarket and drugstore items went from a mere 1,281 in 1964 to 20,076 in 1994, though many of these innovations presumably would have occurred in the absence of private-label competition. "Quantum Leap." *Investor's Business Daily*, Executive Update CEO Briefing, January 20 1995, p. A3.

[3] The standard analyses can be found in any good introductory or intermediate undergraduate microeconomics textbook (e.g., Lipsey, Courant, and Ragan, pp. 219, 254–260). In a common textbook example, entry into a competitive market shifts the market supply curve to the right, lowering the equilibrium price. Similarly, when entry occurs, noncompetitive firms may increase their as advertising and product differentiation to appeal to rivals' consumers.

[4] Several industry executives report that they fight back by raising quality. General Mills Inc. Vice President John Hallberg, said that, because his company feared technological advances that

Salop's (1977) noisy monopoly theory provides a second explanation. By intentionally increasing consumer uncertainty, a firm may be better able to exploit ignorant consumers and earn a higher profit. One way that firms confuse customers is to create "noise" by selling virtually the same product under various brand names. Brand proliferation pays if the cost of producing multiple brands is relatively low and the share of consumers who are willing to buy the higher price product is relatively large. Although this theory is widely believed to be an important explanation for pricing behavior in the pharmaceutical industry, apparently it is less relevant in the food industry where relatively few firms produce both branded and private-label goods in the same sector.

We believe that a third theory, product differentiation, provides a more compelling explanation for price increases. For example, Perloff and Salop, Anderson, de Palma, and Thisse, and Dierker and Dierker use a random-utility-representative consumer model to show that equilibrium prices may rise or fall as the number of products or product differentiation increases.

Similarly, entry may cause the price to rise in a single-dimension spatial model, such as Hotelling's linear model or Salop's (1979) circle model. A price-setting firm that does not face a rival keeps its price down to attract customers who are located relatively far from its product in characteristic space. If another good locates near enough to the existing product so that both firms compete for the same customers, the original firm may raise its price to customers located near its product in characteristic space. The original firm no longer has an incentive to try to attract distant customers who prefer the new product. Perloff, Seguin, and Suslow show whether the price of the existing item rises or falls depends on how close the two products are located.

Thus, a variety of theories can explain why entry leads to higher prices. Under all these theories except the one on quality, consumers who continue to buy branded goods are harmed by this entry due to the higher prices. We next examine empirically whether increased private-label share leads to higher brand-name prices and increased promotion. We also briefly consider whether it is likely that brand-name firms increased differentiation (possibly quality) in response to private labels.

Data

We conduct our tests using Information Resources Incorporated's (IRI) InfoScan™ data. IRI obtains information on all items scanned at cash registers from 11,300 local grocery stores from across the United States. The data are then scaled up to reflect all the sales in stores with revenues of $2 million and greater.

The InfoScan data base contains information on dollar sales and physical volumes of food products at the brand and universal product code (UPC) or item level. The data base also contains the share of dollar sales and physical volume sold on promotion (price reduction, special display, retail ads, and any other type of promotion excluding coupons).

For all major chains, IRI gets a *census*: complete information from all of the chain's stores. IRI obtains between 90% and 92% of its scanner information from this census information. As these data are already complete, no scale adjustment is required to convert this information to national levels.

Random stratified sampling is used for the remaining (primarily nonchain) stores that agree to participate in the survey. A rotating panel design (similar to Census Bureau surveys) is used where a fraction of the stores is dropped from the panel each month and replaced by others.[5] Information about the entry and exit of stores is obtained from the census, from random stratified sampling information, and from field personnel. The random stratified sampling data are then projected to national levels.

The individual *item* data that we use were drawn from the U.S. Department of Agriculture's Economic Research Service's version of the InfoScan data base, which contains 519 different product *types*, which are in turn subsets

have allowed competitors to "come close" to replicating successful brands, it focuses on product improvement: "In Big G (General Mills' cereal division), we have an objective to improve a third of our products every year." (Kennedy).

[5] A rotation procedure is used to deal with dynamics in the market such as the opening and closing of individual stores, the entry or exit of individual chains, and chains acquiring other chains. IRI makes four adjustments. When a chain is expanding into new geographic areas and building new stores, IRI selects the new stores at the same rate as the existing ones, and adds to the sample. If a chain is acquired by other chains, and some stores close down, each remaining store is transferred to its new chain and each chain's sample is adjusted as necessary. If a chain closes stores, those stores are dropped and additional stores are added as needed. If a chain is relatively stable but makes small changes each year, a certain proportion of the sample is changed each year.

of 166 product *categories* from 5 major supermarket *departments* (edible groceries, frozen food, bakery, dairy, and deli).

We were provided with data from thirty-four randomly selected categories—a little over one-fifth of the available categories. We include only thirty-two of these categories in our analyses because one category, baby food, had no private-label or generic purchases during the relevant period, and another, wine, had only a trivial amount (0.3% of sales).

Although the data set contains information on each individual branded item sold, it reports only aggregated data for generic and private-label items per time period. Thus, we do not know how many private-label items or firms there were, but we do know the average price and the total quantity sold.

Local promotion information is collected by IRI field auditors on a weekly basis and is used to develop physical and sales volume measures of food products sold under promotion and merchandising. The auditors track and classify the use of displays, retail ads, and any other retailer merchandising efforts. Promotion information is assembled each week and merged with weekly scanner data. The information allows IRI to differentiate regular everyday sales from sales made under promotion or special merchandising. The Economic Research Service data base provides ten promotion measures (five for dollar sales and five for physical volume), which reflect the share of sales and physical volume sold under price reduction, display, feature, feature and display, and any individual or combined use of these promotions. Price reduction refers to items with temporary sale prices; display, to aisle or end displays; feature, to items that are primarily advertised in local papers or paper inserts; feature and display, to items that are both advertised and on display.

We measure price for a brand as the total revenue divided by the total quantity (measured in units of weight or volume).[6] We derive our nominal prices from sales data that are net of discounts such as from coupons. The nominal prices are converted into real prices using the Consumer Price Index (where the index equals one in the first period).

The data set covers a little over two years. The sample is divided into twenty-nine time periods of four weeks each, which we call *months*. Thus, there are thirteen IRI months per year. The first month in the sample ended on 8 December 1996, and the last one on 31 January 1999.

Evidence on the Private-Label Invasion

Have private-label products substantially penetrated food and beverage sectors and do they continue to enter rapidly? We find that the quantity and revenue shares of private-label products and the rates of increase of these shares are high in many (but not all) food and beverage industries.

Averaging over all thirty-two of our remaining categories (and weighting each category equally), the revenue share of private-label and generic items is 14.3% and the quantity share is 19.0%. Private-label and generic goods are nearly two-thirds of the quantity share of frozen poultry, but only 1% of pickles and relish. Generics' share was 0.6% of hot cereal sales, 0.5% of shortening and oil, and 0.3% or less for all other categories. Moreover, no generics were sold in roughly half of the categories. Henceforth, we treat both private label and generics as one group, which we call *private-label* goods.

To determine whether the rate at which the quantity share of private-label goods increased over our time period, we regressed the logarithm of their share on a time trend and monthly seasonal dummies. In about half of our categories, there was no substantial change in the revenue share of private-label goods. In only two, English muffins and ice cream, did we find a statistically significant (at the 0.05 level) decreasing rate. Private-label goods penetration increased at a statistically significant rate in the remaining 40% of the categories. Double-digit growth rates occurred in slightly more than one-quarter of the categories, which are categories with typically small private-label shares.

Evidence on Name-Brand Responses

Are stylized "facts" about the reaction of name-brand firms to increased private-label competition correct? In particular, did name-brand firms defend their brands against the private-label invasion by lowering their prices, conducting sales, engaging in other promotional activities, and increasingly differentiating their products?

[6] We experimented with a variety of other measures of price (e.g., average price per item, rather than by weight), but found that our qualitative results are unaffected by the weighting used.

Prices

How do prices respond to private-label entry? Each of the four theories that we discussed above explains why brand-name prices may rise or fall after entry of private-label products. We lack the data to distinguish between these theories, so we take a reduced-form approach that is consistent with all the theories. We start by examining the correlation between name-brand and private-label share directly. We then consider various alternative reduced-form tests of this relationship. Finally, we discuss the correlation between private-label share and prices for all goods and private-label products.

Brand-name prices. We inspected the histogram for each brand price in each category. Generally, these distributions look lognormal, with a single peak and a long right tail. Thus, we summarize these distributions by the first two moments of the log price.[7]

We start by examining the effect of private-label penetration on the pricing behavior of individual name-brand firms. Table 1 shows the results of the regressions of the log (real) price of each of the eight largest firms and the log average price of the other branded firms in each category on the log of the share of private-label goods and three seasonal (quarterly) dummies (adjusted for first-order autocorrelation). One reason that we control for seasonality in these regressions is MacDonald's finding that food prices tend to fall in periods in which demand peaks.

We have a remarkable result: When the share of private-label goods rises, the prices of name-brand goods tend to rise (even after controlling for the possible endogeneity of the private-label share). Despite the large number (288) of estimated coefficients, every statistically significant coefficient (0.05 criterion) is positive.

A similar phenomenon has been observed in the pharmaceutical market (Caves, Whinston, and Hurwitz; Grabowski and Vernon; Frank and Salkever, 1992, 1997). When generic pharmaceutical manufacturers are allowed to sell an exact clone of a previously proprietary drug, they sell at a price far below the original name-brand product price. Although price-sensitive consumers switch to the generics, the brand-conscious consumers who continue to buy the name-brand drug are frequently charged a higher price than they paid originally. For example, Frank and Salkever (1997) reported that the share of prescriptions sold by retail pharmacies that was accounted for by generic products roughly doubled during the 1980s. Using a sample of thirty-two drugs that lost patent protection during the early to mid 1980s, they found that many name-brand prices increased after generic entry and were accompanied by large decreases in the price of generic drugs.

Sensitivity experiments. Are the regressions in table 1 reasonable? Three obvious concerns are that our equations omit other relevant factors, that the rise in the average brand-name price variable reflects a change in composition, and that the share of private-label goods may be an endogenous variable.

We experimented with augmenting our basic regression in table 1 (the log of brand-name price regressed on the log of private-label share and seasonal dummies) with various combinations of the following groups of (log) measures of diversity and market power: (A) Gini indexes for items and for firms,[8] (B) number of name-brand firms, (C) number of brands, (D) number of items,[9] (E) fraction of births and deaths, (F) shares of the two largest, four largest, and eight largest name-brand firms, and the share of the name-brand firms other than the eight largest ones. We added each of these groups of "structure-conduct-performance" (SCP) variables separately to the equation used in table 1. We also experimented with adding several groups of these variables at the same time. None of these SCP variables substantially changed our qualitative results for the coefficient on the private-label share. These extra variables were rarely statistically significant and their coefficients followed no obvious pattern.[10]

[7] Because we determined no clear patterns to the second moment in our regression analyses, we only briefly mention the results here. As the share of private-label goods rises, the variance of the price of branded goods does not change statistically significantly in fourteen categories, falls in six categories, and rises in twelve categories.

[8] The Gini coefficient was calculated as

$$G = \sum_{j=1}^{n} \frac{s_j}{n} [(n - r_j) - (r_j - 1)]$$

where s_j is the share of the jth item, r_j is its rank (the largest share has rank 1), and there are n items.

[9] One might be concerned that an increase in private-label share induces brand-name firms to reduce the number of items they sell (thereby resulting in higher prices). However, the evidence generally rejects this hypothesis, as we show in the following section on product diversity.

[10] We also tried regressing brand-name prices on the SCP variables and seasonal dummies (that is, dropping the

Table 1. Elasticity of Name-Brand Firm's Price with Respect to Private-Label Share

	Eight Largest Brand Firms and Other Brand Firms								
	1	2	3	4	5	6	7	8	9+
Baked beans	0.22[b]	0.42[b]	0.54[b]	0.28[a]	0.25[b]	0.19[b]	0.09	0.10[b]	0.31[b]
Butter	0.29	0.53	−0.82	0.38	−0.13	−0.84	1.15	−0.41	−0.28
Canned ham	−0.03	−0.07	−0.04	0.02	−0.01	0.02[b]	−0.02	0.00	0.04
Canned juices	0.09[b]	0.17[b]	0.37[b]	0.37[b]	0.02	−0.57	0.07	−.18	−0.05
Cottage cheese	−0.14	−0.28	−0.53	−0.09	0.47[a]	−0.11	−0.13	0.03	0.45[b]
Crackers	0.19[b]	0.26[b]	−0.34	−0.17	0.04	−0.03	0.14[a]	0.03	−0.08
Desserts	0.07[b]	0.09[b]	0.03	−0.03	0.05	0.09[a]	0.04	0.01	0.03
English muffins	−0.59	−0.10	0.14	−0.03	−0.24	−0.55	−0.01	−0.55	0.55[b]
Frosting	0.19[b]	0.10[b]	0.04	0.05	−0.13	0.01	0.47[a]	−0.01	−0.08
Frozen baked goods	0.17[b]	0.00	0.49[b]	0.17[b]	−0.05	0.32[b]	0.23[b]	0.28	−0.11
Frozen breakfast food	0.05[b]	0.06[b]	0.08[b]	0.26[b]	0.00	0.07	0.12[b]	0.08[b]	−0.03
Frozen fruit	0.23	0.07	0.10	0.83[b]	0.66[b]	−0.12	0.18	0.57[b]	0.83[b]
Frozen poultry	−0.12	0.03	−0.07	0.14	0.10	0.18	0.12	0.05	0.25[a]
Gelatin mixes	−0.16	−0.22	0.13[b]	0.11	0.20	−0.01	0.17[a]	−0.10	0.63[b]
Hot cereal	0.19[b]	−0.13	0.06[b]	−0.14	0.05[a]	−0.01	−0.04	0.17[a]	−0.06
Ice cream	0.09	0.46[b]	0.57[a]	0.10	−0.13	−0.43	0.25	0.52[b]	0.23[b]
Instant potatoes	0.13	0.01	0.02	−0.15	−0.02	0.02	0.11	0.21[a]	−0.02
Mustard & ketchup	0.31[b]	0.22[b]	0.17[b]	0.20[b]	0.06[b]	0.28[b]	−0.02	0.06	0.29[b]
Peanut butter	−0.01	0.29[a]	0.21[a]	0.01	0.24[a]	0.17	−0.10	−0.02	0.64[b]
Pickles and relish	0.09[b]	0.08	0.09[b]	0.05	0.06[b]	0.02	0.07[b]	0.12[b]	0.09[b]
Pizza products	0.05[b]	0.07	0.02	0.01	0.01	0.15[b]	0.06[b]	0.09[b]	0.05
Pizza, refrigerated	0.02	−0.02	−0.01	−0.16	−0.19	0.03	−0.03	−0.03	−0.03
Popcorn/popcorn oil	0.25[b]	0.01	0.07[a]	0.02	0.13	−0.07	−0.09	0.00	0.14
Rice/popcorn cakes	0.20[b]	−0.02	0.07	0.01	−0.95	−0.02	−0.01	0.04[a]	−0.18
Shortening and oil	0.51[b]	0.02	−0.08	0.17	−0.54	0.08	−0.17	0.03	0.19
Snack/granola bars	0.02	0.16[b]	−0.01	0.01	0.12[b]	0.09[b]	0.13[b]	0.15	0.06
Spaghetti/Italian sauce	0.11[a]	0.02	0.06	0.06	0.02	0.01	0.01	0.30	0.08
Sugar substitutes	0.04[b]	−0.02	0.07[a]	0.33[a]	0.12[b]	0.38[b]	0.05[a]	0.03[a]	0.12[a]
Tea, ready to drink	0.21[b]	0.20[b]	0.45[b]	0.02	0.27[b]	0.19	0.15	0.00	0.18
Tomato products	0.18	0.55	0.08	0.21	0.10[b]	0.23	0.50[b]	0.09	0.06
Vinegar	−0.24	−0.06	0.17	0.06	−0.83	0.08	0.42[b]	−0.04	−0.06
Yogurt	0.37[b]	0.15[b]	−0.01	0.25[a]	0.11	−0.07	0.38	0.04	0.00

[a]Reject the hypothesis that the elasticity (coefficient) is zero at 0.10 confidence level.
[b]Reject the hypothesis that the elasticity (coefficient) is zero at 0.05 confidence level.
Notes: Not reported are three quarterly dummies and a constant. First-order autocorrelation correction imposed.

Similarly, one might be concerned that mergers by grocery store chains played an important role. Because our time period is relatively brief, there was relatively little change in concentration at the national level (unlike at the regional level). We proxied for these changes by adding a time trend, which was not statistically significant and had negligible effects on the private-label share coefficient. Moreover, changes in grocery store market power are unlikely to differentially affect prices within categories of food and beverages.

We were concerned that we lacked good proxies for costs. By excluding such variables, we implicitly assumed that there were no dramatic shifts in costs during our two and one-third year sample period. It is also possible that there were shifts in demand for reasons having nothing to do with private labels. As a partial adjustment for unobserved shifts in costs and demand, we included a time trend. Again this trend was not statistically significant and had negligible qualitative effects.

We examined whether our main price result is due to a change in the composition of items sold by brand as private-label share increases. Suppose that prices did not change but that private-label products are disproportionately large and that larger sizes have lower prices per ounce. Then, the introduction of private labels will result in higher average brand prices.

private-label share). Again, the SCP variables were rarely statistically significant and had no obvious pattern.

We examined the quantity weighted average size of branded items to determine whether they rose or fell over our sample period. We found that weighted average item sizes increased for sixteen categories and fell for sixteen. For those sixteen categories with significantly positive branded price responses (table 2), the weighted average size rose for ten and fell for six categories. For those seven categories with extremely strong positive price responses (a significant branded price elasticity of >0.2), the weighted average item sizes increases for six and fell for one. Moreover, the sizes are comparable between branded and private-label firms; private-label firms do not disproportionately produce only large sizes. Thus, we conclude that the hypothesis that the entry of private labels leads to greater sales of branded items that are smaller is false, particularly for those categories of most interest.

Table 2. Elasticities of Price with Respect to the Share of Private-Label Goods

	All	Branded	Private Label
Baked beans	−0.03	0.04	−0.36[b]
Butter	−0.25	0.16	−0.47
Canned ham	−0.10[b]	−0.08[a]	−0.39[b]
Canned juices	0.02	0.13[b]	−0.14[b]
Cottage cheese	−0.46[b]	−0.02	−0.84[b]
Crackers	−0.27[b]	−0.12[b]	−0.27[b]
Desserts	0.06[a]	0.06[a]	−0.04
English muffins	−0.54[b]	−0.10	−0.67[b]
Frosting	0.09[b]	0.11[b]	−0.02
Frozen baked goods	0.11	0.22[b]	−0.10
Frozen breakfast food	−0.02[a]	−0.01	0.11[b]
Frozen fruit	0.48[b]	0.24	0.21
Frozen poultry	0.34[b]	0.35[b]	−0.02
Gelatin mixes	0.26	0.30[a]	−0.06
Hot cereal	−0.08[b]	0.07[a]	0.01
Ice cream	−0.02	0.18[b]	0.06
Instant potatoes	−0.09[b]	−0.05	0.00
Mustard and ketchup	0.15[b]	0.30[b]	−0.01
Peanut butter	−0.08	0.01	−0.15[a]
Pickles and relish	0.05[b]	0.06[b]	−0.11[a]
Pizza products	−0.06[b]	−0.04[b]	−0.19[b]
Pizza, refrigerated	0.00	−0.02	0.21
Popcorn and popcorn oil	−0.43[b]	−0.13[b]	−0.09
Rice and popcorn cakes	0.02	0.09[a]	−0.15[b]
Shortening and oil	0.12[a]	0.31[b]	−0.07[a]
Snack bars/granola bars	0.00	0.01	0.04[b]
Spaghetti/Italian sauce	0.11[b]	0.14[b]	−0.15[b]
Sugar substitutes	−0.35[b]	−0.06[b]	−0.74[b]
Tea, ready to drink	0.30[b]	0.32[b]	0.07
Tomato products	0.10	0.43[b]	−0.20[b]
Vinegar	−0.63[b]	0.31	−0.30[a]
Yogurt	0.07	0.19[b]	−0.05

[a]Reject the hypothesis that the elasticity (coefficient) is zero at 0.10 confidence level.
[b]Reject the hypothesis that the elasticity (coefficient) is zero at 0.05 confidence level.
Note: Not reported are three quarterly dummies. First-order autocorrelation correction imposed.

Finally, we considered the possibility that the share of private-label goods is endogenous. That is, we need to consider alternative explanations for why private-label share and brand-name prices are positively correlated. We have presented economic theories that are consistent with the possible explanation that larger private-label share leads to higher brand-name prices. Alternatively, higher prices of branded goods could increase the demand for private labels. To disentangle these two stories we use instruments to control the possible simultaneity of the private-label share variable in our price equation.[11]

Various factors may affect the private-label share. First, over time, consumers, having tried private-label products, become convinced that their quality rivals that of name-brand products, so the consumers increasingly buy these products (cf. the "try it you'll like it" model of Kohn and Shavell). Second, both the price of name-brand goods and the likelihood of entry of private-label goods depend on the existence of unfilled niches in product space. Third, firms may introduce new private-label items when the price of name-brand goods is unusually high. Fourth, consumers may increasingly buy private-label products if branded prices rise (substitution effect). If the increase in the share of private-label goods is due to only factors that are exogenous or at least predetermined, then we are justified in treating the share of private-label goods as exogenous in our price regressions. However, to be sure, we conduct Hausman tests of endogeneity of private-label share using instruments.

To derive instruments, we hypothesized that the same factors causing the private-label share to grow in one food category affect other food categories. Thus, we used the growth of the share of private-label goods in other markets as instruments in each given market. We divided the thirty-two industries into seven

[11] As an alternative to treating private-label share as endogenous, we tried regressing price on a one period or two-period lag of the private-label share—so that share was "predetermined." Not surprisingly, the results were virtually the same as when we used current share. We also experimented with a Granger-type model with short lags of both prices and shares, which was not informative (we have too short a period for such a temporal ordering test to make sense).

groups: canned goods, frozen goods, sweets, condiments, dairy, Italian, and other.[12] We took the average of the share of private-label goods in each of these groups and used these as instruments (dropping the one to which the given industry belongs). Thus, each equation had six instruments.

We then regressed the log price of branded goods in each category on the share of private-label goods and three seasonal dummies with and without using instruments. The instrumental variables estimates were very close to the original estimates. For example at the category level, we rejected exogeneity at the 0.05 level on the basis of a Hausman test in only two of the thirty-two industries (frozen poultry and rice and popcorn cakes), and even in those industries the efficient and consistent point estimates were very close. Consequently, we report only our generalized least squares estimates.

Relative prices. We have demonstrated that name-brand prices rise in response to private-label entry. We now ask, do private-label prices and overall market prices rise or fall with increased private-label penetration?

If private-label goods usually sell for less than do branded goods, the overall average price in the market place should lie between that of private-label and name-brand goods and should fall with entry of private-label goods. The private-label price is less than the price for branded goods in all categories except frozen poultry, where the private-label prices are substantially higher than those of name-brand goods. (Frozen poultry private-label goods have the largest share—nearly two-thirds of industry quantity—of any category.)

In table 2, we investigate the effects of private-label entry on overall, branded, and private-label prices. Table 2 reports the entry elasticities from the regressions of the logs of average overall price, the average branded prices, and the average private-label price on the same right-hand side variables as in table 1: private-label share and three quarterly dummies (where we control for first-order autocorrelation).

We considered three possible theories about the effects of increased penetration on private-label prices:

1. If the private-label goods are essentially identical generic goods that are priced competitively at constant marginal cost, entry of additional private-label goods should have no effect on their price.
2. If the private-label items are monopolistically competitive as described by a Chamberlinian model, where all goods compete with each other symmetrically (that is, not asymmetrically as they would in a spatial model), entry is likely to lower the average price.
3. If the private-label goods are effectively branded (e.g., Safeway's well-regarded Select brand) and spatially differentiated from other branded goods, entry could raise or lower price.

We expected that either the first or second stories apply in these food industries, so we expect private-label prices to stay constant or fall with entry. The empirical evidence is consistent with these predictions. In virtually every category, private-label penetration has no statistically significant effect or a negative effect on the price of private-label goods. The only exceptions are frozen breakfast foods and snack and granola bars.

From table 1, we already know that penetration has either no statistically significant effect or raises the price of individual branded goods.[13] Although conventional industry wisdom predicts that the overall average price will fall with increased private-label penetration, the question remains whether it does so given the increase in name-brand prices. The overall price has a statistically significant negative elasticity in ten categories (31%), a positive effect in six categories (19%), and is unchanged in the remaining ones. In all but one industry where the overall elasticity is positive, the name-brand elasticity is an even larger positive number. We conclude that an increase in private-label share is correlated with either no effect or a decrease in the price of private-label goods, no effect or an increase in the price of

[12] The categories in our groups are *canned*: canned ham, canned juices; *dairy*: butter, cottage cheese, yogurt; *frozen*: frozen breakfast food, frozen fruit, frozen poultry, and frozen baked goods; *Italian*: pizza products, refrigerated pizza, spaghetti/Italian sauces; *sweets*: desserts, frosting, gelatin mixes, ice cream, snack/granola bars, sugar substitutes; *condiments*: mustard and ketchup, pickles and relish, vinegar; *other*: baked beans, crackers, English muffins, hot cereal, instant potatoes, peanut butter, shortening and oil, popcorn and popcorn oil, ready-to-drink tea, rice and popcorn cakes, tomato products.

[13] However in table 2, the elasticity for several of the aggregated name-branded categories is statistically significantly negative. Presumably this inconsistent result reflects the aggregation of several negative (but statistically insignificant) elasticities for the individual firms in table 1.

branded goods, and usually (but not always) no effect or a negative effect on the overall price.

Promotional Activities

According to our stylized "facts", name-brand firms engage in sales—price reductions—or nonprice promotions in response to the private-label invasion. Unfortunately, we do not have information about these firms' national advertising, but we do know about local and in-store promotions—which are increasingly the dominant forms of promotion.

Name-brand firms frequently engage in promotional activities. In a typical month, the share of name-brand items with temporary price reductions ranges from 5% in hot cereal to 18% in butter.

The nonprice promotional activities include local feature ads and in-store displays. The lowest share of items with nonprice promotions of merchandising is 4% for sugar substitutes and vinegar, but the share exceeds a third for canned ham, crackers, ice cream, and ready-to-drink tea. The share of all merchandising—price and nonprice promotions combined—reaches nearly a half for canned ham and ice cream.

There is a pronounced downward trend in promotional activities. Except for refrigerated pizza and rice and popcorn cakes, the quantity share of items with price promotions is stable or declining. There is little change in the share of nonprice promotions, with statistically significant decreases in only four categories and increases in only four categories.

We regressed the share of items on sale on the share of private-label goods and the seasonal dummies. Table 3 shows the elasticity of the share of price reductions and nonprice promotions with respect to the private-label share. Every statistically significant elasticity of price reductions with respect to private-label share is negative: Name-brand firms either make no change or have fewer sales. As private labels expand, name-brand firms are substantially less likely to engage in nonprice promotions using feature ads and displays. Not only are virtually all the statistically significant elasticities negative (the pizza product category is the only exception), but most of these negative elasticities are larger than one in absolute value—in many cases much larger. For example, the elasticities for rice and popcorn cakes, yogurt, mustard and ketchup, and hot cereals are between −4 and −5, while the elasticity for butter is nearly −11. The statistically significant sales elasticities are also negative, though usually smaller in absolute value than the nonprice promotion elasticities. Thus, our findings once again repudiate the conventional wisdom: Name-brand firms react to increased private-label competition by holding fewer sales and reducing the share of items with nonprice promotions.

Table 3. Elasticity of the Share of Promotions with Respect to the Private-Label Share

	Price Reductions	Nonprice Promotions
Baked beans	−0.89[b]	−3.33[b]
Butter	4.17[a]	−10.94[b]
Canned ham	0.14	0.19
Canned juices	−0.58	−0.84[b]
Cottage cheese	−0.45	1.73
Crackers	−0.17	−0.48[b]
Desserts	−0.49[a]	−0.32
English muffins	0.78	−1.51[b]
Frosting	−2.17[b]	−2.93[b]
Frozen baked goods	−0.82[b]	−1.70[b]
Frozen breakfast food	−0.25[b]	−0.02
Frozen fruit	−1.13	−0.97
Frozen poultry	−0.11	−0.21[a]
Gelatin mixes	−0.29	−1.70[b]
Hot cereal	−1.87[b]	−4.90[b]
Ice cream	−1.09[b]	−1.17[b]
Instant potatoes	−0.99[a]	−3.89[b]
Mustard and ketchup	0.22	−4.48[b]
Peanut butter	−0.14	−3.10[b]
Pickles and relish	−0.78[b]	−0.53[b]
Pizza products	−0.08	0.76[b]
Pizza, refrigerated	−1.02[b]	−0.03
Popcorn and popcorn oil	−1.66[b]	−3.92[b]
Rice and popcorn cakes	−1.32[a]	−4.08[b]
Shortening and oil	−0.27	−2.09[b]
Snack bars/granola bars	−0.17	−3.02
Spaghetti/Italian sauce	−0.38[a]	−0.96[b]
Sugar substitutes	−0.40	−2.29[b]
Tea, ready to drink	−0.37[b]	−0.45[b]
Tomato products	−0.86[a]	−1.15
Vinegar	−0.12	0.00
Yogurt	−2.90[b]	−4.05[b]

[a] Reject the hypothesis that the elasticity (coefficient) is zero at 0.10 confidence level.
[b] Reject the hypothesis that the elasticity (coefficient) is zero at 0.05 confidence level.
Note: Not reported are three quarterly dummies. Autocorrelation correction imposed.

Differentiation

As we lack information about the detailed characteristics and qualities of the gigantic number of items produced, we cannot directly look at the degree of differentiation. Instead,

we use the number of items, the number of births and deaths of items, and the ratio of items to firms as proxies for the attempts by name-brand firms to differentiate their products.

What has happened to the number of name-brand items and firms? Have the private-label goods driven some name-brand firms and items out of business? Or, have name-brand firms—attempting to further differentiate their products—increased the number of items they sell?

The number of firms, brands, and items varies substantially across industries. In a typical month, the canned ham industry had an average of thirty firms, fourty-one brands, and eighty-six items, whereas the ice cream industry had more than eleven times as many firms (342), more than fifteen times as many brands (626), and nearly eighty-five times as many items (7,294).

Unlike at the beginning of the 1990s, the number of branded items and firms is falling in the majority of categories. Although the number of items and firms is more likely to be increasing in categories where total quantity is growing, the relationship between quantity growth and growth in the number of items or firms is not a strong one. Counterexamples include ready-to-drink tea products, where quantity grew at 13.2% per year, yet the number of branded firms selling these products fell by 8.3% per year and the number of branded items dropped at a 7.9% annual rate.

Does the number of items per firm fall as private-label penetration increases? To answer this question, we regressed the log of the ratio of items to firms on private-label share and three seasonal dummies, correcting for first-order autocorrelation. Table 4 shows that differentiation—as measured by items per firm—does not increase with private-label competition, contrary to our stylized "fact". There is a statistically significant elasticity of the items per firm with respect to private-label share in only seven categories. Of these, only one elasticity is positive. Of course, it is still possible that name-brand firms increasingly modify their products' characteristics or raise the quality of existing products.

Another indicator of differentiation by firms is the rate at which they create new products (and kill off old ones). The average number of births and deaths per firm are roughly equal in most categories, which is consistent with relatively small rates of increase or decrease in the number of items per firm over time. Additionally, this observation is consistent with the flagpole theory in which firms are constantly creating new items and removing old items to try to stay abreast of changing consumer tastes.

Table 4. Elasticities of Number of Name-Brand Items, Number of Firms, and Items per Firm with Respect to the Private-Label Share

	Number of Items	Number of Firms	Items per Firm
Baked beans	−0.07[a]	−0.02	−0.03
Butter	−0.19[b]	−0.12	−0.06
Canned ham	0.00	0.02	−0.01
Canned juices	−0.09	0.02	−0.23[b]
Cottage cheese	−0.22[b]	−0.28[b]	0.08
Crackers	−0.03	0.02	−0.05
desserts	0.02	−0.01	0.00
English muffins	0.14	0.19	−0.08
Frosting	−0.06	0.00	−0.07
Frozen baked goods	−0.04	−0.01	−0.06
Frozen breakfast food	0.12[b]	0.12[b]	0.02
Frozen fruit	−0.27	−0.41	0.25
Frozen poultry	0.03[a]	0.14[b]	−0.13[b]
Gelatin mixes	0.02	−0.01	−0.03
Hot cereal	−0.06[a]	0.04	−0.11[b]
Ice cream	−0.01	0.07	−0.16[b]
Instant potatoes	−0.01	−0.08	0.08
Mustard and ketchup	0.03	0.05[a]	−0.02
Peanut butter	0.09	0.14	−0.05
Pickles and relish	−0.01	0.00	−0.03[a]
Pizza products	0.03	0.04	−0.01
Pizza, refrigerated	0.10	0.15[b]	0.03
Popcorn and popcorn oil	0.10	0.27[a]	−0.10
Rice and popcorn cakes	−0.03	0.15[b]	−0.19[b]
Shortening and oil	−0.02	0.07	−0.10
Snack bars/granola bars	0.07	0.11[b]	0.12[b]
Spaghetti/Italian sauce	0.02	0.03	−0.03
Sugar substitutes	−0.27[b]	−0.18[b]	−0.10[b]
Tea, ready to drink	−0.13[a]	−0.06	0.03
Tomato products	0.00	−0.02	0.06
Vinegar	−0.17	−0.32[b]	−0.02
Yogurt	−0.02	−0.08	0.02

[a]Reject the hypothesis that the elasticity (coefficient) is zero at 0.10 confidence level.
[b]Reject the hypothesis that the elasticity (coefficient) is zero at 0.05 confidence level.
Note: Not reported are three quarterly dummies. Autocorrelation correction imposed.

The quantity share of new and deceased products out of all branded items is relatively small. (The share of births is from the current period and the share of deceased goods is from the previous period.) One might expect that firms would choose to eliminate unsuccessful products with small shares. Given that there are roughly an equal number of births and deaths, one might infer that the collective share of births would be larger than that of

deceased goods. In only a few sectors is the share of births is substantially larger than that of cancelled products. For example, the share of new canned ham items and new frozen poultry items are roughly twice that of deceased items. In most sectors, the shares of the births and the deaths are roughly equal.

We might also expect that the prices of both new and eliminated items would be lower than the prices of other items. New products might have low introductory prices. Before eliminating an unsuccessful product, a firm might try lowering its price. However, the prices of both new and eliminated items are roughly equal and are usually fairly close to the prices of other goods (the price ratios in the table are roughly equal to one). One notable exception is popcorn and popcorn oil where the prices of new and eliminated items are only about two-thirds that of continuing items. Another interesting exception is mustard and ketchup where new (more specialized?) items typically cost twice as much as do existing products, and even eliminated items are 50% more expensive than continuing items.

Summary and Conclusions

Using statements by industry experts, we collected a set of stylized facts about the invasion of private-label products into supermarkets. We then used supermarket scanner data to examine the validity of these beliefs.

The first belief is that private-label products continue to expand their share of food industries. This view is correct in only some food categories. We find that the quantity share of private-label (and generic) goods is increasing in less than half of food and beverages categories, but this share is growing at double-digit annual rates for one in four categories.

The second set of beliefs concerns the response of name-brand firms to the increased competition from the private labels. The conventional industry wisdom is that name-brand firms defended their brands against the private-label invasion by lowering their prices, engaging in additional promotional activities, and increasingly differentiating their products. Our empirical evidence is inconsistent with these beliefs.

Increases in the share of private-label goods are correlated with a rise in the price of name-brand goods. Because an increase in private-label share has no effect on or decreases the price of private-label goods, the overall price level usually (but not always) remains unchanged or falls. As the share of sales to private-label products rise, name-brand firms hold fewer sales and decrease the share of items with nonprice promotions. When the private-label share increases, the number of name-brand items per firm—a measure of differentiation—is unchanged or falls.

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