Do Firms Price and Advertise to Maximize Profits?
Evidence from U.S. Food Industries

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Abstract

Based on a model that incorporates brand entry deterrence through advertising and pricing strategies, this paper investigates whether firms' advertising and pricing policies deviate from their short-run profit maximization strategies and how advertising and pricing entry deterrence strategies vary with market conditions. We estimate the advertising and pricing response of incumbents to entrants in four food industries: beer, carbonated soft drinks, ready-to-eat cereal and yogurt, and find that incumbents deviate significantly from profit maximization advertising and pricing policies. There is a U-shaped relationship between the potential market share of an entrant and incumbents' pricing but an *inverse* U-shape with respect to advertising level. This means that incumbents are more likely to price higher and advertise less to deter entry when potential entrants are more competitive in terms of potential market share. Empirically, we show this to be the case in the four food industries studied.

Keywords: Incumbents; entrants; food industries; advertising and pricing

JEL Classification: L11; L21; M37

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1. Introduction

The insight that firms make "strategic investments" to alter future competition conditions is one of the most fundamental ideas in industrial organization, and the question of whether advertising acts as a barrier to entry has been a subject of ongoing controversy in the literature. Ever since Sutton (1991)'s thought-provoking idea that advertising might serve as a sunk cost, and therefore erect a barrier to entry for new firms, theoretical and empirical work on the entry-deterrence effect of advertising has been extensive. Advertising, as a powerful marketing instrument of firms in the consumer packaged goods industry, is similar to investments in productive capacity in the sense that advertising can serve as a sunk cost that new entrants must take into account. Therefore, advertising increases the risk of entry. However, advertising is different from investments in productive capacity in several ways in that it is not only a demand but also a supply side barrier (Schmalensee, 1983, 1978). First, investment in productive capacity by an incumbent generally discourages other firms by making high levels of output, and thus lower prices, relatively more attractive as a response to entry. But an incumbent's investment in advertising increases the set of customers who would not be tempted by an entrant's product at any level of entrant advertising, and this makes the incumbent less eager to expand output or lower price in response to the entry of competitors. With price discrimination ruled out, an incumbent's investment in advertising becomes more attractive.

The first point suggests that advertising is *persuasive* (Dixit and Norman, 1978). This view holds that advertising alters consumers' tastes and creates product differentiation and brand loyalty. As a consequence, the demand for a firm's product becomes more inelastic and advertising results in higher prices. In addition, advertising by established firms may give rise to entry barriers, indicating that advertising can have important anti-competitive effects, which results in concentrated markets characterized by high prices and profits. The second point illustrates the *informative* view (Grossman and Shapiro, 1984) which, in contrast, suggests that markets are characterized by imperfect information and advertising is an endogenous response that the market offers as a solution to search costs that deter consumers from learning about a product's price and quality. Therefore, when a firm advertises, demand will be more elastic; advertising thus facilitates entry and has important pro-competitive effects. Therefore, the impact of advertising on entry is ambiguous and its two countervailing effects can have dramatically different normative and positive implications for the consumer welfare effects of advertising.

Strategic investment models are difficult to test directly, and the vast majority of this literature is theoretical. Empirical analyses of the effect of advertising on entry deterrence have produced mixed results. Some studies suggest that the overall impact of advertising on entry is positive in that there are situations under which entrants perceive a greater likelihood of success in markets where advertising is important (Sudhir, 2001; Kessides, 1986). Some studies conclude that brand advertising is not a barrier to entry (Morton, 2000), while others indicate that firms use advertising outlays to deter entry (Becker and Murphy, 1993; Fudenberg and Tirole, 1984; Chicu, 2013). However, Fudenberg and Tirole (1984) claimed that low advertising prior to entry is a credible threat of deterrence because it allows the incumbent firm to cut prices if a competitor were to enter, while Becker and Murphy (1993) and Chicu (2013) claimed that firms over-advertise to deter entry. This disparity indicates that whether firms choose to under-advertise or over-advertise to deter entry is conditioned on other market variables. Therefore, there is no uniform strategy for all firms.

There are also studies investigating the relationship between entry-deterrence effects and market structure. Schmalensee (1983) developed a model in which incumbent monopolists never find it optimal to increase advertising if entry is more likely than not. Becker and Murphy (1993) claimed that oligopolistic industries usually advertise more than monopolistic industries because demand for an oligopolistic firm's product is more elastic, and hence more sensitive to advertising, than is demand for a monopoly's product. Ellison and Ellison (2011) suggested that investment levels should be monotonic in market sizes if firms do not invest to deter entry. However, strategic investments to deter entry may result in non-monotonic investment because they are unnecessary in small markets and impossible in large markets. In the former, no investments are needed to deter entry, while in the latter deterring entry is almost impossible. Ellison and Ellison (2011) found that incumbents in medium-sized markets advertise less prior to patent expiration. This stream of literature indicates that there might be some correlation between the magnitude of the entry-deterrence effect and market structure. Existing literature indicates that whether firms play competitively or cooperatively is strongly correlated with market structure. Firms in monopolistic and competitive markets are more likely to advertise cooperatively, while firms in oligopolistic markets with a lot of product differentiation are more likely to advertise competitively. Lee (2002) claimed that the long-debated advertising-concentration relationship differs depending primarily on the appropriability of advertising. He found that Korean manufacturing industries show an inverted U-shaped relationship between the Herfindahl-Hirshmann index of concentration (HHI) and industry intensity for consumer goods industries but a lazy J-shaped relationship for producer goods industries.

Overall, the existing literature suggests that firms have an incentive to practice entry deterrence not just with respect to profit-maximization but also to deter potential entrants by setting advertising as a sunk cost. Separating out the effects of advertising on demand and cost from entry deterrence is therefore critical, and more work is clearly required to understand exactly whether firms use advertising as an entry-deterrence instrument and, more importantly, under what conditions firms are motivated to use advertising to deter entry. Understanding how advertising investment might deter entry has important policy implications for both antitrust authorities and economists. For example, antitrust authorities should be more cautious about the market conditions under which firms may use advertising to create entry barriers, and economists can test whether firms are sufficiently rational and forward-looking to invest strategically.

In this paper, we develop two competing models by separating the profit-maximization effect and the entry-deterrence effect of advertising, and incorporating an entry-deterrence conduct parameter that can be parameterized. Based on this model, we develop an empirical model to test for entry-deterrence effects of advertising. Using sales and advertising data from four food industries, beer, carbonated soft drinks (CSD), ready-to-eat cereal (RTEC) and yogurt, across U.S. markets, we examine the entry-deterrence effects of firms' advertising, and also test for the relationship between the entry-deterrence effect and market concentration. We find that there is an inverse U-shaped relationship between entry deterrence and entrants' competitiveness.

2. Model

We model the behavior of incumbents and entrants in the market with and without the entry-deterrence effect, and then propose several testable hypotheses.

2.1 Demand side

Let a firm's demand be a linear function of its own advertising goodwill and price as well as its competitor's advertising goodwill and price. That is:

$$D_{it} = \alpha_0 + \alpha_i p_{it} + \alpha_j p_{jt} + \beta_i GW_{it} + \beta_j GW_{jt} + \gamma x_i + \epsilon_{it}, \quad (1)$$

where $t = 1, \dots, T$ denotes markets, GW_{it} represents the advertising goodwill of the incumbent/entrant in market t, x_i is vector of product characteristics, and ϵ_{it} is a non-zero stochastic term.

As for the cumulative advertising effects, we assume that advertising goodwill accumulates in the following way:

$$GW_{it} = \sum_{i=0}^{n_t} \rho^i A_{t-i}, \quad (2)$$

where ρ denotes the carryover effects of advertising until period n_t.

2.2 Supply side

Following Chintagunta, Kadiyali and Vilcassim (2006), we assume that firms choose their price and advertising levels in each time period. We measure cooperative or aggressive advertising behavior by the degree of advertising deviation from Nash-Bertrand advertising expenditures.

We consider two model settings. The first scenario assumes that a firm takes a rival's price and advertising as given and chooses price and advertising levels to maximize its profit. The second scenario assumes that a firm's advertising will affect a rival's advertising and price, and that a firm's pricing will also impact a rival's price and advertising, so that a conduct parameter can be introduced to indicate the competitive behavior of firms. Suppose there are I firms, each of which produces the $i = 1, \ldots, I$ different brands of a food industry. Under both scenarios, the firm's profit maximization problem is:

$$\max_{p_{it}, A_{it}} \Pi_{it} = (p_{it} - c_{it}) D_{it} - A_{it}, \tag{3}$$

where p_{it} denotes the price of brand i in market t, c_{it} denotes marginal cost of brand i in market t, D_{it} denotes demand of brand i in market t, A_{it} represents the advertising expenditure of brand i in market t.

Scenario 1: Pricing and advertising without entry-deterrence effect

When there is no entry-deterrence effect, the incumbent's pricing and advertising policies are not affected by an entrant's marketing policies. The necessary conditions for a Nash-Bertrand equilibrium are obtained by setting

$$\frac{\partial \Pi_{it}}{\partial p_{it}} = \frac{\partial \Pi_{it}}{\partial A_{it}} = 0. \tag{4}$$

The first-order condition for deriving the optimal price is

$$p_{it} = c_{it} - \frac{D_{it}}{\partial D_{it} / \partial p_{it}} = c_{it} - \frac{D_{it}}{\alpha_i}. \tag{5}$$

The optimal advertising expenditure is derived by differentiating the equation with respect to A_{jt}. The optimal advertising policy is as follows:

$$(p_{it} - c_{it}) \frac{\partial D_{it}}{\partial A_{it}} - 1 = 0. \tag{6}$$

After derivation, the optimal advertising to sales ratio is

$$\frac{A_{it}}{P_{it} * D_{it}} = -\frac{\varepsilon_A}{\varepsilon_P}. \tag{7}$$

where, in line with the Dorfman-Steiner (1954) model, ε_A denotes the demand elasticity of advertising, and ε_P is the demand elasticity of price.

Scenario 2: Pricing and advertising with entry-deterrence effect

Suppose an incumbent sets price and advertising expenditure strategically by taking an entrant's pricing and advertising strategy into account. In reality, the incumbent can react to the entrant's action at time t in time period t, and the incumbent can react with the same instrument used by the rival firm. Taking the entrant's response into consideration, the necessary conditions for an equilibrium are now given by

$$\frac{\partial \Pi_i}{\partial p_{it}} + \frac{\partial \Pi_i}{\partial p_{jt}} \frac{\partial p_{jt}}{\partial p_{it}} = 0, \tag{8}$$

$$\frac{\partial \Pi_i}{\partial A_{it}} + \frac{\partial \Pi_i}{\partial A_{jt}} \frac{\partial A_{jt}}{\partial A_{it}} = 0, \tag{9}$$

In above equations, the terms $\frac{\partial p_j}{\partial p_i}, \frac{\partial A_j}{\partial A_i}$ capture the reactions of the entrant and they are referred to as strategic conduct parameters. We define conduct parameter as follows:

$$\mu_{ji}^{pp} = \frac{\partial p_{jt}}{\partial p_{it}};\ \mu_{ji}^{AA} = \frac{\partial A_{jt}}{\partial A_{it}}, \tag{10}$$

where μ_{ji}^{pp} is a conduct parameter used to capture deviations from Nash-Bertrand equilibrium pricing, and they can be used to represent a flexible form of interaction among firms. If the conduct parameters are zero, it indicates that the interaction among firms is consistent with Nash-Bertrand equilibrium. Otherwise, the interaction between firms will be softer or tougher than Nash-Bertrand pricing, depending on the sign of the conduct parameters. Therefore, the conduct parameters indicate the simultaneous interactions among firms that can result in deviations from Bertrand-Nash behavior. μ_{ji}^{AA} is the advertising conduct parameter; as in the case of price, whether advertising is tougher or softer than Nash-Bertrand equilibrium depends on the signs of the conduct parameter.

Based on equation (6), the optimal pricing strategy and advertising strategy should satisfy

$$p_{it} = c_{it} - \frac{D_{it}}{\sum(\partial D_{it}/\partial p_{jt})(\partial p_{jt}/\partial p_{it})} = c_{it} - \frac{D_{it}}{\alpha_i + \alpha_j \mu_{ji}^{pp}}, \tag{11}$$

and

$$(p_{it} - c_{it}) \frac{\partial D_{it}}{\partial A_{jt}} \frac{\partial A_{jt}}{\partial A_{it}} = (p_{it} - c_{it})(\beta_i + \beta_j \mu_{ji}^{AA}) = 1. \tag{12}$$

After manipulation, we obtain

$$\frac{A_{it}}{P_{it}*D_{it}} = -\frac{\varepsilon_A}{\varepsilon_P} * \frac{1+\mu_{ji}^{AA}}{1+\mu_{ji}^{PP}}, \tag{13}$$

Suppose p_{it}^*, A_{it}^* and $AS_{it}^*$are the equilibrium price, advertising and advertising to sales ratio under scenario 1, when there is no entry-deterrence effect of pricing and advertising. Suppose $\tilde{p}_{it}$, $\tilde{A}_{it}$ and $\widetilde{AS}_{it}$ are equilibrium price, advertising and advertising to sales ratio under scenario 2, which takes strategic entry-deterrence advertising behavior into account. We then have the following hypotheses:

Hypothesis 1: If $\mu_{ji}^{PP} > 0$ then $\widetilde{AS}_{it} < AS_{it}^*$. If $\mu_{ji}^{PP} < 0$ then $\widetilde{AS}_{it} > AS_{it}^*$

If firms price *competitively (cooperatively)*, then the advertising to sales ratio is *lower (higher)* than when firms advertise and price without taking entry deterrence into account.

Hypothesis 2: If $\mu_{ji}^{AA} > 0$, then $\widetilde{AS}_{it} > AS_{it}^*$; If $\mu_{ji}^{AA} < 0$, then $\widetilde{AS}_{it} < AS_{it}^*$

If firms advertise *competitively (cooperatively),* then the advertising to sales ratio is *higher (lower)* than when firms advertise and price without considering entry deterrence.

Hypothesis 3: If $\mu_{ji}^{AA} > \mu_{ji}^{PP}$, then $\widetilde{AS}_{it} > AS_{it}^*$; If $\mu_{ji}^{AA} < \mu_{ji}^{PP}$, then $\widetilde{AS}_{it} < AS_{it}^*$

If the degree of advertising competition is *higher (lower)* than that of price competition, then the advertising to sales ratio is *higher (lower)* than when firms advertise and price without taking entry deterrence into account.

From a theoretical standpoint, firms can either advertise and price competitively or cooperatively, and empirical studies can reveal which strategy prevails in the market.

3. Data and methodology

3.1 Data

For sales and price, we use scanner data supplied by Information Resources Incorporated (IRI; see Bronnenberg, Kruger and Mela (2008)) and advertising data supplied by Kantar Media Stradegy, provided by the Zwick Center for Food and Resource Policy at the University of Connecticut. The sales data consists of quarterly data for sales of beer, carbonated soft drinks (CSD), and ready-to-eat cereal (RTEC) in grocery and drug stores for the 28-quarter period from January 2005 to December 2011 in 50 U.S. designated market areas (DMAs), as defined by Information Resources, Inc. (IRI). Advertising data consists of quarterly advertising expenditure data for beer, CSD, RTEC, and yogurt matched to the sales data for each product at the brand level.

Table 1 provides the summary statistics for the entire sample at the market level. The number of brands is the smallest in the yogurt industry, with an average of 61 brands across markets, while the average number of brands is highest for the beer industry, at 323 brands. The ratio of entering brands to existing brands is almost same across the four industries, with an average of 6%, while the ratio of exiting brands is also almost the same across four industries, with an average 5%, indicating that the number of brands within an industry increases slightly over the years, which might be a manifestation of firms' brand-proliferation strategy. As for "market concentration," Table 1 shows that the HHI of yogurt is highest, with an average of 0.086, while that of the RTEC industry is the lowest at 0.035. Across the four industries, the unit sales of incumbent brands are much higher than those of entrant brands. However, the ratio of unit sales generated by an entrant brand is only 7% in the beer industry, while it is about 29% in the RTEC industry, and 21% and 24%, respectively, in the CSD and yogurt industries. As for price and advertising, the table suggests that the price of incumbent brands is relatively higher than that of entrant brands, while incumbents spend more on advertising than entrants, except in the yogurt industry.

It seems that entrants are generally charging a lower price and advertising more aggressively than incumbents. The entry-deterrence literature indicates that incumbent firms respond selectively to threats from potential entrants because incumbents differ in their incentives to respond. Incentives to respond vary according to the characteristics of the incumbent (Simon, 2005) and the characteristics of the market. Empirical studies have enriched our understanding of how incumbents respond to entry *ex post* and *ex ante*.

3.2 Estimation strategy

Our estimation strategy is similar to that of Vilcassim, Kadiyali and Chintagunta (1999). We first convert the demand share equation (2) into a logistic equation. Performing the Koyck transformation yields the following equation:

$$D_{it} = \rho D_{it-1} + \alpha_i(p_{it} - \rho p_{it-1}) + \alpha_j\left(p_{jt} - \rho p_{jt-1}\right) + \beta_i A_{it} + \beta_j A_{jt} + \varepsilon_{it}, \quad (14)$$

Equations (12) and (13) can thus be rewritten as:

$$p_{it} = \gamma_1 + \gamma_2 D_{it}; \quad (15)$$

$$A_{it} = \delta_1 + \delta_2 p_{it}, \quad (16)$$

where $\gamma_1 = c_{it}, \gamma_2 = -\frac{1}{\alpha_i + \alpha_j \mu_{ji}^{PP}}, \delta_1 = -c_{it}(\beta_i + \beta_j \mu_{ji}^{AA}), \delta_2 = \beta_i + \beta_j \mu_{ji}^{AA}$.

We estimate the system of equations (15) and (16) under equilibrium scenario 2 using a simultaneous equation system using 3SLS. We then recover the marginal cost, advertising conduct parameter μ_{ji}^{AA} , and pricing conduct parameter μ_{ji}^{PP}. We use the likelihood ratio test to test whether the conduct parameters are zero or not, and then investigate which factors drive advertising and pricing strategies across markets and industries. The analyses were performed with SAS 9.4 and Stata 14.

4 Empirical results

Demand equation and entry-deterrence strategies

Table 2 presents the estimation results of equations (15) and (16) and the estimated marginal cost, pricing conduct parameter, advertising conduct parameter for incumbents and entrants in the four industries, respectively. As expected, the higher the price, the lower the demand will be. More advertising leads to more unit sales. The estimated marginal costs are reasonable in that they are less than the average price. However, the estimated pricing conduct parameter and advertising conduct parameter vary considerably across industries. Figure 2 presents the scatter plot of the pricing conduct parameter and advertising conduct parameter for the four industries at the market level. On average, incumbent brands in the beer and RTEC industries adopted the same strategies in response to entrant brands: Incumbent brands set prices higher and advertise less. However, firms in the CSD and yogurt industries adopted entirely opposite strategies in reaction to entrant brands: They priced lower and advertised more.

The results indicate that the pricing and advertising strategies of industries differ sharply from each other. It is necessary to explore the possible drivers of the different responses of incumbent brands to entrant brands. A potential explanation for incumbents' different reactions to entrant firms might be that entrant brands are different in that they have uncertain market power. A closer look at the summary statistics of entrants in the four industries indicates that entrants in cereal industry have more market share, on average, in that the sales ratio of entrants is the highest, 0.289, while the ratio of number of entrants is the lowest, 0.143, indicating that entrant brands in this industry are highly competitive. Nevertheless, entrant brands in the beer industry have the lowest sales ratio and the highest number ratio, suggesting each entrant brand is very uncompetitive, while the competitiveness of entrants in the CSD and yogurt industries is in between that of cereal and beer. So, it is very likely that incumbents' entry-deterrence strategies are correlated with the competitiveness of new entrants. It is also very likely that there is an inverse U-shaped relationship between advertising cooperation and entrant's competitiveness and a U-shaped relationship between pricing cooperation and entrant's competitiveness. We will explore this relationship in the following section.

Relationship between entry deterrence and competitiveness of entrants

We test the quadratic relationship between entrant competitiveness and pricing and the advertising entry-deterrence strategies of incumbent brands using the following equations:

$$\mu_{kt}^{AA} = \vartheta_0 + \vartheta_1 Entrant\_Comp_{kt} + \vartheta_2 Entrant\_Comp_{kt}{}^2 + \epsilon_{kt} \tag{17}$$

$$\mu_{kt}^{PP} = \varphi_0 + \varphi_1 Entrant\_Comp_{kt} + \varphi_2 Entrant\_Comp_{kt}{}^2 + \zeta_{kt} \tag{18}$$

where $\mu_{kt}^{AA}, \mu_{kt}^{PP}$ denotes the incumbent's pricing and advertising strategies in market k at time t, respectively. Table 3 presents the estimation results. We utilized fixed effects regression and cluster standard errors at the market level. The table indicates that there does exist an inverse U-shaped relationship between entrant competitiveness and incumbent's advertising, and there is a U-shaped relationship between entrant competitiveness and incumbent's pricing.

Figure 3 also suggests that when the competitiveness of an entrant is relatively small, incumbents are more likely to price higher and advertise less to accommodate entry. However, when entrants are very competitive, incumbents are also more likely to price higher and advertise less to deter entry. However, when the competitiveness of entrants is moderate, it is very likely that incumbent firms will price lower and advertise more to accommodate entry.

The results can also be explained from the perspective of the signals sent out by incumbents. When the incumbents in an industry price higher and advertise less, which can be viewed as a signal that the incumbents are strong and likely to be monopolistic, only brands that are competitive enough or those that are so small that they cannot threaten the incumbents at all, will enter the market; the beer and ready-to-eat cereal industries are good examples of this. However, when incumbents price lower and advertise more, potential entrants view this as a signal of profitability, and entrants with moderate competitiveness can enter the market. The interaction between incumbents and entrants in CSD and yogurt industry illustrates this case well.

5 Conclusion

Based on our empirical estimation with data from four food industries: beer, CSD, RTEC, and yogurt, this paper investigates why firms deviate from short-run profit maximization when setting price and advertising expenditures. By incorporating entry-deterrence strategies via advertising and pricing into a firm's behavior, we find that incumbents in the beer and RTEC industries adopt competitive advertising and cooperative pricing strategies in response to entrants, while incumbents in the CSD and yogurt industries, on the other hand, adopted cooperative advertising and competitive pricing strategies with entrants. We attribute the difference in behavior to the competitiveness of entrants. When entrants are extremely uncompetitive or extremely competitive, the incumbents are more likely to price higher and advertise less, which can be viewed as signals to potential entrants that the incumbents are competitive enough that they do not need to price lower and advertise more to attract customers. This strategy also selects entrants in the sense that only entrants that are competitive enough will enter the market. However, industries in which incumbents adopt lower prices and higher advertising send out the signal that there is great potential for profits and, therefore, entrants with moderate competitiveness are also able to enter the market. This result is similar to that of Ellison and Ellison (2007) and Dafny (2005), who showed that under some circumstances actions designed to deter entry can be inferred from observing non-monotonic U-shaped investment responses to changes in the threat of entry, and that investment will be a non-monotonic function of a characteristic of the market, such as geographical distance from the potential entrant.

Table 1: Summary statistics of industry brand dynamics

	Beer	CSD	Cereal	Yogurt
Number of incumbent brands	323.45	132.363	228.683	61.104
	(4.444)	(0.647)	(0.861)	(0.751)
Number of entrant brands	72.41	19.299	33.017	9.913
	(1.397)	(0.222)	(0.308)	(0.220)
Number of exit brands	19.23	5.859	10.326	2.72
	(0.416)	(0.091)	(0.154)	(0.125)
Ratio of entrant brands	0.214	0.146	0.143	0.162
	(0.002)	(0.001)	(0.001)	(0.003)
Ratio of exit brands	0.057	0.044	0.045	0.044
	(0.001)	(0.001)	(0.001)	(0.002)
HHI	0.064	0.068	0.035	0.087
	(0.001)	(0.001)	(0.002)	(0.002)
Average sales by incumbent brands	301.616	1878.3	65.742	257.243
	(8.091)	(37.662)	(1.413)	(11.874)
Average sales by entrant brands	18.318	374.336	18.124	69.411
	(0.520)	(8.517)	(0.469)	(5.468)
Sales ratio by entrant brands	0.071	0.213	0.289	0.24
	(0.002)	(0.004)	(0.005)	(0.011)
Advertising expenditure by incumbent brands	228.832	225.991	90.811	41.478
	(14.922)	(14.848)	(3.984)	(4.814)
Advertising expenditure by entrant brands	7.193	66.719	11.288	26.726
	(1.448)	(5.858)	(1.135)	(4.259)
Average unit price by incumbent brands	89.261	33.036	239.541	127.806
	(0.318)	(0.088)	(0.405)	(0.653)
Average unit price by entrant brands	124.27	50.258	283.194	150.464
	(0.841)	(0.348)	(0.873)	(1.336)
Number of observations	1400	1400	1400	1400

Table 2: Estimated results and parameters

Parameter	Variable	Beer		CSD		RTEC		Yogurt	
		Incumbent brands	Entrant brands	Incumbent brands	Entrant brands	Incumbent brands	Entrant brands	Incumbent brands	Entrant brands
ρ	Constant	0.971***	0.953***	0.989***	0.993***	0.991***	0.966***	1.006***	1.016***
		(0.006)	(0.009)	(0.004)	(0.006)	(0.004)	(0.007)	(0.004)	(0.007)
α_i	Own price difference	-2.286**	-0.084***	-84.729***	-0.394	-0.303***	0.026***	-4.163***	-0.209***
		(1.286)	(0.022)	(6.692)	(0.299)	(0.045)	(0.008)	(0.319)	(0.072)
α_j	Rival price difference	-0.524***	-0.019	0.725	5.78**	0.02	-0.075***	0.047	-1.4***
		(0.219)	(0.127)	(0.772)	(2.585)	(0.012)	(0.029)	(0.103)	(0.223)
β_i	Own advertising expenditure	0.04***	0.003	0.089***	-0.018	0.006***	-0.008**	-0.013	-0.017***
		(0.005)	(0.004)	(0.017)	(0.016)	(0.002)	(0.004)	(0.024)	(0.006)
β_j	Rival advertising expenditure	-0.009	0.002***	-0.095**	0.024***	0.011**	0.009***	0.009	-0.003
		(0.045)	(0)	(0.041)	(0.006)	(0.006)	(0.001)	(0.009)	(0.016)
γ_1	Marginal cost	85.032***	121.288***	32.753***	47.357***	235.745***	268.287***	122.933***	153.103***
		(0.442)	(1.181)	(0.145)	(0.561)	(0.618)	(1.047)	(0.432)	(0.669)
γ_2	Unit sales	0.011***	0.14***	0.000***	0.011***	0.079***	0.939***	0.018***	0.076***
		(0.001)	(0.051)	(0)	(0.001)	(0.008)	(0)	(0.001)	(0.005)
γ_1	Marginal cost	85.032	121.288	32.753	47.357	235.745	268.287	122.933	153.102
μ_{ji}^{pp}	Pricing conduct parameter	**102.111**	0.984	**-4.728**	14.870	**34.806**	11.792	**-9.082**	11.385
μ_{ji}^{AA}	Advertising conduct parameter	**-0.357**	5.765	**0.736**	3.222	**-0.412**	0.710	**0.164**	-2.703
Regression R^2									
Equation (15)	Units equation	0.932	0.841	0.963	0.896	0.976	0.911	0.970	0.921
Equation (16)	Price equation	0.059	0.004	0.011	0.059	0.068	0.237	0.118	0.130
Number of observations		1350	1350	1350	1350	1350	1350	1350	1350

Table 3: Impact of entrant competitiveness on incumbents' advertising and pricing strategies

	Pricing conduct parameter	Advertising conduct parameter
Entrant competitiveness	-207.8**	0.390**
	(-2.19)	(2.00)
Entrant competitiveness-squared	11.66**	-0.0244*
	(1.96)	(-1.84)
Constant	335.6	-0.596
	(1.64)	(-0.63)
N	5586	5586

Note: t-statistics is in parentheses. *, **, *** denotes significance at 1%, 5%, and 10%, respectively.

Figure 1: Brand dynamics in beer, CSD, RTEC and yogurt industries in New York

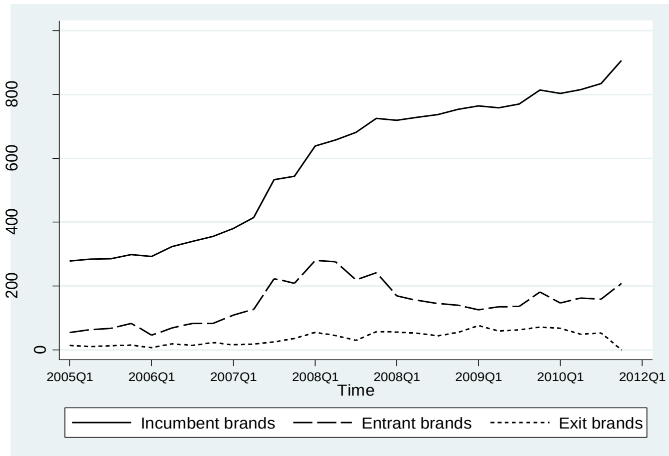


Figure 1.1 Number of brands in beer industry

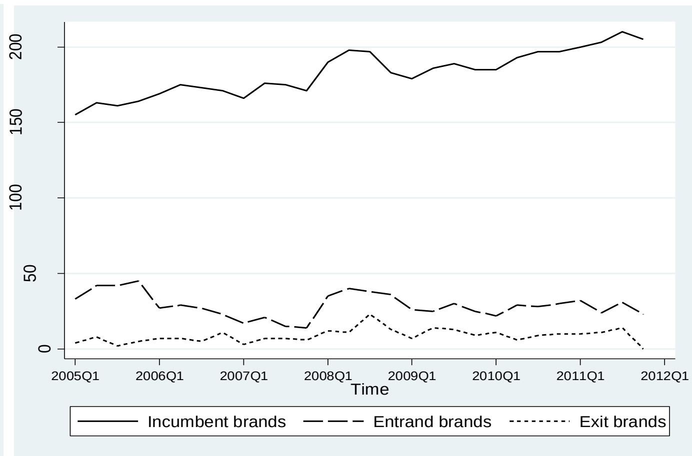


Figure 1.2 Number of brands in CSD industry

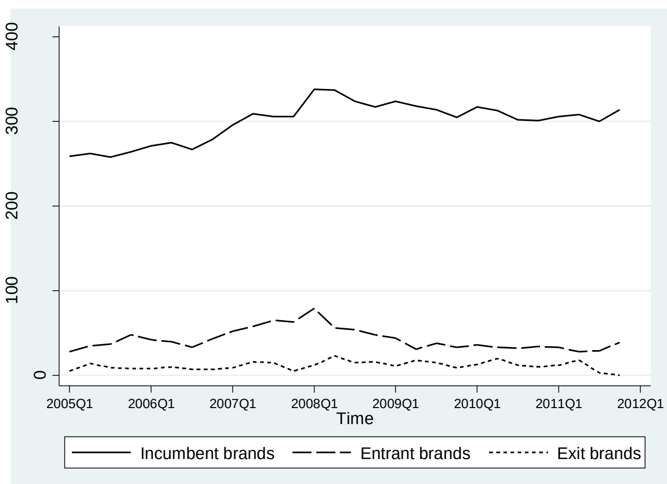


Figure 1.3 Number of brands in RTEC industry

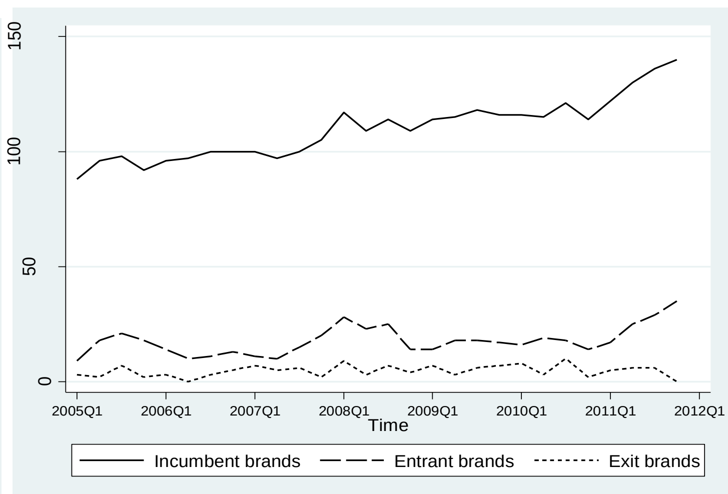


Figure 1.4 Number of brands in yogurt industry

Figure 2: Pricing and advertising strategies of incumbents in four industries

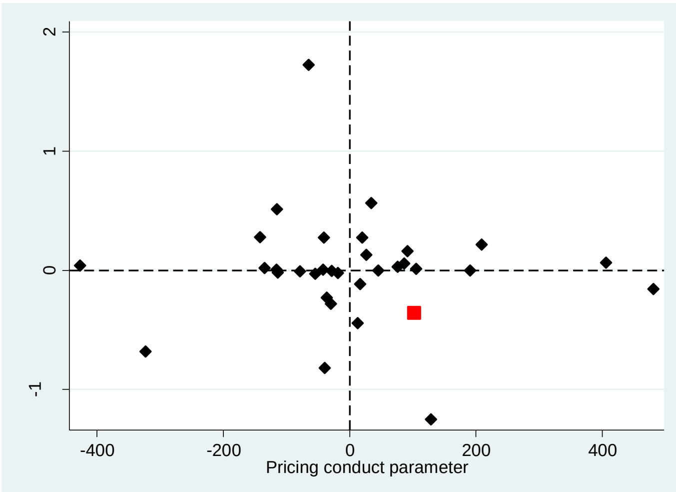


Figure 2.1 Pricing and advertising in the beer industry

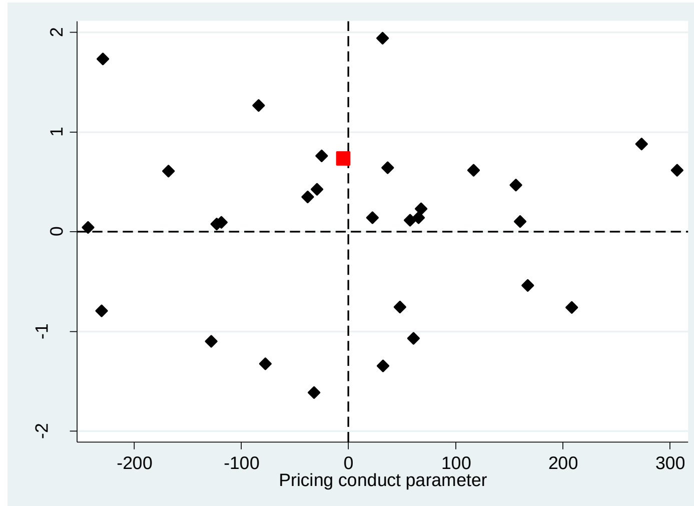


Figure 2.2 Pricing and advertising in the CSD industry

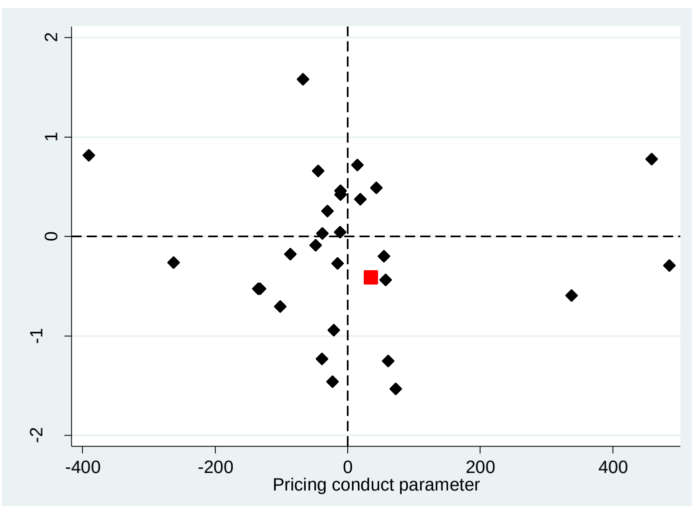


Figure 2.3 Pricing and advertising in the RTEC industry

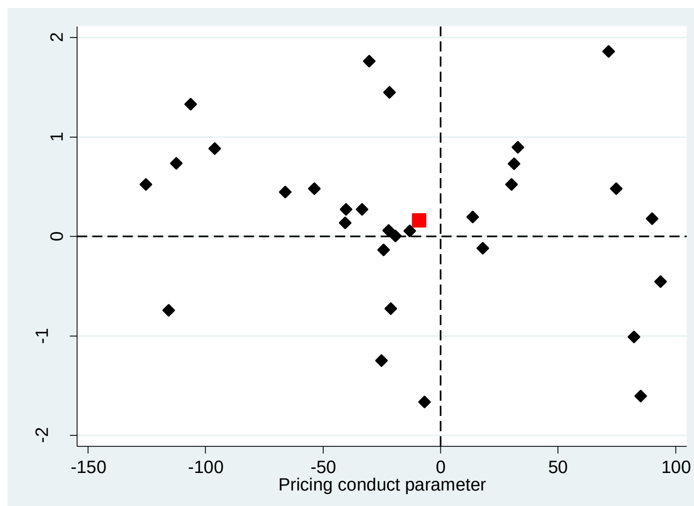
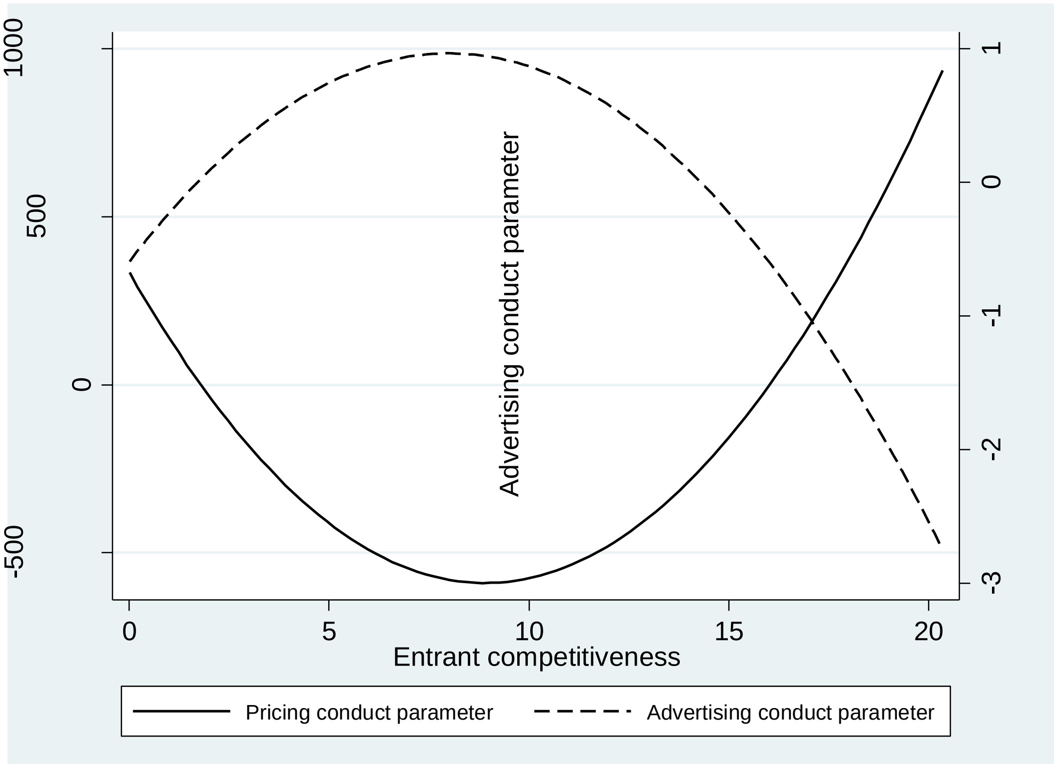


Figure 2.4 Pricing and advertising in the yogurt industry

Figure 3: Relationship between advertising, pricing strategies and entrant competitiveness



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