"NATIONAL BRANDS VERSUS PRIVATE-LABELS: AN EMPIRICAL STUDY OF COMPETITION, ADVERTISING AND COLLUSION"

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National Brands versus Private-Labels: An Empirical Study of Competition, Advertising, and Collusion

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Abstract

This paper considers certain aspects of competition between national brands and quality-equivalent private-label brands (a form of store, house or own-label branding). We investigate the impact of advertising on the ability of brands to increase market power using a model of Cournot competition. Supporting recent theoretical arguments (though contradicting others), our industry study reveals that heavy advertising among national brands can increase prices, revenues, and profits for both national brands and private-label brands. In particular, we find that all players can peacefully co-exist: national brands collude amongst themselves, private-label brands collude amongst themselves, and national brands collude with private-label brands. This holds despite price dispersion across brands, with private-label brands being sold at lower prices. Model outcomes are quantitatively validated by cross-competitor correlations which reveal perfectly synchronized pricing strategies, and qualitatively validated by industry interviews.

Key Words: Retailing, Private-Label Brands, Advertising, Price, Market Power, Collusion, Competition

1. Introduction

Consider the following:[1]

> "The popularity of quality, private-label products is causing concern for branded marketers" (*Adweek*, October 1992),
>
> "Private label brands are commanding unprecedented new power ..." (*Food Technology*, March 1993),
>
> "Private-label nightmare: big name marketers are being stalked by high-quality store brands," (*Advertising Age*, April 1993),
>
> "Price wars seem inevitable in 1994 for most food categories, and food marketers likely will deepen their involvement in private label[s]," (*Brandweek*, July 1993)

versus:[2]

> "The 'boom' in private labels may not be as deadly to brand name products as some have feared," (*Advertising Age*, August 1993),
>
> "... the war between national brands and private labels may be over." (*Advertising Age*, October 1993),
>
> "The competitive pressures of store brands are a blessing to [national] brand managers," (*Advertising Age*, January 1994),
>
> "Private labels' proclamations that they would take over the food industry were proven false," (*Advertising Age*, October 1994).

Referring to what Kotler (1994, p. 449) calls the *battle of the private-label brands*, this paper investigates the role of defensive advertising by national brands facing high-quality private-label brands. In doing so we consider the two conflicting scenarios predicted in both the trade and academic literatures, reviewed later: either (1) advertising cannot prevent price wars, or (2) defensive advertising can lead to a peaceful and profitable co-existence.

A common strategy used by national brands facing high-quality private labels is to increase advertising expenditures. This defensive strategy has been recently used by Procter

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[1]Sources, respectively: Kirk (1992, p. 38), Hollingsworth (1993, p. 88), Liesse (1993a, p. 1), and Spethmann (1993, p. 30).

[2]Sources, respectively: Danzig (1993, p. 2), Liesse (1993b, p. 27), Kelly (1994, p. 22), and Verdon (1994, p. 25).

and Gamble, for example, for a number of feminine hygiene products (Freeman 1994). By studying this advertising strategy, we hope to make two contributions in the literature. First, we propose an empirical approach to understand if, and explain why, defensive advertising can result in one of the two scenarios found in the trade literature. We use an econometric model of Cournot competition which combines certain aspects of the literature concerned with industry conduct (Breshnahan 1989) and the economics of information (Nelson 1974, Schmalensee 1978). No marketing study, to our knowledge, empirically considers potential competition/collusion between established national brands and private-label brands.[3] Second, we rigorously test prevailing theories of advertising: namely, we investigate whether advertising increases or decreases prices across brands of equivalent quality. This test is based on certain unique characteristics of private-label competition.

Our discussion will proceed in the following order. In Section 2 we summarize relevant definitional and managerial issues related to a particularly interesting form of store branding: *quality-equivalent private labels*. We discuss how defensive advertising is often used by national brands facing private-label brands. In Section 3 we review the relevant theoretical literature which generates conflicting hypotheses, clarifying the diverging scenarios mentioned above. In Section 4 we discuss shortcomings of traditional methodologies and propose a model to study the two conflicting scenarios. We then apply the model to a "typical" product category: a heavily consumed beverage. The final section presents explanations for the observed outcome: private-label competition may result in substantial market power (profits) for all players based on advertising-generated differentiation. Monopolistic pricing appears to be masked (or be facilitated) by heavy advertising and promotion amongst national brands. Profits increase over time for all players even though the shares of the national brands decline and quality-equivalent private labels charge substantially lower prices. The national brands' "Battle Against The Private Labels" may in fact result in "An Alliance with Private Labels".

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[3]Our study contrasts to others which consider the effects of advertising or promotion rivalry on discouraging entry of other national brands (entry is endogenous; see, e.g. Lal 1990 or Gasmi, Laffont and Vuong 1992), or the effects of shelf-price promotions by national brands on passive retailers (Rao 1991). Here, we consider cases where entry has already occurred by quality-equivalent private-label brands which compete against national advertisers (entry is exogenous to the study), and retailers play an equally important role in pricing policies across all brands and advertising is explicitly considered.

2. Private-Label Competition

2.1. *Background*

Starting from negligible levels in the 1950s, by 1993 store-brand sales represented a significant proportion of total economic activity, representing 18 percent of the entire U.S. retail market. This includes 25 percent of apparel sales, 18 percent of packaged goods sales, 15 percent of scannable grocery-product sales, and 10 percent of cola sales.[4] For one discounter alone, private-label sales approached $1 billion by the mid-1980s (Wal-Mart).[5] These trends have recently fueled interest in the academic literature (see, for example, Connor and Peterson 1992, Fugate 1986, Huang et al. 1991, Hurwitz and Caves 1988, Grossman and Shapiro 1986, Lattin 1991, Lee et al. 1986, Pabba 1986, Rao 1991, Scherer 1993, West 1992). Given the potential confusion over the various terms used in the trade and academic literature (e.g. own label, private label, private brand, house brand), it becomes important for our discussion to distinguish between two types of store brands: "store labels" and "private labels".

"Store labels", common in the 1960s, 1970s, and early 1980s, are generally generic or budget store brands which traditionally offer manifestly lower quality (in terms of packaging or content quality) for lower prices and usually carry the product class name and the store's name on the label (e.g. Safeway Toilet Tissue). Recently, the trade literature has noted that: "... though price was once a concern, quality that is at parity with national brands has emerged as the key ingredient of a successful store brand," (Wilensky 1994, p. 23) and "... private label brands are now considered comparable to national brands" (Kirk 1992, p. 38). Private-label brands are defined as those which have high quality, with some offering manifestly superior quality to national brands, and establish loyalties to both the label and the store (unlike generics). Private-label brands are generally not advertised, not heavily promoted (Rao 1991), and do not display the store's name on the label. They are allocated premium shelf space, and typically generate higher retail margins (from 5 to 50 percent), despite being sold at lower prices (from 10 to 40 percent) than national brands.[6] National

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[4]Sources: Liesse (1993a, 1993b), Silverstein and Hirschohn (1994).

[5]Marketing News, vol. 26, no. 23, November 9, 1985, p. 1, 14-15.

[6]Silverstein and Hirschohn (1994).

brands and low-quality generics have difficulty building entry barriers to private-label brands as these are launched by the distribution channels themselves who have direct control over entry (shelf allocation) and end-user prices; whereas sellers of "me-too" brands must convince retailers to stock or promote their products with substantial market pull or trade promotions.

Kotler (1994, pp. 448-450) describes the competition between national and private-label brands as follows (emphasis not added):

> In spite of [the] potential disadvantages, middlemen [retailers] develop private brands because they can be profitable. They search for manufacturers with excess capacity who will produce the private label at a low cost. Other costs, such as advertising and physical distribution, may also be low. This means that the private brander is able to charge a lower price and often make a higher profit margin. The private brander is able to develop strong store brands that draw traffic into the stores. The competition between manufacturers' and middlemen's brands is called the *battle of the private-label brands*. ... Middlemen are now building quality in their store brands, thus building consumers' satisfaction. Many shoppers know that the store brand is often manufactured by one of the larger manufacturers anyway.

Some chain stores create a limited number of private-label brands, while others, including smaller regional chains, have strategies of offering over 1000 private-label items.[7] This trend has been traditionally more advanced for grocery products in Europe and Canada than in the United States due to the former having higher levels of nationwide concentration in retailing: Loblaws (Canada), Sainsbury and Tesco (United Kingdom), and Carrefour (France). Retailers with private labels span various industries including both mass and up-scale clothing stores, general discounters, regional drug store chains, regional and national grocery stores and specialty retailers.[8]

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[7]For example, Arbor Drug Stores, Loblaws, Wegmans Food Markets, and Schnuck grocery stores.

[8] These include, for example, respectively: The Gap, The Limited, Macy's, Sak's Fifth Avenue, Neiman Marcus, Wal-Mart, K-Mart, Arbor Drugs Inc., May Drug Stores, Schnuck Markets Inc., Dominiks, Wegmans' Food Markets, Safeway, Loblaws and Kinney Shoe Corporation.

2.2. *Quality-Equivalent Private Labels (QEPLs)*

Among the varying forms of private labels, we are interested in studying competition generated by *quality-equivalent* private-labels (QEPLs); we will not consider private-labels of superior quality to the national brands, though such products are becoming more commonplace.[9] By *quality-equivalence* we adopt the trade literature's definition which is **from the manufacturers' perspective.** QEPL brands offer equivalent *tangible* search and experience qualities to national brands -- i.e. net of utilities or preferences generated solely by the brand name. QEPLs have, therefore, equivalent market access and are indistinguishable from national brands in blind (unbranded) sensual tests. An example of quality equivalence is two identical boxes (package forms) containing equivalent quality sugar cubes (contents) with the brand names printed on the boxes (labels) as the only distinguishing feature. Given a sufficiently refined level of engineering tolerance, physical qualities will always vary between any two products, even for those having the same brand name (e.g. due to imperfect manufacturing controls). QEPL competition represents, however, the closest case, short of commodity exchanges, to competition between *homogeneous goods*. **For the consumers' perspective**, however, *perceptual* qualities may substantially differ across QEPLs and national brands due to communication or advertising (distribution and physical qualities being equivalent across brands). Such vertical differentiation might be measured using branded (non-blind) taste tests for food products, or experience tests for non-food products (e.g. plastic bags, sweaters, photographic film). QEPL manufacturing is possible when product formulation/design knowledge and raw materials are readily accessible across competitors. QEPLs typically emerge from mature industries which are unprotected by patents and rely on commodity-based or low-wage/unskilled manufacturing. QEPLs are found in numerous consumer product categories and are often seen as being the most threatening competitors to national brands.[10]

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[9]Sources for the information in this discussion include various issues of *Advertising Age*, *Brandweek*, *Food Technology*, *Bobbin*, and industry interviews.

[10]These include health and beauty aids (toothbrushes, feminine hygiene products, rubbing alcohol, cold capsules, vitamins, tonics, first aid bandages), disposable products (hygiene napkins, facial tissues, mouth washes), cleaning products (detergents, plastic bags, powder and liquid soaps), food items (table salt, spices/seasonings, cookies, snacks, frozen foods, seafood, breakfast cereals), financial services (credit lines, credit cards), garden supplies, do-it-yourself products (power and hand tools), pet products (dog food, kitty litter), beverages (juices), dairy products, clothing, and footwear.

2.3. *Managerial Issues*

The emergence of QEPLs has generated both coordinated and non-cooperative strategies across retailers and national brand manufacturers. Retailers source QEPLs from companies which do not traditionally market advertised brands (e.g. Weyerhaeuser Company producing disposable hygiene products), or from manufacturers of nationally advertised brands. National brands may be sourced from overseas suppliers who themselves produce QEPLs (which is common in the apparel industry). Industry trade publications have noted that firms which are traditionally seen as being threatened by private label brands are recently "... moving aggressively to combine their branded programs with private label[s]" (Smarr 1989, p. 74). National brand manufacturers currently supply a variety of QEPLs across numerous categories: photographic film with processing included, credit lines, medical products, petroleum-based products, cookies, snacks and frozen pasta.[11] Perhaps one of the most noted national brand manufacturers who also produces QEPLs is R.J. Reynolds Tobacco Company (supplying variety of products to over 200 retailers, such as Albertson's Supermarkets). Reflecting a coordinated strategy, one of the largest manufacturers of nationally-branded mens' sweaters, Lord Jeff, has for decades produced QEPL sweaters for its preferred retailers (Smarr 1989).[12] The decision by manufacturers to produce QEPLs is not fully understood due to the extensive use of subsidiaries or off-shore subcontractors.

In contrast to overtly cooperative strategies, certain national brand manufacturers have stated policies of not co-manufacturing private labels or are known to actively defend their brands from private-label competition.[13] One of the most common reactions to private label entry is to dramatically increase advertising. This defensive strategy is often used by national branders who cannot risk modifying a product's physical quality in fear of consumer backlash (e.g. the New Coke). Quality changes also become especially risky when the product is widely accepted, is standardized, or when changes can be easily mimicked by the private

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[11] Firms include Eastman Kodak Company, Barclays Bank, Baxter Healthcare Corporation, General Electric Credit Corporation, Valvoline Oil Company and Keebler Company.

[12] One retailer, for example, Sears Roebuck & Company, manufacturers and sells private label brands, but also manufactures private labels for competitive retailers.

[13] These include Procter and Gamble Company, Johnson and Johnson, Kraft General Foods, Kellogg Company and Coca-Cola Corporation (see Liesse 1993b).

branders. Defensive advertising being the primary strategic response to QEPLs, certain industry watchers claim that "price wars seem inevitable", especially among national brands, whose shares frequently decline vis-a-vis store brands (Spethmann 1993).

Retailers' strategies have followed a consistent pattern. When launching QEPLs, they typically "de-list" or exit from their shelves weaker brands, low-quality generics, or poorly supported national brands and generously allocate premium shelf space (eye-level, hand-level or end-of-aisle) to the private labels (Weintraub 1989). By doing so, retailers limit their offerings to only heavily advertised products and QEPLs.

QEPL competition generates a number of managerial questions. From the national brand *manufacturers' perspective*:

> Does a manufacturer imperil the price premium of its advertised brand if it also produces a private label of equivalent quality and sells this to retailers which carry its brands? Will defensive advertising by national brands engender a price war? Can national brands maintain profits when their market shares decline?

From the *retailers' perspective*:

> What will be the equilibrium shopping behavior of consumers who see heavily advertised and QEPL brands on the same shelf? Can private-label brands maintain prices over time in the face of high levels of advertising spending by national brands?

Economic models of advertising offer conflicting hypotheses in parallel with the debate currently observed in the trade literature. Hence, it is strongly proposed in both academic and managerial domains to focus on empirical tests of market outcomes. Before proposing a model which can help managers better answer these questions, we will briefly review the relevant theoretical literature.

3. The Hypothesis

Our study seeks to understand if defensive advertising by national brands facing QEPL brands will lead to one of the two scenarios discussed in the trade literature:

H_0. prices are driven toward competitive levels: market power is low,

versus,

H_1. prices are above those implied by competition: market power is high.

By "market power" we mean the degree to which firms are able to price above marginal costs as implied by competition (Tirole 1990, p. 284). The primary force behind H_0 is the logic that advertisers will have no choice but to reduce prices in the face of clone-like competitors who charge substantially lower prices. This is especially true for search or experience goods where advertising claims of superior quality are untenable in the long run (Nelson 1974).[14] A number of authors have recently argued, however, that advertising may serve to increase market power.[15] In this section we briefly review two independent mechanisms identified in the literature: (1) advertising leading to differentiation and (2) advertising facilitating collusive arrangements.[16] It should be recognized that the national brands advertise heavily on national media (e.g. television), whereas QEPLs mostly benefit from in-store display or umbrella advertising (focusing on store attributes), if at all. The literature on advertising generally does not distinguish across communication forms, but by overt advertising expenditures. In our study, national brands are generally considered to be heavy advertisers, whereas QEPLs are considered to be non-advertisers (though they benefit from information generated from consumer search).

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[14]Also, one might foresee QEPLs reducing price in order to compete against increased advertising by national brands, causing a price war.

[15]See Ekelund and Saurman (1988), Sutton (1991) and Wills (1987) for more thorough reviews.

[16]Given our interest in studying pricing strategies across brands of similar quality, we will concentrate on price-advertising relationships, as opposed to related literature streams discussing price-quality or quality-advertising relationships (see, for example, Tirole 1990 for a review of these areas).

3.1 *Advertising: Differentiation*

In his review of the literature, Tirole (1990, p. 278) proposes a *principle of differentiation*, which holds that firms generally seek to avoid direct price competition via differentiation: "Two firms producing perfect substitutes face unbridled competition ... In contrast, product differentiation establishes clienteles ... and allows firms to enjoy some market power over these clienteles." He further notes that firms use a variety of marketing tools to create differentiation, including "gadgetry and advertising" (p. 278). Advertising, as a mechanism to differentiate, is used, therefore, to create market power by "relax[ing] price competition (p. 286)", and may allow firms to better price discriminate, or extract consumer surplus (see Tirole, Chapter 7 for a discussion on the relationship between differentiation and price discrimination).[17]

In the case of products of equivalent quality, advertising's ability to increase market power via differentiation is based on advertising being persuasive. Viewed as persuasion, advertising, especially on television, affects consumers' judgement, utility, and/or reservation prices.[18] Such advertising is typically non-informative (e.g. does not emphasize price-quality comparisons), may be deceptive, or serves to reduce cross-price elasticities of demand, thus increasing market power; see Comanor and Wilson (1979), Schmalensee (1978), and Tellis and Wernerfelt (1987).[19] Not all persons, however, are necessarily persuaded (Burger and Schott 1972, Griliches and Cockburn 1993). *National brand seekers* (i.e. persons who are persuaded) purchase nationally advertised brands. *Private-label seekers* (i.e. persons not persuaded) purchase lower-priced QEPLs which are not heavily advertised; see Rao (1991) and Lattin (1991) for interesting discussions on the implications of such segmentation on promotion strategies. Where *advertising is persuasion*, market power is increased for both

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[17]Differentiation can be vertical (advertising creates uniformly higher quality perceptions for national brands) or horizontal (advertising itself is a distinguishing quality sought by some, but not others).

[18]When all consumers are equally persuadable, advertising wars may emerge, thus increasing selling costs which may result in higher industry-wide prices (Gerstner 1985). In QEPL competition, however, not all firms advertise heavily.

[19]While the existing empirical studies have shown a positive relationship between advertising and price elasticities (see, for example, Krishnamurthi and Raj, 1985), little empirical evidence demonstrates situations where market prices are positively correlated to brand advertising.

retailers who price discriminate, and heavily advertised brands who charge premiums. In this scenario, *prices do not fall toward marginal costs*, supporting H_1. It is important to understand that differentiation also increases market power for the QEPLs, which are not advertised, since they stand to face less competition within the lower priced segment of the market (i.e. they face less direct competition from the national brands). We should also note that retailers set end-user prices for both the advertised and their own private-label brands (potentially internalizing competition across brands within their stores). Both parties stand to gain from possible price discrimination based on advertising differentiation. A retailer will price both the national and QEPLs so as to minimize consumer surplus (discrimination); not selling or reducing the price of advertised products to brand-seekers may reduce profits. This form of discrimination would not be possible were it not for the existence of advertisers.

In contrast to the *advertising as persuasion*, another influential stream of literature views *advertising as information*. A product's price and quality (i.e. value) is directly or indirectly conveyed, encouraging marginal cost pricing for brands with similar search or experience qualities (Nelson 1974). In equilibrium, advertising is informative of tangible quality/price differences and misrepresentation is not sustainable (i.e. both the form and the level of advertising are determined in equilibrium). Even in cases where quality is difficult to judge for a large proportion of the population or brands are heavily endowed with credence qualities (Darby and Karni 1973), advertising is likely to increase market efficiency and prices will signal quality. This is especially true when quality uncertainty leads to information search from expert consumers.[20] Extending this stream of thought to QEPL competition, advertising will *narrow all brands' prices toward competitive levels (i.e. toward marginal costs)*, supporting H_0.[21] An obvious difficulty in applying this line of reasoning to QEPL competition comes from the fact that advertising occurs amongst the higher-priced brands, who have few incentives to advertise price (quality) differences (similarities). While private-label brands are generally known to have lower prices than national brands, this outcome may

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[20]For recent refinements see Bagwell and Ramey (1988, 1993, 1994), Devinney (1988), Ippolito (1990), Stegeman (1991), Klein and Leffler (1981), Milgrom and Roberts (1986), Ross (1988), Wiggins and Lane (1983), and Wolinsky (1983).

[21]The public policy implication is that if advertising is restricted to be zero across all firms (e.g. by law), prices will generally increase for all firms.

be temporary and should be observed over an extended period. Gradual adjustments may take place, as predicted. Summarizing, according to the literature on the economics of advertising, our hypothesis can be rephrased as follows:

H_0. advertising → information → price wars → decreases market power

versus,

H_1. advertising → persuasion → differentiation → increases market power.

3.2 *Advertising: Collusion*

Independently from differentiation, a number of authors argue that advertising may facilitate collusive arrangements which also serve to increase market power (also leading to H_1). Some have considered, for example, the use of advertising to inhibit the entry of other branded products (Bagwell and Ramey 1988, Brozen 1974, Koh and Leung 1992 McAfee 1994, Rizzo and Zeckhauser 1990, Slade 1990, Verbeke 1992, Wills and Mueller 1989).[22] Gasmi, Laffont and Vuong (1992) empirically consider the case of advertising competition between Coca Cola and Pepsi-Cola using a model of duopoly in differentiated markets where firms can collude in advertising, price or both.[23] In the case of QEPL competition, national brands are not likely to create credible entry barriers against retailers who have direct control over shelf space, or who have already launched QEPL brands within the category. Advertising may serve, however, to discourage entry by other national brand manufacturers. Advertising-based barriers can, therefore, limit the number of nationally branded entrants and thus serves to increase market power amongst advertising brands.

In addition to creating entry barriers, a coordination argument is frequently invoked in cases where firms use advertising as a tacit communication mechanism, instead of using overt, possibly illegal, communication channels (e.g. memorandums of understanding).[24]

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[22] See also Lal (1990) who studies tacit collusion based on promotion coordination across heavily advertised brands.

[23] This approach has been recently challenged in Gisser (1991) who finds that concentration leads to intensive advertising rivalry, and argues that concentration, not advertising per se, increases entry barriers.

[24] Firms may also use the same advertising agency as a device to facilitate collusive behavior; see Demsetz (1973), Bernheim and Whinston (1985) and Zhang (1993). See also Baye and Kovenock (1994) and Levy and Gerlowski (1991) on how advertisements to "offer the lowest prices in town or

This mechanism is less relevant to private-label competition for a number of reasons. First, retailers and national branders "legally" and routinely communicate as the former buy from the latter on a regular basis; tacit coordination becomes unnecessary. This communication is also facilitated by some manufacturers producing both national and private-label brands. In addition, shelf-space allocation negotiations also lead to conversations between national and private-label branders. This explicit communication and industry structure, therefore, stands to facilitate cartel-like behavior which can be coordinated in the course of normal operations. While advertising may not be directly used as a communications tool, it nevertheless identifies the parties likely to be in conversation: retailers and national brands manufacturers who advertise the most (i.e. firms with brands which receive shelf space).

Finally, we can conjecture that advertising rivalry can play the role of masking explicit collusion (private cartels) from the public; masking, therefore, is another form of advertising persuasion. A casual observation, such as, "the industry must be competitive given all of the advertising wars" illustrates such a mask. Of course, the management of cartel-like behavior becomes complicated because store brands compete against each other, as well as against the national brands. The extent to which this cross-store/cross-brand coordination is possible in practice is becomes an empirical issue.

Summarizing, the literature has recognized that advertising may serve to facilitate collusive conduct by discouraging entry, facilitating communications, or masking cartels. The emergence of any of these mechanisms would stand to increase market power. It is important to note that the literature treats advertising-based differentiation and advertising-based collusion as two independent mechanisms (though both may be at work simultaneously). Collusive conduct need not depend on differentiation (i.e. advertising can foster collusion in prices without products being differentiated based on advertising). Likewise, advertising differentiation can occur without price-fixing behavior. Either mechanism can theoretically be sustained by advertising and both result in high market power (avoiding price wars). While primarily interested in developing a test for the general hypothesis (H_0 versus H_1), we will later discuss particular aspects of advertising (differentiation, versus collusion) in order to gain insight into the specific mechanisms likely to be at work within our empirical study.

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we'll pay the difference" encourage collusive pricing strategies across retailers for national brands (not facing QEPLs).

4. An Empirical Study

4.1. *Traditional Empirical Approaches*

Our study is not the first to empirically investigate the controversy over whether advertising leads to price wars or price inflation within the marketing literature (e.g. see Farris and Albion 1980).[25] In a broad study, Farris and Reibstein (1979), for example, report a positive relationship between advertising, quality and relative price based on a study of 227 consumer businesses. Problems in previous studies include (1) not controlling for shifts in marginal costs over time or across products (e.g. high prices may not reflect market power, but shifts in factor input prices), (2) products are of varying physical quality and prices net of quality differences are unobtainable (a control offered by studying QEPL competition), and (3) competitive conduct based on strategic variables is not identified. Failure to consider conduct may lead to the erroneous conclusion that a decline in the market shares of national brands reflects a competitive weakness. Clearly, if share declines of the national brands are coupled with sufficiently high price increases, the declines in shares may result in higher total revenues and profits (controlling for shifts in marginal costs). The entry of low-priced quality-equivalent brands does not, in and of itself, imply higher levels of competition. Similarly, observing isolated correlations in the number of competitors, their shares, advertising levels, promotion activities or prices for sub-groups or individual firms may reflect a continuum of outcomes ranging between monopolistic and perfectly competitive outcomes.

4.2 *The Model*

In contrast to focusing on the isolated behavior of individual brands, for the reasons stated above we focus at category-level dynamics which are revealing of brand-level strategies. We assume that brands differ by their advertising levels and that all brands are tangibly equivalent in quality as viewed by manufacturers. We also assume that national brands and QEPLs have equivalent distribution and that prices across competitors are fully revealed at the point of purchase (given adjacent shelf locations; Conner and Peterson 1992).

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[25]Other studies consider the relationship between advertising and quality (Lambin 1976; Gerstner 1985), though the results are not consistent. Some show a positive correlation, while others show very little, or negative correlation.

We assume that the category is fully mature implying (1) advertising spending at the brand-level does not affect aggregate industry demand (a testable assumption), and (2) no further marginal cost reductions are possible due to cumulative learning. We also assume that firms do not engage in limit pricing strategies; entry by low-priced brands has occurred to its limit. Total costs may vary, though marginal costs are assumed similar across brands. Each brand maximizes profits which are calculated as an average unit margin times quantities sold, less a lump sum advertising expenditure; for any brand, therefore, advertising costs do not enter into the marginal cost function (derived from the total cost function). These assumptions narrow the applicability of the model to mature categories which have already experienced substantial private-label entry across major retailers for an extended period of time on a national basis (if advertising is measured nationally).

Our methodology uses a model of market conduct proposed in the industrial economics literature (see Breshnahan 1989 for a review). Market conduct models have been recently applied to the study of gasoline pricing (Slade 1992), and cable television pricing (Rubinovitz 1993). To our knowledge the marketing literature has yet to consider the effects of advertising across national brands and QEPLs based on market structure models. The approach requires simultaneous estimation of marginal costs and demand in order to measure the extent to which prices reflect competitive outcomes. In what follows, we adopt this approach while extending it to include an explanatory covariate: advertising. After describing the basic model, we discuss certain implementation concerns.

For a specific category definition, brands face the following market demand function:

$$P_t = f(Q_t, Z_t) \tag{1}$$

where P_t is the prevailing price in period t ($t = 1, \ldots, T$), Q_t is the industry-level quantity demanded in time t, and Z_t is a vector of market-specific factors affecting demand (e.g. exogenous or non-advertising based shifts in preference, etc.). Since we assume that the market is in complete maturity, advertising expenditures do not enter the demand equation. In a study of promotion strategies across national and private-label brands, Rao (1991) similarly assumes that aggregate demand is unaffected by marketing activities. Industry total revenues, TR_t, are therefore defined as,

$$TR_t = Q_t f(Q_t, Z_t) \quad (2)$$

Differentiating Equation (2) for Q_t, marginal revenues, MR_t, are defined as,

$$MR_t = f(Q_t, Z_t) + Q_t f_{Q_t} \quad (3)$$

where f_{Q_t} is the partial derivative of $f(Q_t, Z_t)$ with respect to Q_t.

Let θ be a measure of market power within the category ($0 \leq \theta \leq 1$). If $\theta=0$, prices reflect perfect competition (all firms price at marginal costs). The more market power, the higher θ above 0. If $\theta=1$, prevailing prices reflect monopolistic levels (perfect market power, or marginal revenue pricing). If we assume that firms will never price lower than marginal costs, and will never price beyond monopolistic levels, we specify (as in Rubinovitz 1993) the following supply relationship:

$$P_t = \theta (P_t - MR_t) + MC_t(.) \quad (4)$$

where $MC_t(.)$ are marginal costs. Marginal costs are derived from the total cost function which incorporates advertising as an additive lump sum expense:

$$TC_t = F_t + A_t + V_t(.) \quad (5)$$

where TC_t are total costs, F_t are the fixed costs, A_t are lump-sum advertising expenditures, and $V_t(.)$ are variable costs in period t which are a function of industry-specific input factor prices (e.g. wage rates) and quantities produced. Substituting Equations (1) and (3) into the right-hand side of Equation (4) we obtain,

$$P_t = -\theta Q_t f_{Q_t} + MC_t(.) \quad (6)$$

Equation (6) has three important characteristics. First, we see that θ provides a direct measure of market power while simultaneously controlling for both supply and demand. Second, we see that advertising affects neither industry demand nor marginal costs. Finally, we observe

that quantities sold do not affect marginal costs, as learning effects are assumed to be negligible.

Given these characteristics, we seek to understand the effects of advertising on θ; or

$$\theta_t = f(A_t) \tag{7}$$

where A_t is advertising in time *t* and $f(A_t)$ is bounded between 0 and 1; advertising is likely to increase over time as a strategic defense against QEPLs (a testable conjecture). We are interested in understanding whether $\partial\theta/\partial A_t>0$, advertising increases market power, or whether $\partial\theta/\partial A_t<0$, advertising increases price competition. As discussed above, the theoretical literature has generated conflicting arguments as to why θ_t is increasing in A_t or decreasing in A_t, leaving the question to empirical research. Should advertising act as information as proposed by Nelson (1974), among others, prices should converge across quality-equivalent brands and ultimately approach marginal costs (or levels implied by Cournot competition), otherwise advertising may generate differentiation or facilitate collusion among sellers leading to lower levels of output or non-competitive prices.

4.3. *Implementation Issues*

As noted in Breshnahan (1989), specifications lack generality across industries and must be tailored to the case being studied (i.e. the specification for the automobile industry will differ from that of the banking industry given different supply and demand drivers). Beyond specific industry requirements, care must be taken in interpreting the model results when Cournot competition is assumed among *N* symmetric players. As shown in Appendix A, $\theta=(1/N)$ reflects Nash outcomes in prices/outputs. When $1\geq\theta>(1/N)$, then θ reflects price levels beyond those implied by Cournot competition. This property can be exploited within empirical applications, where *N* is known, by reducing the threshold for tests of market power. For example, if $N=4$, then for market power to be implied, θ need exceed only $(1/4)=0.25$, rather than equal 1.0; likewise, values statistically equivalent to or less than 0.25 reflect competitive outcomes. In marketing contexts, *N* can be considered the evoked or consideration set of brands the consumer is likely to choose from at the point of purchase.

As the model can be used without measures of symmetry or the number of brands, applying this property to competition across quality-equivalent brands proves paradoxical. The assumption of symmetry, in practice, is often supported from narrow price dispersion (and market shares) observed across competitors within a given industry. Limiting the study to brands which compete within a narrow range of prices (cross-sectionally) is common in empirical studies using this general approach. In this respect, if we limit the model to the study of QEPLs alone, or national brands alone, then we are on reasonable grounds to assume that $\theta=(1/N)$ is Nash equilibrium, where N is the number of QEPLs, or national brands in competition, respectively. If, however, we use the framework while aggregating across both national and QEPLs, the Nash interpretation of $\theta=(1/N)$ poses an interesting philosophical dilemma. Suppose we assume the null hypothesis is "advertising works as information": H_0. Then any price dispersion observed must be assumed (on an ex ante basis) to be caused by random imperfections in the market (differentiation not being possible). The Nash interpretation of $\theta=(1/N)$ is justified in terms of our ability to reject the null (i.e. we assume the data are generated under the null, and apply the model accordingly). In this case, we cannot pre-judge the data as reflecting a process which rejects the null hypothesis. However, the empirical application of the model may reject the null -- potentially implying differentiation. Qualities, although identical from the manufacturer's point of view, are "perceptually" different across brands leading to price dispersion. While this implies market power, symmetry is lost in consumers' "perceptual" space, though retained in managers' "full-information tangible quality" space. The actual value of N may, therefore, be lower in perceptual space than in the tangible product space. Strictly using $\theta=(1/N)$ as a threshold for market power may, therefore, be too stringent from the consumer's view (but not the manager's); i.e. we tend to increase our chances of finding market power using $\theta=(1/N)$ as a threshold. In all cases, if we empirically cannot reject that $\theta=1$, yet reject $\theta=0$ this will nevertheless present strong evidence against the null hypothesis. In addition, we can conservatively assume that the evoked N is never less than 2; if not, then we reject the null by definition. The threshold in this case is $\theta>(1/2)=0.5$ to reject the null. Of course, we accept, from a philosophical point of view, that we cannot pre-impose that price dispersion necessarily reflects differentiation as this may simply represent marginal imperfections and/or transient outcomes.

Given the cautionary note above, we propose applying the model in stages. First we investigate the hypothesis at the disaggregated level by limiting the data to national brands in the first case, and private-labels in the second; finding market power at either level is sufficient to reject the null. We then consider models which aggregate across national brands and QEPLs. We will further report a number of internal and external tests which can shed light on the validity of the empirical application. In all cases, we conservatively test θ being significantly different for 0.5 (N>2). In other words, brands always face at least one other competitor in the product class.

Despite the potential quandary posed by structural approaches for products of similar quality, where some are advertised, and others are not, it is important to note that studying QEPL competition proves to generate a rigorous yet conservative test of advertising's effect on competition. We are more likely to find dispersion when physical quality differences are pronounced, thus erroneously leading to an inflated measure of market power (i.e. prices may reflect physical quality differences). We now turn to an implementation of the basic model using a data set which meets the criteria established above.

4.4. *The Data*

To apply the aforementioned model, we use data from what may be the most consumed product category in the world; managers estimate that over 65 percent of the world's households, representing over 2.6 billion people, consume the product on a regular, and for many on a daily, basis. Beyond stating that the brands belong to a beverage category, we do not reveal the exact product class or the national location where the data were collected. For reasons of sensitivity, we will refer to brands as Brand A, Brand B, Brand C, and so forth. The data represent national figures. The form of competition is limited to quality-equivalent brands, as defined earlier. The product category studied is analogous to fruit juice, table salt, or sugar cubes. The product class is international in scope, the raw materials are sold in auctions, and there has been heavy purchases from multiple generations of consumers. Industry studies reveal that over 98 percent of households in the country studied consume brands within the category (national or private-label brands); generic store

labels are not present in this category.[26] Both national and private-label brands in the product class have all been in competition for more than two decades; over this period there were neither exists nor entry of brands. This market is of academic interest since information asymmetries are low or non-existent (both consumers and manufacturers can easily assess quality across brands) and search costs are negligible. National brands compete against private-label brands in approximately 90 percent of the country's retail outlets. There are three major retail chains (i.e. N=3 when the analysis is limited to QEPLs alone). All major retailers have a long history of private-label competition within this category. The brands sold have equivalent experience qualities (e.g. "flavor"), and packaging (excluding the printed label). The firms use the same sourcing for the consumable portion of the product (e.g. they purchase from the same "orchard"). Industry studies reveal that consumers can not distinguish quality differences across brands in blind tests. Given strong quality equivalence, QEPL entry would normally reflect a substantial threat to national brands (under the null hypothesis discussed in the previous section). Unlike some other beverages, the brands studied are not based on secret formulas.

Data on advertising, pricing and sales (monthly data reported by A.C. Nielsen) were collected over a 62 month period from January 1987 to February 1992. The series begins after private-label brands had established a strong and stable presence in the industry. Industry sales are stagnant over the period and advertising levels in the industry are uncorrelated with industry sales (*p-value*>.69). The study period ends prior to the impact of a discontinuous innovation introduced in the early 1990s which might contaminate the series (a new formulation introduction in a related category). All brands can be grouped into three mutually exclusive, yet collectively exhaustive categories: (1) four advertised national brands, (2) unadvertised or minor national brands, and (3) private-label brands produced and sold by the three major grocery chains. Figure 1 shows the time trend of industry sales for major brands and private-label brands. Table 1, Panel A, provides descriptive statistics for each group. National advertisers are highly concentrated. Two brands (Brand A and Brand B) account for nearly all of the industry advertising and most of the national brand sales. Brands

[26]Specialty and/or exotic versions of the product category are excluded from this analysis; these represent about 20 percent of total category sales; the remaining 80 percent are the brands under study.

C and D are secondary brands, and Brand D is owned by the same firm as Brand A. Combined, these four brands account for virtually all product class advertising (measured in television exposure levels, or gross-rating point equivalents). The top two Brands (Brand A and B) are considered long-standing rivals by the general public who have virtually 100 percent adult-unaided awareness of the two brands. Minor brands account for some 11 percent of total industry revenues, yet have negligible advertising levels. Private labels are mostly sold by the major grocery chains; their shares of industry revenues have grown from some 11 percent in the mid-1980s to over 15 percent in the early 1990s. Private labels do not use names which are associated with the names of the stores. The primary difference between advertisers and private labels are their absolute price differences. A unit of the product is commonly priced, for example, at 1.56 for an advertised brand, versus 0.98 for a private-label brand.

4.5. *Empirical Specification*

To formally test the effects of advertising on price competition across QEPLs and national brands, we begin by specifying Equation (7) of the model as follows:

$$\theta_t = 1 - [1/(1+\exp(-k*\ln(ADV_t)))] \qquad (8)$$

where ADV_t is the level of industry advertising activity in time period t, and k is constant; the natural logarithm of ADV_t is always positive for the series studied, and ADV_t is generally increasing in t. As k approaches large positive values, then θ_t approaches 0 and advertising leads to competitive equilibria (supporting H_0). If k approaches large negative values, then θ_t approaches 1 and we conclude that advertising leads to market power (supporting H_1). When k=0, Nash prices are implied for competition between 2 symmetric brands: i.e. θ=0.5 when k=0. For a market of more than two evoked brands, k=0 is a non-competitive outcome.

In order to estimate θ_t, we develop a system of equations for market demand and supply adapting models proposed in Rubinovitz (1993). Market demand, Equation (1), is modelled as a Cobb-Douglas function of per capita output, Q_t, inflation-adjusted per capita sales of nonalcoholic beverages ($NONALCOHOL_t$), real consumer interest rates ($INTEREST_t$) and a dummy variable ($DUMMY_t$) signifying the period over which one of the advertisers

changed a package design (during the second half of the series):

$$P_t = e^{a0}Q_t^{a1}\text{NONALCOHOL}_t^{a2}\text{INTEREST}_t^{a3}e^{a4\text{DUMMY}_t}e^{et} \quad (9)$$

or, taking natural logarithms,

$$\ln(P_t) = a_0+a_1\ln(Q_t)+a_2\ln(\text{NONALCOHOL}_t)+a_3\ln(\text{INTEREST}_t)+a_4\text{DUMMY}_t+e_t \quad (10)$$

where P_t is the inflation-adjusted price in time t, Q_t is the per capita quantity sold in t (using weight/volume standardization across brands), and e_t is a random disturbance term. NONALCOHOL_t is used to control for any general shifts in tastes between alcoholic and nonalcoholic beverages (a potential factor for this particular category); INTEREST_t is used to control for possible shifts between savings and disposable income.[27] DUMMY_t is simply used as a control variable; the results are not sensitive to the inclusion/exclusion of this variable. Again, advertising expenditures are not included in the demand equation for two reasons: (1) the industry is several decades mature, and (2) when included, it shows no effect on industry sales. Given this demand relationship, to develop the supply equation we need to specify the marginal cost function and substitute it into Equation (6). Marginal costs, in Equation (4) above, are assumed to be a function of wages which were deemed to be the single key factor input price (other factor inputs such as raw materials are hedged over time and show minimal variation, as opposed to labor costs which cover logistics and handling):

$$\ln(MC_t) = b_1 \ln(\text{WAGES}_t) + u_t \quad (11)$$

where b_1 is a constant parameter, WAGES_t is an inflation-adjusted average hourly wage index per worker in the country studied[28], and u_t is a disturbance term. It should be noted

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[27]Additional demand drivers, such as income per capita, were considered but found severely collinear with the retained variables, virtually constant over the study period, or insignificant across all models tested. Data sources: *International Financial Statistics*, International Monetary Fund, various issues, and *International Marketing Data and Statistics*, Euromonitor Publications, various issues.

[28]Additional cost factors were considered, such as measures for cost of capital and energy, yet these proved highly collinear with wages and generated singularities within the estimation procedure.

that we do not estimate/specify the total cost function as we need to only understand marginal costs; in the total cost function, we assume costs rise with output at a constant rate (though multiplicative with wages); there are no production learning effects on marginal costs. From equations (6), (9), and (11) we finally obtain the following market conduct equation (see Appendix B for a discussion of the derivation):

$$\ln(P_t) = - \theta_t a_1 + b_1 \ln(WAGES_t) + u_t \qquad (12)$$

where u_t is a disturbance term. We estimate equations (10) and (12) simultaneously with θ_t specified in equation (8). To insure efficiency, parameters of the resulting nonlinear system (a_0 a_1, a_2, a_3, b_1 and k) are estimated using seemingly unrelated nonlinear least squares; all parameter estimates are, therefore, asymptotically efficient. Table 1, Panel B, provides descriptive statistics for the model variables.

4.6 *Results*

As mentioned above, we apply the model in stages by first analyzing competitors within specific groups. Models 1, 2, and 3 in Table 2 report model estimates when the data (prices and quantities) are constrained to include only advertisers, only national brands (advertisers and minor brands), as well as only private labels, respectively. Across all of the models, the parameter estimates for key variables are generally significant and all have plausible values (e.g. negative demand elasticities). In particular, we focus attention on the parameter k which measures the relationship between advertising and market power. Across all of the models we see that k is negative and statistically significant, implying that advertising creates market power. This holds true irrespective of whether we limit the data to advertised brands or private labels. In other words, advertising by national brands reduces price competition among both the QEPLs (in our study, these represent the sales across the three major retailers), and the national brands. This result is consistent with the argument that advertising serves to differentiate brands of similar quality. Based on these estimates, we can reject H_0 in favor of H_1: advertising serves to increase market power, or helps firms avoid price wars. The models further indicate that market power is extremely high within each sub-group studied. Advertisers, national brands, and store brands all appear to charge collusive

prices or act as monopolists (θ_1, θ_2 and θ_3>.999). Again, based on the analysis of these sub-groups alone, we can reject the null hypothesis. Model 4 aggregates across all brands and indicates that prevailing prices across all brands reflect monopolistic outcomes. The significant estimate of k=-1.3597 in Model 4 corresponds to an average estimate of θ_4>.999 (even though advertisers and private labels are selling at different price points). In other words, all firms appear to collectively use cartel-like pricing strategies. Our strong results naturally raise concerns over the validity of the models. In the next sections we report model-based, method-based and external validation tests before drawing definitive conclusions with respect to the hypotheses.

4.7 *With-in Model Validation*

Two model-based validity tests are considered. Our first test involves an alternative measure of advertising intensity. So far we have measured advertising intensity using the total industry advertising levels (total exposure levels), as is consistent with the theoretical literature on advertising. An alternative measure is to consider the coordination or rivalry in advertising levels over time across the major competitors; Lal (1990) considers this behavior in promotion competition. Table 3 reports the correlation in advertising levels across advertisers over time; Figure 2 plots the advertising levels over time. The statistically significant correlations in advertising across competitors, as shown in Table 3, may indicate coordinated rivalry for this industry, though the correlations are low. Table 4 reports four models which substitute total advertising levels with the absolute difference between the top two advertisers' advertising levels (Brand A and Brand B). Models 5, 6 and 7, reported in Table 4, indicate that the previous results are insensitive to the measure of advertising intensity (θ_5, θ_6 and θ_7 are each greater than .999); nonlinear estimation of θ, when the data are limited to private label sales, failed to converge. Model 8 reports a duopolistic aggregation whereby rivalry (sales, pricing, and advertising) is limited to only the top two advertisers (Brand A and Brand B). Again, we find evidence of market power (θ_8>.999).

Our second validity test considers two additional null hypotheses based on Equation (8). While we have rejected H_0, we may not be in a position to reject H_1. The fit statistics reported in Tables 2 and 4 for k measure whether conduct is statistically different from θ=0.5, or Nash prices when the market is limited to two or more symmetric firms (i.e. when k=0,

then θ=1/2=0.5). A significant and negative k implies a rejection of prices being generated from duopolistic competition, but this does not indicate a rejection of perfect competition, nor a failure to reject purely monopolistic pricing. Sixteen additional models were run by adding an intercept constant, k_0, to a conduct parameter, k^*_1, in order to estimate the alternative hypotheses ($k=k^*_1+k_0$). The intercept value forces the conduct parameter to measure deviations from θ=0 or θ=1. For example, in the case of Model 1, we re-estimated the parameters by imposing k_0=1.5 or k_0=-1.5 (depending on the hypothesis). Eight models tested the null of perfect competition (θ=0; $k=k^*_1+1.5$; k^*_1 is sufficiently negative and significant), and eight tested the null for cartel strategies (θ=1; $k=k^*_1-1.5$; k^*_1 is not significantly different from zero) using the variable definitions in the eight models reported in Table 2 and 4. In all cases estimated, we reject perfect competition (*p-values*<.005), yet are unable to reject monopolistic pricing (*p-values*>.4) across all models. Based on these tests of alternative null hypotheses, the models strongly reject the hypothesis that advertising intensity and/or the entry of quality-equivalent QEPLs leads to a lowering of market power.

4.8 *Validation using Alternative Methods*

The use of structural conduct models is rather recent (Breshnahan 1989). Prior studies in this area generally focused on the dynamics of industry concentration and profit margins (see Scherer and Ross 1990, pp. 70-73, for a review). While certain of these have been criticized for various limitations, it would be nevertheless instructive to know if they fail to reject the null hypothesis (H_0). We now consider two such measures of market power and correlate these with advertising. The first is the Herfindahl-Hirschmann Index (HHI) which is simply the sum of squared market shares across the competing brands; in our case the number of brands remained constant over the time period considered. We calculate the HHI using shares from the four advertised brands, the minor brands, and the QEPL brands, representing six total competitors (a typical level of competition within a given store). We then correlate this index with advertising. Rejecting the null hypothesis, the index is positively and significantly correlated with advertising levels (Pearson correlation equals .29 with a *p-value*<.03).

An alternative measure of conduct is proposed in Connor and Peterson (1992): a quasi-Lerner index. The Lerner Index (0<L<1) gives an aggregate estimate of gross contribution

for the industry (Lerner 1934). The Lerner index is calculated as *(price-marginal cost)/price* using values observed over the series considered. All other factors held constant, high values of *L* imply high levels of market power. As the index is difficult to calculate when data on marginal costs are not in the public domain, Conner and Peterson (1992) propose using a *quasi-Lerner* index which is calculated as follows: $L = (PN-PP)/PN$, where *PN* is the average price of national brands and *PP* is the average price of private-label brands. While this measure suffers from the assumption that private label brands price at marginal costs, or perfectly competitive levels, it may nevertheless provide a rough approximation of national brand profitability or power over time.[29] Lending support to the econometric model, the quasi-Lerner index calculated from our data significantly correlates with total advertising levels (Pearson correlation =.34; *p-value*<.01). Identical results are obtained when we assume various mark-up levels above marginal costs for the private labels (thus deflating *PP*), as this is a monotonic transformation of the index. It is interesting to note that Conner and Peterson (1992) find similar results in a cross-sectional survey of over 153 private-label categories. In their study, the authors find that the gross margins of national brands vis-a-vis private labels are higher, and price dispersion generally greater, in categories having higher levels of advertising expenditures. Returning to the broader managerial concern, these alternative methodologies support the contention that advertising by the national brands facing QEPLs neither leads to higher levels of competition (thus a reduction in profit margins for the national brands), nor price wars.

4.9 *External Validation*

We now turn to validation using information external to the model: (1) quality correlations with strategic variables, (2) cross-competitor correlations over time in price, (3) relative-price dynamics, and (4) industry interviews. The purpose of this discussion is to infer circumstantial evidence in support of the reported outcome. First, we consider the apparent contradiction offered by the existence of private-label branding to the hypotheses generated

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[29]The Lerner values calculated from the econometric models gives values greater than .95 for the category studied. Given that previous empirical studies of market conduct have estimated Lerner Index values ranging from .10 (retail gasoline) to .88 (banking), the value for this product class appears to reflect extraordinary market power (Breshnahan 1989).

from the *advertising as information* school of thought. In the cases of *quality-equivalent* private-label competition, we note that *quality is not correlated to price* (quality is constant, yet prices vary). This certainly holds for the category studied, but is also a generality for this type of competitive environment (Kotler 1994). We further note that there is *no correlation between advertising and quality*, and *there is a positive correlation between price and advertising* (higher priced brands advertise the most, yet do not offer superior quality). For a product class heavily endowed with both search (in terms of price) and experience (taste) qualities, these casual observations would suggest that competitive mechanisms identified by Nelson (1974), among others, may not be at work in markets of national and quality-equivalent private-label brands. Advertising appears to be persuasive, in this case, by generating differentiation. We might conjecture, however, that this equilibrium is temporary and the role of *advertising as information* may emerge over time.

We can consider possible dynamics by looking at Figure.3 which shows absolute prices over time across competitors. Graphically, there appears to be strong evidence of coordinated pricing strategies, with the prices of Brands A, B, and C, for example, being indistinguishable. Furthermore, we note that prices across all brands are generally increasing over time. While there are price differences across private labels and advertised brands, prices appear to be perfectly *synchronized* across all brands, as revealed in the cross-competitor correlations in prices. While we might expect synchronization between brands sold by the same firm (i.e. the competition is internalized between Brand A and Brand D which are sold by the same firm), we observe correlation levels across all competitors which are rarely seen in even the physical sciences, with most exceeding 0.99; see Table 5. While synchronization appears manifestly non-competitive (especially given that there is price dispersion), they may be produced from either perfectly competitive (generated by price wars), or perfectly cooperative strategies (i.e. the opposite corner of the prisoner's dilemma matrix). While the existence of inherent price dispersion would suggest cooperative strategies, revenue dynamics across brands may be revealing. If we calculate inflation-adjusted total revenues for national brands and QEPLs we should be able to gauge whether the share declines of national brands are also associated with declines in revenues or profits, assuming constant marginal costs over the period of study. The correlation of time to revenues is positive and statistically significant for the advertisers, all national brands, and

private labels (Pearson correlations being 0.62, 0.49, and 0.44 respectively with all *p-values*<.01).[30] The synchronized pricing levels cannot reflect perfectly competitive outcomes. Rather, the encroachment of QEPLs and the advertising response offered by the national brands are associated with revenue increases for all players (despite national brand share declines).

The possibility of non-competitive pricing can also be considered (as an equilibrium) based on the correlations presented in Tables 6 and 7 which report price-sales and price-advertising correlations across competitors (Scherer and Ross 1990, pp. 70-73). A number of correlations (highlighted in boxes) are unlikely to have been generated from a competitive market. For example, since all of the brands are perfectly synchronized in price, any one brand's price elasticity (with sales or with advertising) is identical across brands (i.e. the effect of a change in my price on my sales is identical to any other brand changing its price by the same amount on my sales); see Tables 6 and 7 respectively. Furthermore, should a brand's share change over time and prices are synchronized, then that brand will have positive price elasticities. This is seen for Brand B, in Table 6, which modified a package form and gained shares from other national brands, especially Brand A. In contrast to the correlations in Table 6, should purely competitive forces be at work in this market, prices would adjust so that elasticities would become negative and large in absolute value.

We gain further insight into industry dynamics by directly observing, in Figure 4, the time path of the ratio of advertisers' prices to private labels' prices over time.[31] While the *advertising as information* hypothesis holds that this ratio should decline over time (as total advertising has generally increased over this period), we observe that the price gap is not declining and may be widening. Combined, these external analyses would suggest that there is discrimination between *national brand seekers* and *private-label seekers* and that advertising is associated with this equilibrium. We can further conclude that the emergence of private-label brands does not lead to price erosion or competitive pricing, even though the brands sold are of similar quality. Rather, price dispersion likely reflects price discrimination, and not competition, across advertising-induced segments.

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[30]Similar results are obtained using advertising levels as these are correlated with time.

[31]Advertisers are defined as the four advertised brands: Brands A, B, C and D.

Finally, industry interviews were conducted to shed additional light on whether firm strategies are designed to sustain collusive arrangements. Two questions are of interest: does coordination take place (offering external validity to the results reported in Tables 2 and 4), and what mechanisms are likely to prevent general detection? While explicit (as opposed to tacit) coordination was affirmed by managers interviewed, long-run arrangements appear to go unchallenged for two reasons. First, the public perceives competition since private-label brands appear to be offering competitive prices (rather than extracting consumers' surplus within the context of price discrimination). Second, advertisers frequently promote their brands (e.g. with "2-for-1" and bundled offers) yet prices, when averaged over the month, are maintained to a synchronized level. Apparent promotion rivalry and large-scale advertising campaigns give the additional appearance of competitive strategy (e.g. to the public). Daily prices are allowed to vary with a common agreement that any short-term promotional fluctuations will even out across brands, which results in a monopolistic average price in the medium term. Price wars appear to exist on a daily basis yet long-run price-war behavior is prevented.

5. Concluding Remarks

Returning to the managerial question of whether defensive advertising by the national brands will necessarily fail to prevent price wars against quality-equivalent private labels, the answer is "no". This answer supports recent conjectures in the trade literature and the cross-sectional study reported in Conner and Peterson (1992). The case demonstrates that profits (market power) can increase as a result of advertising which serves to create differentiation (though physical qualities are equivalent) leading to price discrimination; advertising may also be used to mask collusive arrangements between QEPLs and national brands. It should be noted that these are not likely to be tacit arrangements as the parties communicate on a regular basis in the course of normal operations. The two parties are simultaneously partners and competitors. The case presented here is especially of interest as the brands studied are typical of other commodity-based products, the product class is one of the most heavily consumed in the world, the quality equivalence observed across brands is often considered the worst case scenario for the national brander, and the cartel-like behavior is being observed

in a country with strong anti-trust traditions.

From a methodological perspective, we contribute to the literature by proposing a rigorous test which can be applied for any given industry facing similar forms of competition. The structural approach suggested directly measures the extent to which defensive advertising strategies by national brands affect competitive/collusive outcomes against/with private-label brands. Improving upon previous empirical methodologies, the approach also proves useful in testing prevailing theories proposed in the literature on the economics of information. For the case studied, advertising does not serve an informational role but is persuasive in two ways: by differentiating brands and masking collusive prices. These findings explain, in part, the simultaneous existence of price dispersion and synchronized pricing strategies over time for all competitors.

Returning to what Kotler calls the *battle of the private-label brands*, from a normative perspective our study suggests that sellers of national or heavily advertised brands should not necessarily reduce prices to compete against private-label brands. Rather, there appears to emerge two distinct consumer segments of *national brand seekers* and *private-label seekers*, with the former willing to pay premiums for the advertised brands. The co-existence and apparent stability of these segments may allow all players to price discriminate within an unofficial cartel. From the retailers' perspective, these outcomes reflect a natural price discrimination strategy which extracts greater levels of consumer surplus and profit. Private-label brands, on the other hand, may not be adversely affected by defensive advertising by the national brands as this may increase opportunities for price discrimination. The recent trend of national branders manufacturing high-quality private labels demonstrates their logical participation in this price discrimination. Clearly, private labels may not cannibalize national brands provided that they are supported by persuasive advertising leading to differentiation. Given these insights, future normative research considering the choice of the manufacturer to produce a private label and heavily advertise, or forego this strategy (in the face of certain entry from private labels which they do not manufacture) is warranted.

From a theoretical perspective, our study rejects the *advertising as information* hypothesis and we find that advertising sustains (significantly increases) market power and/or facilitates collusive strategies. We fail to identify, however, what it is that makes advertising so persuasive. How can it be that a large segment of consumers persistently chooses

advertised brands which offer no qualitative benefits (i.e. from the firm's perspective)? This is especially puzzling in cases when the both the private-label and advertised brands are manufactured by the same firm. It may be that the public enjoys seeing the advertisements and, by purchasing the brands, encourages the advertisers to continue advertising. Sentiments reflected in statements such as: "I buy the brand because I want to reward the advertiser", or " I buy the brand because I do not want the advertiser to go bankrupt so I can continue to see the commercials" may be rational motivations if advertisements are inherently tied to the brand consumed. Two brands of similar quality in this case give different utilities (i.e. the consumer is happy, for whatever reason, to recall an advertisement when buying or consuming an advertised brand); this may be true, even if the consumer knows the brands are similar. For psychological or social reasons (peer or point of purchase social pressure), national brand consumers may not feel the same emotions or physical sensations when either buying or consuming quality-equivalent private-label brands compared to advertised brands.[32] Research designed to better understand the motivations of private-label versus national brand seeking consumers appears warranted and may shed light on the causal mechanism driving the observed equilibrium.

Finally, our study was limited to a single category which is typical to many which are based on standardized raw materials. The characteristics of this category have allowed us to make certain simplifying assumptions in our econometric formulation. Namely, information asymmetries are low (on prices), consumer search costs are low and firms are symmetric in quality, and distribution coverage. The product class studied stands as an important example as to how the emergence of quality-equivalent private-label brands need not lead to competitive market outcomes, and how advertising need not lead to price reductions by either QEPL manufacturers or national branders. The category we studied is typical of many others facing what is often seen as the worst form of competitve threat: the entry of lower-priced quality-equivalent competitors. Further research on additional categories is nevertheless warranted in order to understand how generalized our results are to other product classes.

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[32]Within the category studied, industry tests show that all brands receive equivalent blind-quality taste scores, but national brands receive an un-blind score of about 160, versus 100 for store brands.

Appendix A. Derivation of Market Conduct

We begin by assuming N quality-equivalent brands, as previously defined, competing in output within a given market. Costs for each brand, i, are assumed to follow the following functional form:

$$C_{it} = F_{it} + A_{it} + V_{it}(q_{it}, w_t), \tag{A1}$$

where C_{it} is the total cost of brand i in period t ($t = 1, \ldots, T$), F_{it} are the fixed costs of brand i in period t, A_{it} are lump-sum advertising expenditures, V_{it} are the variable costs of brand i in period t which are a function of brand-level outputs, q_{it}, and a vector of industry-specific input factor prices, w_t (e.g. wage rates). Since advertising is included as a lump sum cost, it does not appear in the marginal cost function, MC_{it} (the derivative of the total cost function with respect to q_{it}). Each firm faces the following market demand function:

$$P_t = f(Q_t, Z_t) \tag{A2}$$

where P_t is the price in period t, Q_t is the industry-level quantity demanded in time t, and Z_t is a vector of market-specific factors affecting demand (e.g. secular, or exogenous shifts in preference, etc.). Given the above conditions on costs and demand, the first order profit maximization conditions yield the following structural equation (Breshnahan 1989):

$$P_t = -\lambda\,(\partial P_t/\partial q_{it})\, q_{it} + MC_{it} \tag{A3}$$

where MC_{it} is the marginal cost function for brand i, and λ is a measure of market conduct. If we aggregate across brands, we obtain the following industry-level model of market structure:

$$P_t = [-\lambda\,(\partial P_t/\partial Q_t)\, Q_t + \Sigma\, MC_{it}(.)]/N \tag{A4}$$

Assuming that all brands have similar marginal cost functions (symmetry in q_{it} under full information), then equation (A4) can be re-written as:

$$P_t = -\theta\,(\partial P_t/\partial Q_t)\, Q_t + MC_t(.) \tag{A5}$$

where $\theta = 1/N$ under Nash equilibrium. Equation (A5) is equivalent to Equation (6) in Section 4.2.

Appendix B. Econometric Development

From equation (9) we have,

$$\partial P_t/\partial Q_t = a_1(P_t/Q_t) \tag{B1}$$

From equation (11) we have,

$$MC_t = (WAGES_t)^{b1}e^{u_t} \tag{B2}$$

Substituting equation (B1) and (B2) into equation (6), the market conduct equation, we get

$$P_t = -\theta_t\, a_1 P_t + (WAGES_t)^{b1}e^{u_t} \tag{B3}$$

After rearranging equation (B3) with respect to P_t and taking the natural log, we have

$$\ln(P_t) = -\ln(1 + \theta_t a_1) + b_1 \ln(WAGES_t) + u_t \tag{B4}$$

Since we note that $\ln(1 + \theta_t a_1)$ is approximately equal to $\theta_t a_1$ for the relatively small values of $\theta_t a_1$ (Rubinovitz 1993), equation (B4) can be simplified into equation (12) that is given in Section 4.5.

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Figure 1.

SALES ACROSS COMPETITORS (WITH INDUSTRY TOTAL)

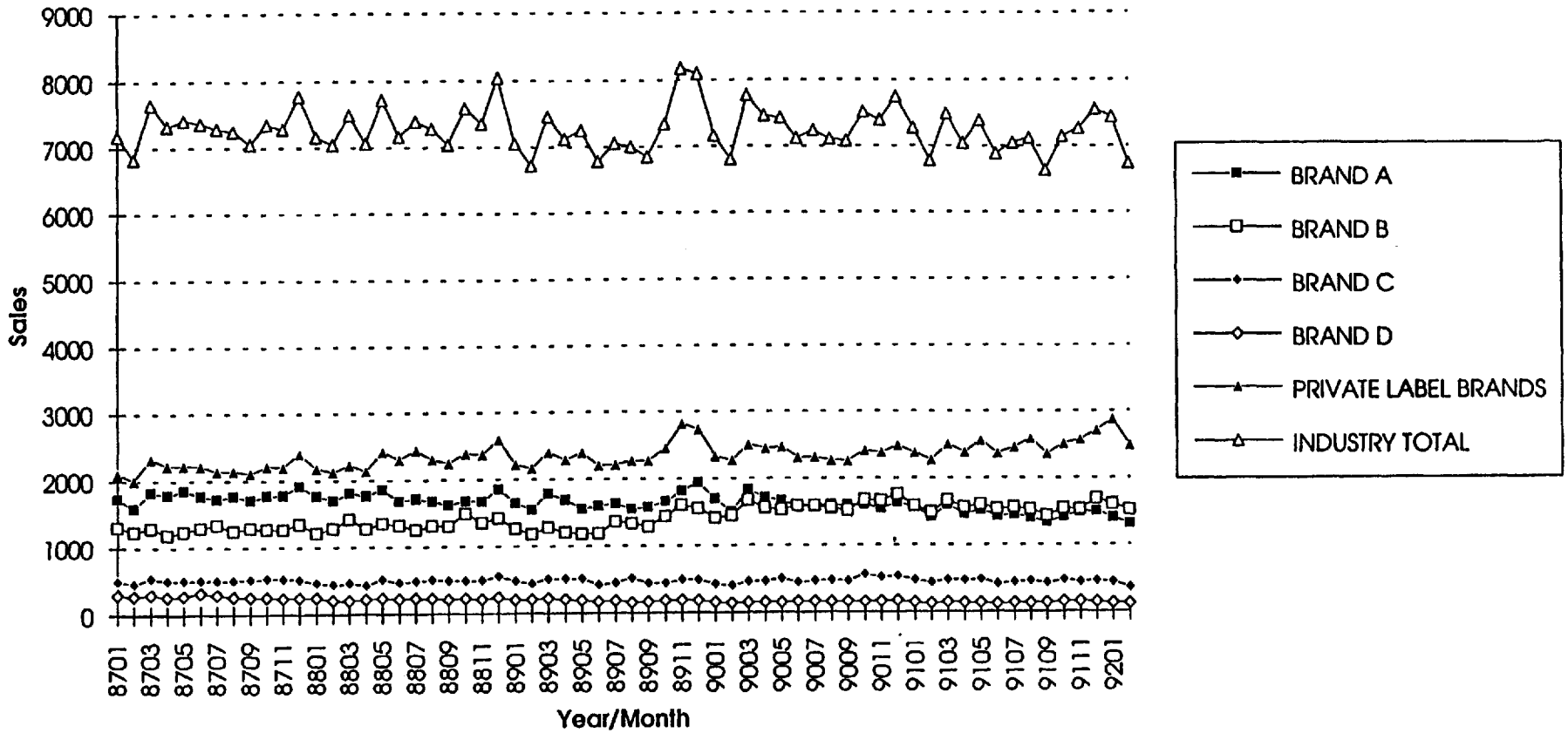

Figure 2.

ADVERTISING ACROSS COMPETITORS (WITH ADVERTISING IN TOTAL)

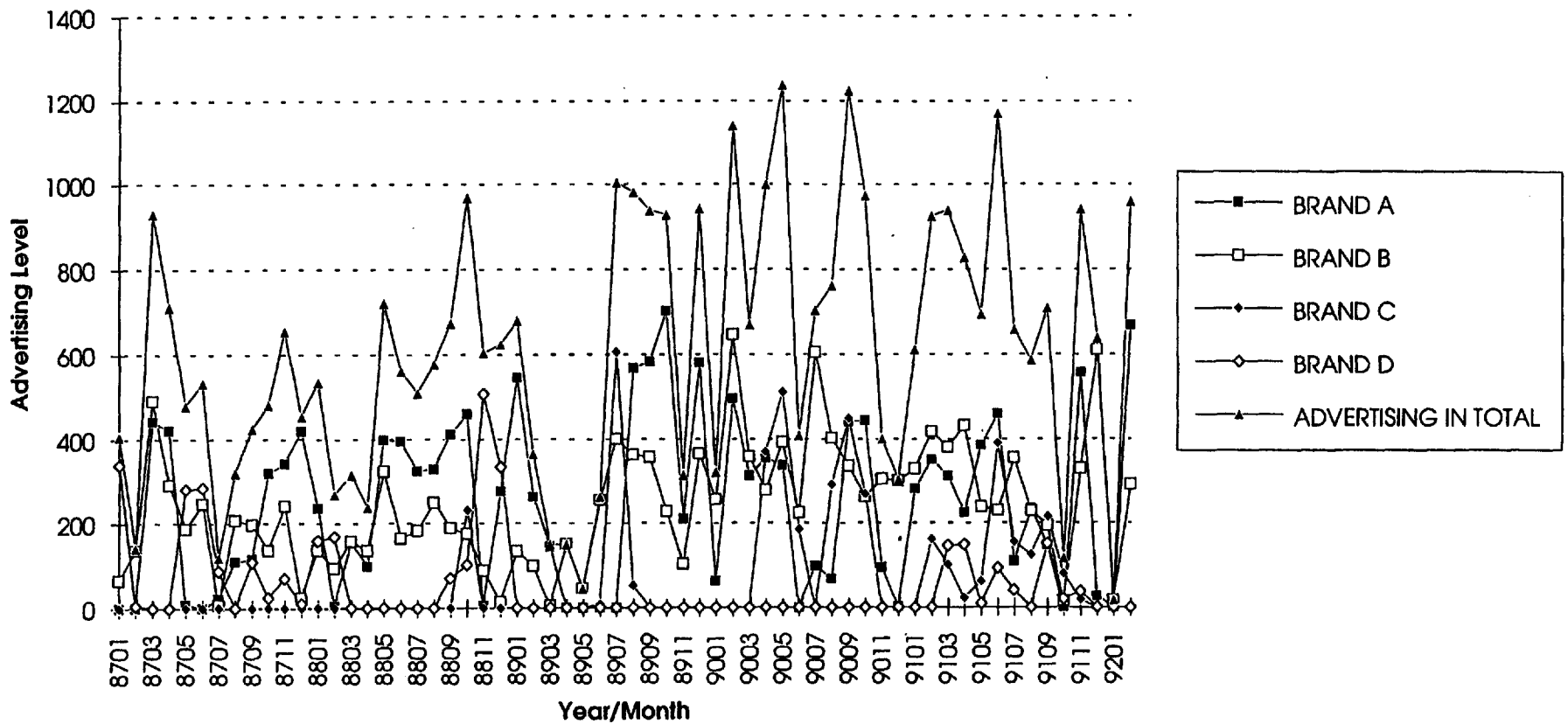

Figure 3.

PRICE TREND ACROSS COMPETITORS

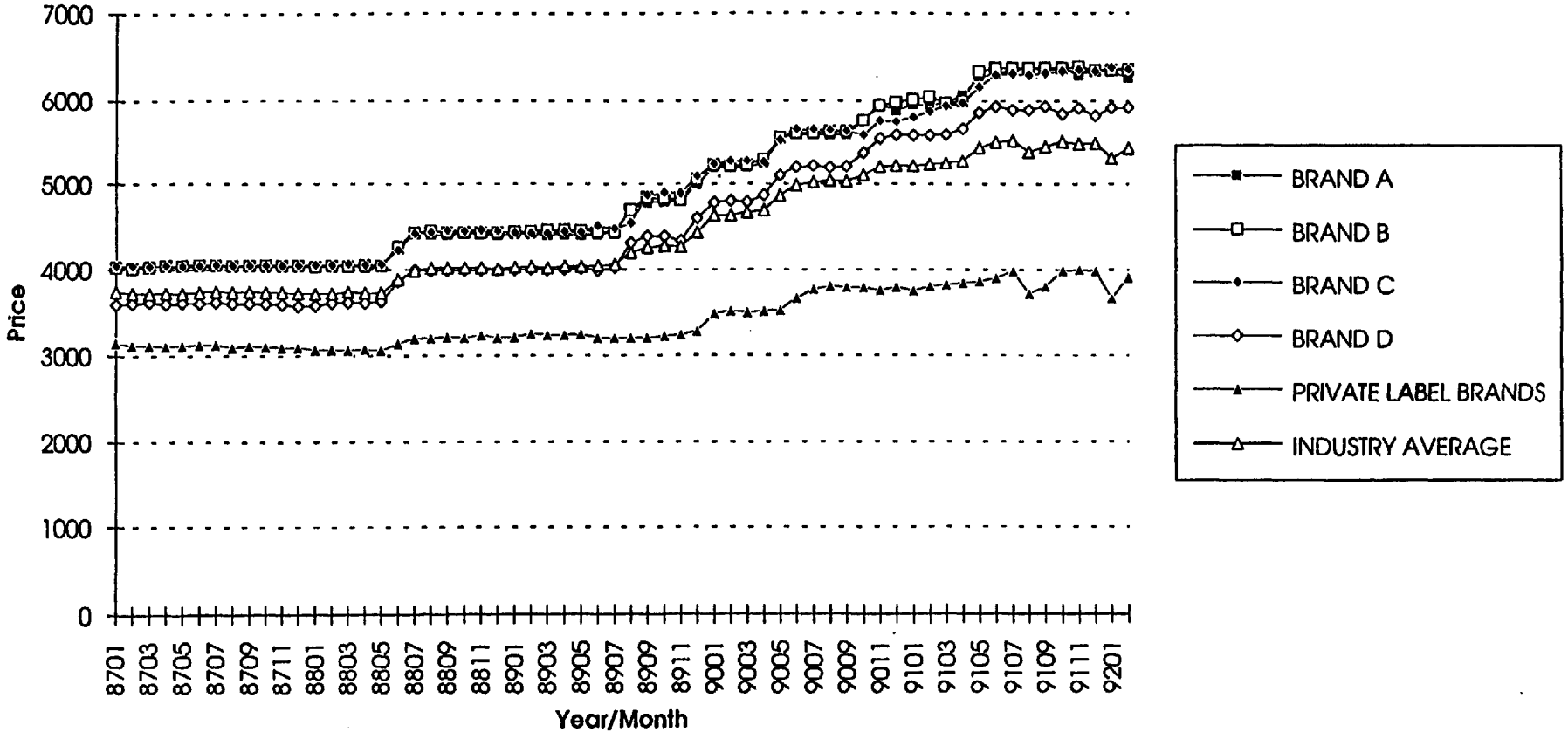

Figure 4.

RELATIVE PRICE TREND BETWEEN ADVERTISERS AND PRIVATE LABEL BRANDS

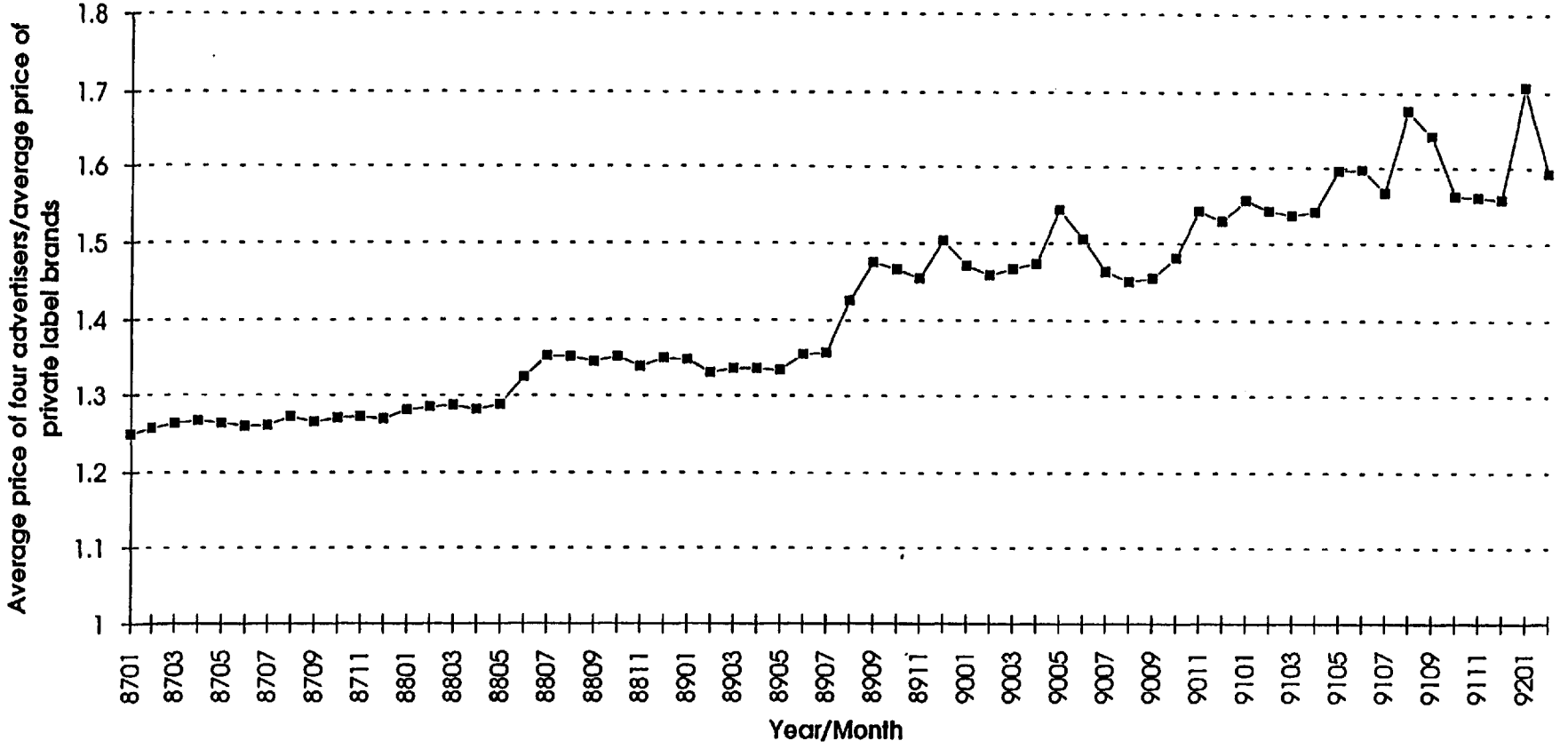

Table 1. Descriptive Statistics Across Competitors: Pricing, Advertising and Sales
(n=62)

Panel A

Competitor	Mean	Stdev	Minimun	Maximum
Prices				
Brand A	4967.65	873.52	4023	6380
Brand B	4991.21	882.67	4015	6390
Brand C	4971.13	852.33	4035	6380
Brand D	4548.61	882.19	3565	5930
Minor Brands	4869.53	767.77	3897	6170
All National Brands	4957.85	889.36	3971	6370
Private Labels	3413.94	321.68	3061	4000
Industry Average	4445.94	672.90	3710	5520
Advertising				
Brand A	247.65	203.70	0.01	701
Brand B	243.39	147.27	5	646
Brand C	69.37	140.09	0	605
Brand D	51.79	103.36	0	507
Total	612.19	313.19	18	1237
Sales				
Brand A	1650.9	144.10	1316	1938
Brand B	1423.37	160.76	1176	1764
Brand C	479.1	39.21	360	559
Brand D	194.16	52.42	122	320
Minor Brands	473.87	33.45	384	544
National Brands Total	4901.03	277.22	4237	5448
Private Labels	2353.92	175.10	2012	2873
Industry Total	7265.76	329.18	6630	8167

Panel B

Competitor	Mean	Stdev	Minimun	Maximum
Prices				
Industry Average	4445.94	672.90	3710	5520
Advertisers	4869.65	872.06	3921.25	6247.5
All National Brands	4957.85	889.36	3971	6370
Private Labels	3413.94	321.68	3061	4000
Brand A & B	4979.43	877.96	4022.5	6380
Sales				
Industry Total	7265.76	329.18	6630	8167
Advertisers	3747.53	197.04	3327	4169
National Brands Total	4901.03	277.22	4237	5448
Private Labels	2353.92	175.10	2012	2873
Brand A & B	3074.27	168.77	2739	3509
Advertising				
Total Advertising	612.19	313.19	18	1237
Abs. Ad. Difference Between Brand A & B	173	129.92	3	584
Other Variables				
Wage Index (1985=100)	140.56	17.80	113.03	172.3
Expenditure on Non-Alcoholic Beverages	3228.59	305.39	2710.83	3744
Interest Rate	12.1	1.92	9.66	14.86
Round or not (Dummy)	0.53	0.50	0	1

Table 2.

SUMMARY OF THE MODEL ESTIMATION (WITH THE IMPACT OF ADVERTISING OF THE WHOLE INDUSTRY)

Model Variable (Coefficient)	Model 1	Model 2	Model 3	Model 4
Dependent Variable • Price: P_t	Advertisers	National Brands	Private-Labels	Industry
Supply Variable				
• $WAGES_t$ (b_1)	2.6170***	2.6719***	-0.4045	1.4820***
Demand Variables				
• INTERCEPT (a_0)	-31.8350**	-15.6354	0.0456	-13.7254
• Q_t (a_1)	-3.3435***	-3.3550***	-3.3618***	-3.3946***
• $NONALCOHOL_t$ (a_2)	-3.3608*	-1.3481	0.8741	-1.3098
• $INTEREST_t$ (a_3)	0.2249	0.3174*	-0.3567*	0.0913
• $DUMMY_t$ (a_4)	-0.0893	-0.1886***	0.2770***	-0.0328
Structure Variable				
• ADV_t (k)	-1.4851***	-1.4677***	-1.7115**	-1.3597***
• Mean Value of θ	θ_1=0.9996	θ_2=0.9996	θ_3=0.9998	θ_4=0.9993
Model Fit				
• MSE (Supply Equation)	0.0026	0.0025	0.0008	0.0016
• MSE (Demand Equation)	0.0300	0.0267	0.0401	0.0243

*** $p < 0.01$
** $p < 0.05$
* $p < 0.1$

Table 3: Pearson Correlations Across Competitors: Advertising
***(p-values* in parentheses, n=62)**

		Advertising				
		Brand A	**Brand B**	**Brand C**	**Brand D**	**Total**
Advertising	**Brand A**	1				
	Brand B	.26509 (.0373)	1			
	Brand C	.05343 (.68)	.23006 (.072)	1		
	Brand D	-.27645 (.0296)	-.29132 (.0216)	-.11545 (.3716)	1	
	Total	.70774 (.0001)	.64941 (.0001)	.55213 (.0001)	-.03840 (.767)	1

Table 4.

SUMMARY OF THE MODEL ESTIMATION (WITH THE IMPACT OF THE DIFFERENCE OF ADVERTISING LEVELS BETWEEN BRAND A AND BRAND B)

Model Variable (Coefficient)	Model 5	Model 6	Model 7	Model 8
Dependent Variable • Price: P_t	Advertisers	National Brands	Industry	Brand A and Brand B
Supply Variable • $WAGES_t$ (b_1)	2.5421***	2.5960***	1.3877***	2.3921***
Demand Variables • INTERCEPT (a_0) • Q_t (a_1) • $NONALCOHOL_t$ (a_2) • $INTEREST_t$ (a_3) • $DUMMY_t$ (a_4)	-30.9220** -3.3521*** -3.2380* 0.2283 -0.0886	-14.7353 -3.3636*** -1.2275 0.3202** -0.1882***	-14.4115 -3.4043*** -1.3971 0.0892 -0.0344	-28.8855* -3.3929*** -2.8686 0.2171 0.0492
Structure Variable • ADV_t (k) • Mean Value of θ	-3.7033*** θ_5=0.9997	-3.6887*** θ_6=0.9997	-4.0623*** θ_7=0.9998	-3.6975*** θ_8=0.9997
Model Fit • MSE (Supply Equation) • MSE (Demand Equation)	0.0025 0.0302	0.0025 0.0269	0.0016 0.0244	0.0025 0.0332

*** $p < 0.01$
** $p < 0.05$
* $p < 0.1$

Table 5. Pearson Correlations Across Competitors: Price
***(p-values* in parentheses, n=62)**

		Price							
		Brand A	Brand B	Brand C	Brand D	Minor Brands	All National Brands	Private Labels	Industry Average
Price	Brand A	1							
	Brand B	.99939 (.0001)	1						
	Brand C	.99714 (.0001)	.99741 (.0001)	1					
	Brand D	.99907 (.0001)	.99928 (.0001)	.99635 (.0001)	1				
	Minor Brands	.99177 (.0001)	.99219 (.0001)	.99164 (.0001)	.99293 (.0001)	1			
	All National Brands	.99953 (.0001)	.99965 (.0001)	.99810 (.0001)	.99935 (.0001)	.99415 (.0001)	1		
	Private Vables	.97229 (.0001)	.97241 (.0001)	.96900 (.0001)	.97277 (.0001)	.96611 (.0001)	.97159 (.0001)	1	
	Industry Average	.99757 (.0001)	.99774 (.0001)	.99495 (.0001)	.99814 (.0001)	.99292 (.0001)	.99793 (.0001)	.98309 (.0001)	1

Table 6. Pearson Correlations Across Competitors: Price and Sales
***(p-values* in parentheses, n=62)**

		Price							
		Brand A	Brand B	Brand C	Brand D	Minor Brands	All National Brands	Private Labels	Industry Average
Sales	Brand A	**-.77729** (**.0001**)	-.77482 (.0001)	-.77318 (.0001)	-.77507 (.0001)	-.76273 (.0001)	-.77473 (.0001)	-.75138 (.0001)	-.76660 (.0001)
	Brand B	.81745 (.0001)	**.81486** (**.0001**)	.81302 (.0001)	.82104 (.0001)	.82092 (.0001)	-.81835 (.0001)	-.80279 (.0001)	.82591 (.0001)
	Brand C	-.43156 (.0005)	-.43541 (.0004)	**-.46914** (**.0001**)	-.43307 (.0004)	-.44150 (.0003)	-.44053 (.0003)	-.38725 (.0019)	-.42389 (.0006)
	Brand D	-.85629 (.0001)	-.85902 (.0001)	-.86159 (.0001)	**-.86199** (**.0001**)	-.87765 (.0001)	-.86464 (.0001)	-.79661 (.0001)	-.85694 (.0001)
	Minor Brands	.54816 (.0001)	.54919 (.0001)	.54403 (.0001)	.54452 (.0001)	**.50467** (**.0001**)	.54464 (.0001)	.53415 (.0001)	.54232 (.0001)
	National Brands Total	-.56630 (.0001)	-.56700 (.0001)	-.57525 (.0001)	-.56441 (.0001)	-.56563 (.0001)	**-.56836** (**.0001**)	-.52942 (.0001)	-.55372 (.0001)
	Private Labels	.59097 (.0001)	.59182 (.0001)	.60426 (.0001)	.58383 (.0001)	.57426 (.0001)	.59268 (.0001)	**.48853** (**.0001**)	.56390 (.0001)
	Industry Total	-.12897 (.3178)	-.12918 (.317)	-.12982 (.3146)	-.13125 (.3092)	-.13759 (.2862)	-.12986 (.3144)	-.15278 (.2358)	**-.13268** (**.3039**)

Table 7. Pearson Correlations Across Competitors: Advertising and Price
(*p-values* in parentheses, n=62)

		Advertising				
		Brand A	**Brand B**	**Brand C**	**Brand D**	**Total**
Price	**Brand A**	**.08112**	.39008	.32696	-.21810	.31045
		(.5308)	(.0017)	(.0095)	(.0886)	(.0141)
	Brand B	.08930	**.38712**	.32582	-.22308	.31223
		(.4901)	**(.0019)**	(.0098)	(.0814)	(.0135)
	Brand C	.08699	.39202	**.32784**	-.21879	.31535
		(.5014)	(.0016)	**(.0093)**	(.0876)	(.0125)
	Brand D	.09246	.39888	.32958	**-.22236**	.32174
		(.4748)	(.0013)	(.0089)	**(.0824)**	(.0108)
	Minor Brands	.08620	.40922	.36981	-.23263	**.33713**
		(.5053)	(.001)	(.0031)	(.0688)	**(.0074)**
	All National Brands	.08599	.39313	.33402	-.22489	.31597
		(.5064)	(.0016)	(.008)	(.089)	(.0124)
	Private Labels	.03061	.42461	.33625	-.18704	.30825
		(.8133)	(.0006)	(.0075)	(.1455)	(.0148)
	Industry Average	.07594	.41128	.34458	-.22053	.32414
		(.5575)	(.0009)	(.0061)	(.085)	(.0102)

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