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. 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. We report seven non-structural and one structural test to support this conclusion.

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

In a recent *Harvard Business Review* article, Quelch and Harding (1986, p. 100) write (emphasis added):

Several factors suggest that the private-label threat in the 1990s is serious and may stay that way regardless of economic conditions.

Recent trade press articles present alternative perspectives; 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.

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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 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 either of the two scenarios found in the trade literature. We test for these outcomes using a battery of tests, including an econometric model of market structure which combines certain aspects of the literature concerned with industry conduct (Bresnahan 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. Second, we 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 apply a variety of methodologies to a "typical" product category (a heavily consumed beverage) in order to study the two conflicting scenarios. We then apply the methodologies. The final section presents explanations for the observed outcome: private-label competition may result in substantial market

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3Our 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.
power (profits) for all players based on advertising-generated differentiation and price discrimination. 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". This conclusion stands in contrast, for example, to Quelch and Harding's (1996) perspective that national brands must "fight to win".

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.¹ For one discounter alone, private-label sales approached $1 billion by the mid-1980s (Wal-Mart).² These trends have recently fuelled 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

¹Sources: Liesse (1993a, 1993b), Silverstein and Hirschohn (1994).
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. National 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. 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 nation-wide concentration in retailing: Loblaws (Canada),

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Silverstein and Hirschohn (1994).

7For example, Arbor Drug Stores, Loblaws, Wegmans Food Markets, and Schnuck grocery stores.
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.²

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.³ 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

² 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, Schmuck Markets Inc., Dominiks, Wegmans' Food Markets, Safeway, Loblaws and Kinney Shoe Corporation.

³Sources for the information in this discussion include various issues of Advertising Age, Brandweek, Food Technology, Bobbin, and industry interviews
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.\textsuperscript{10}

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.\textsuperscript{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).\textsuperscript{12} The decision by manufacturers to produce QEPLs is not fully understood by the consuming public due to the extensive use of subsidiaries or off-shore subcontractors.

\textsuperscript{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.

\textsuperscript{11}Firms include Eastman Kodak Company, Barclays Bank, Baxter Healthcare Corporation, General Electric Credit Corporation, Valvoline Oil Company and Keebler Company.

\textsuperscript{12}One retailer, for example, Sears Roebuck \& Company, manufacturers and sells private label brands, but also manufactures private labels for competitive retailers.
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. 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. Quality changes also become especially risky when the product is widely accepted, is standardized, or when changes can be easily mimicked by the private 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-à-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

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23 These include Procter and Gamble Company, Johnson and Johnson, Kraft General Foods, Kellogg Company and Coca-Cola Corporation (see Liesse 1993b).
domains to focus on empirical tests of market outcomes. Before proposing methodologies 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:

**Scenario #1:** prices are driven toward competitive levels: market power is low,

versus,

**Scenario #2:** 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 Scenario #1 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). A number of authors have recently argued, however, that advertising may serve to increase market power. In this section we briefly review mechanisms identified in the literature: (1) advertising leading to differentiation and, possibly, concentration, and (2) advertising facilitating collusive arrangements. 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

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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.


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).
advertisers, whereas QEPLs are considered to be non-advertisers (though they benefit from information generated from consumer search).

3.1 Advertising: Differentiation and Concentration

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).\textsuperscript{17} Boulding et al. (1994) support this view and find that firms may be able to use advertising to "insulate" themselves from direct competition when advertising communicates unique and positive messages. Mitra and Lynch (1995) provide a psychological basis for this effect in their study of information theories of advertising.

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.\textsuperscript{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).\textsuperscript{19} Not all persons, however,

\textsuperscript{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).

\textsuperscript{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.

\textsuperscript{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.
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 retailers who price discriminate, and heavily advertised brands who charge premiums. The result is Scenario #2, prices do not fall toward marginal costs. 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. Extending this stream of thought to QEPL competition,

advertising will narrow all brands' prices toward competitive levels (i.e. toward marginal costs), leading to Scenario #1. An obvious difficulty in applying this line of reasoning to QEP 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 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 scenarios can be rephrased as follows:

**Scenario #1:** advertising → information → price wars → decreases market power versus,

**Scenario #2:** advertising → persuasion → differentiation → increases market power.

With respect to Scenario #2, the literature has noted that there is a close relationship between concentration and product differentiation (see, for example, Milne 1992). Heavy persuasive advertising by a limited set of firms will tend to concentrate shares amongst brands; this concentration, in turn, may lead to increases in market power beyond those implied by competition (Gomes 1986).

### 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 Scenario #2). 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

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\(^{21}\)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.

\(^{22}\) 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.
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). 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 an empirical issue.

24Firms 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 we'll pay the difference" encourage collusive pricing strategies across retailers for national brands (not facing QEPLs).
Summarizing, the literature has recognized that advertising may serve to facilitate collusive conduct by discouraging entry, facilitating communication, 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 we are primarily contrasting Scenario #1 and #2, 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.

4. An Empirical Study

We now turn to an empirical study of the issues raised above. Our approach relies on an example of a heavily consumed, yet typical, product category with QEPL competition. After reviewing the data set, we propose multiple approaches to test the opposing scenarios.

4.1. The Data

To evaluate the effects of advertising on the market power, 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 data were released under the condition that the category remain confidential. The public revelation of the category may have career and legal implications for the manager(s) who released the data set.
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 have 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 exits 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, where \(N\) is the number of competitors). 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. One might objectively assume that the category has high search and experience qualities, and very little, if any, credence qualities. Given strong quality equivalence, QEPL entry would normally reflect a substantial threat to national brands (under Scenario #1 discussed in the previous section). Unlike some other beverages, the brands studied are not based on secret formulas and the category is somewhat mundane.

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 (\(p\text{-value}>.69\)). The study period ends prior to the impact of a discontinuous innovation introduced in the early 1990s which

\(^{26}\)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.
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 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 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 emphasize the store’s identity. 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; all prices reported are "paid" prices, incorporating consumer promotions.

4.2. Seven Non-Structural Tests

We now turn to empirical tests of the scenarios discussed above. Given the numerous measures or tests of market power proposed in the literature, we adhere to Kwoka (1985) and Lunn's (1986, p. 53) conclusion that it is often "unclear which measure should be used" and that using multiple measures and "reporting the results of each and letting individuals reach their own conclusions may be appropriate." To this end, we report both non-structural and structural tests which may provide convergent validity to our overall conclusions.
We begin with seven "non-structural" tests which attempt to infer non-competitive outcomes using rather simple, yet often direct, measures of market power using concentration ratios, relative price measures, margins, revenue dynamics, and elasticities. After these tests are reported, we present econometric models similar in spirit to those reviewed by Bresnahan (1989) in order to provide a structural test for advertising's effect on market power.

4.2.1 Advertising, Concentration and Market Power

A vast number of empirical studies have shown a positive relationship between industry concentration and market power (see the review in Mueller 1989) and has lead the European Union, the U. S. Department of Justice and the U.S. Federal Trade Commission, for example, to consider changes in industry concentration as a proxy for changes in market power. A number of authors have considered the effects of advertising on concentration (e.g. Eckard 1987; Gomes 1986). The most commonly accepted measure of concentration, the Herfindahl-Hirschmann Index (HHI), is the weighted sum of squared market shares across the competing brands; in our case the number of brands remained constant over the time period considered. The HHI has been previously used, for example, to measure market power in the beer industry (Roberts et al. 1985) and the food retailing industry (Cotterill 1986). To test for advertising's effect on power, 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. In this first test, we reject the null hypothesis, as the index is positively and significantly correlated with advertising levels (Pearson correlation equals .29 with a p-value<.03). Advertising appears, in our example, to increase concentration which presumably increases market power.
4.2.2 Margins and Market Power

A number of authors have criticized the use of concentration indexes, including the HHI, as a measure for market power because concentration may result not from non-competitive action, but rather from some firms competing, perhaps via innovation, better than others in the market (Kwoka 1985). Furthermore, there is, for any given category, the untested assumption that concentration does, in fact, lead to higher profit margins over time. The competing scenarios can be more directly tested with measures of profit margins. One such measure is proposed in Connor and Peterson (1992): a quasi-Lerner index. The Lerner Index \(0<\ell<1\) gives an aggregate estimate of gross contribution for the industry (Lerner 1934). The Lerner index is calculated as \((\text{price-marginal cost})/\text{price}\) using values observed over the series considered. All other factors held constant, high values of \(\ell\) imply high levels of market power. This measure has recently been used to evaluate market power in the coffee market (Lopez 1993). Boulding et al. (1994) use the index as a direct measure of differentiation. Should this index be positively related to advertising expenditures, then this would imply greater differentiation and, therefore, 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: \(\ell = (PN-PP)/PN\), 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. 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-à-vis private labels are higher, and price dispersion generally greater, in categories having higher levels of advertising expenditures. Returning to the broader managerial concern, this
methodology supports the contention that advertising by the national brands facing QEPLs does not lead to lower levels of market power (a reduction in profit margins for the national brands).

4.2.3. Price Dispersion and Market Power

Stigler (1961), in his seminal paper "The Economics of Information", makes the point that "price dispersion is a manifestation - and, indeed, it is the measure - of ignorance in the market." Should market power decrease, so too should price dispersion generated from ignorance (persuasion). Following these lines, price dispersion has been proposed as a measure of market power when products are quality-equivalent (Abbott 1994, McAfee 1994). In markets of quality-equivalent brands, should advertising increase market efficiencies, we should expect to see a narrowing of prices over time (lower dispersion) and, especially, as advertising (should it act as information -- reducing ignorance) increases.

We apply this idea in Figure 2 which depicts the time path of the ratio of advertisers' prices to private labels' prices over time.27 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 but widening (the difference being significantly correlated to advertising, p-value<.0001). This would suggest that there is discrimination between national brand seekers and private-label seekers and that advertising is associated with this equilibrium. The emergence of QEPLs in this category 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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27 Advertisers are defined as the four advertised brands: Brands A, B, C and D.
4.2.5. Quality-Price Correlations and Market Power

Given quality equivalence, as defined earlier, we can also consider the apparent contradiction offered by the existence of private-label branding to the hypotheses generated 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 are systematically different); these differences in averages across the entire series are statistically significant, \( p\text{-value}<0.001 \), as summarized in Table 1. This certainly holds for the category studied, but may also be 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 now turn to tests which offer dynamic perspectives.

4.2.4. Synchronization and Market Power

Dynamic non-competitive strategies may leave the "tell-tale" sign of synchronized marketing activities (see Caminal-Echeverria 1987; Lal 1990). While time-dynamic synchronization can be the result of either perfectly competitive or perfectly collusive strategies, synchronized behaviour, coupled with external measures of conduct (e.g. price dispersion and margin maintenance) may lend support to arguments relating to advertising's effect. We can consider possible synchronization 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. This occurs during a period when the primary raw material costs fell (discussed later). 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 2. While synchronization appears manifestly non-competitive (especially given that prices increase and there is dispersion), synchronization 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). Should we be in the price-war corner, we would expect revenues to decline for sellers over time (adjusting for inflation and assuming relatively stable marginal costs), which we consider next.

4.2.6. Revenue-Advertising Correlations and Market Power

Given a stable aggregate industry demand, as shown in Figure 1, Scenario #1 would suggest that total revenues across competitors (especially those losing shares to QEPLs) should decline as advertising increases. 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 both time and advertising 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\(<0.01\)).\(^2^8\) Apparently, the emergence of private labels actually increased total revenues for all brands, including the advertisers. These revenue increases came with prices increases which outpaced cost-of-living increases and increases in factor prices (wages, raw materials; the later decreased in real terms over the study period). The synchronized pricing levels cannot, therefore, reflect perfectly competitive outcomes. Rather, the encroachment of QEPLs and the

\(^{28}\) Similar results are obtained using advertising levels as these are correlated with time.
advertising response offered by the national brands are associated with revenue increases for all players (despite national brand share declines).

4.2.7. Price Elasticities and Market Power

Non-competitive pricing can also be observed (as an equilibrium) based on measures of each brands’ own-price elasticity. For the representative firm, the higher the own-price elasticity (in absolute value), the higher the degree of competition and the lower the level of market power. For products of equivalent quality, Boulding et al. (1990) note, for example, that the Lerner Index (market power, or gross contribution) is the inverse of the absolute value of a brand’s own-price elasticity. They equate higher values in this index to be the result of higher degrees of differentiation (market power is coupled with differentiation). Translating to our case, Scenario #1 would hold that each brand’s own price elasticities would be high (in absolute value) and increasing in advertising. Scenario #2 would hold that price elasticities may remain low, due to advertising-based differentiation. Given the synchronized pricing behavior documented earlier, and the fact that shares changed over time for some of the brands, a direct application of this approach proves problematic, though revealing. Consider, for example, the correlations presented in Table 3 which reports price-sales correlations across competitors; Table 4 provides price-advertising correlations. 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). Furthermore, should a brand’s share increase over time and prices are synchronized, then that brand will have a positive or non-existent own-price elasticity (an infinitely large Lerner Index or degree of market power). This seems to occur for both a heavy advertiser (Brand B) and non-advertisers (minor brands and private labels). In contrast to the correlations in Table 2, should purely competitive forces be at work in this market, prices would adjust so that elasticities (sales-price correlations) would become negative and
large in absolute value. Lacking this, the evidence would suggest a non-competitive outcome, supporting Scenario #2, despite the products being quality equivalent and advertising expenditures increasing over time across the national brands.

4.3 A Structural Approach

The non-structural tests reported above generally suggest that the entry of private labels need not lead to competitive outcomes. These tests do not, however, explicitly model the interaction of supply and demand in order to gauge whether advertising drives firms to price toward marginal costs or marginal revenues. Shifts in certain marginal costs, for example, may explain the observed outcome. To study this possibility, we turn to recently proposed structural models of market conduct (Bresnahan 1989). One advantage of this modelling approach is that it need not make a direct assumption as to the type of game being played amongst the competitors (Brander and Zhang 1990). Rather, we can infer from conduct parameters whether certain gaming outcomes are revealed in the data (Bertrand outcomes, Cournot outcomes, cartel outcomes).

The model assumes that brands differ by their advertising levels and that all brands are tangibly equivalent in quality as viewed by manufacturers. This is critical as we assume that advertising is a long-run strategic variable and is exogenous to current pricing decisions (Fershtman and Muller 1986) which is appropriate here given this particular industry setting. In the first stage, firms play out long-run quality and advertising decisions (advertising may be persuasive). In the second stage, firms play out prices. Here, we are only interested in the second stage (explaining pricing, not advertising levels).\footnote{We would like to thank Eitan Muller for his comments on this issue.} Furthermore, advertising decisions, even though television commercials exist concurrent to prices, are made in advance of pricing decisions. Advertising campaigns/platforms are determined well in advance of prices which can vary on a daily basis. The campaigns had a long history and had do not undergone radical changes during the study period. In the case under study, the national advertisers had undertaken consistent advertising campaigns over the two previous decades (e.g., with a consistent
"jingle" and/or "gimmick"), and private labels had consistently refrained from advertising. We will initially 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). 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 we consider later), 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 (factor input prices were unavailable for each brand individually as these data are proprietary). 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).

4.3.1 A Base-Case Model

Given these assumptions, we estimate a system of simultaneous equations capturing shifts in both marginal costs and demand in order to measure the extent to which prices are affected by advertising and/or reflect competitive outcomes. After describing a base-case model, we discuss certain implementation concerns and later report various alternatives. The advantages of the proposed model is its use as a measurement model of the type of game being played; see Brander and Zhang (1990). The model can, in effect, be used to determine whether the players are forming a cartel, pricing at Cournot, or pricing at Bertrand levels (i.e., pricing at marginal costs).

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

\[ P_t = f(Q_t, Z_t, A_t) \]  \hspace{1cm} (1)

where \( P_t \) is the prevailing price in period \( t (t = 1, ..., T) \), \( Q_t \) is the industry-level quantity demanded in time \( t \), \( Z_t \) is a vector of market-specific factors affecting demand (e.g. exogenous or non-advertising
based shifts in preference, etc.), and \( A_t \) is advertising. Industry total revenues, \( TR_t \), are therefore defined as,

\[
TR_t = Q_t f(Q_t, Z_t, A_t)
\]  

(2)

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

\[
MR_t = f(Q_t, Z_t, A_t) + Q_t f_{Q_t}
\]  

(3)

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

Let \( \theta \) be a measure of market power within the category (0\( \leq \theta \leq 1 \)). If \( \theta = 0 \), prices reflect Bertrand outcomes or perfect competition (all firms price at marginal costs). The more market power, the higher \( \theta \) above 0. If \( \theta = 1 \), prevailing prices reflect monopolistic levels (perfect market power, or marginal revenue pricing). If \( \theta = 0 \), firms are locked in Bertrand competition and earn no profits (as discussed later, \( \theta \) = the inverse of the number of symmetric competitors implies Cournot competition). If we assume that firms will never price lower than marginal costs, and will never price beyond monopolistic levels, we specify the following supply relationship:

\[
P_t = \theta (P_t - MR_t) + MC_A(t)
\]  

(4)

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

\[
TC_t = F_t + A_t + V_A(t)
\]  

(5)

where \( TC_t \) are total costs, \( F_t \) are the fixed costs, \( A_t \) are lump-sum advertising expenditures, and \( V_A(t) \) 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,

\[
P_t = -\theta Q_t f_{Q_t} + MC_A(t)
\]  

(6)
Equation (6) has three important characteristics. First, we see that $\theta$ 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 (the former assumption is relaxed later). 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 $\theta$; or

$$\theta = f(A_t)$$  \hspace{1cm} (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 defence against QEPLEs. 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 or, in the limit, generates Bertrand outcomes. As discussed above, the theoretical literature has generated conflicting arguments as to why $\theta$ is increasing in advertising or decreasing in advertising, 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 Bertrand competition), otherwise advertising may generate differentiation or facilitate collusion among sellers leading to lower levels of output or non-competitive prices (or prices higher than those implied by either Bertrand or Cournot competition).

4.3.2 Implementation Issues

As mentioned above, we are interested in knowing if advertising increases market power beyond competitive levels. This leads to the question: what are competitive levels? Clearly, if firms are playing Bertrand, any positive $\theta$ indicates an avoidance of Bertrand outcomes, prices are higher than Bertrand competition. Likewise, $\theta = 1$ is a clear indication of "no competition" or collusion (whether firms are playing either Bertrand or Cournot). When are prices higher than those implied by Cournot
competition? Testing for Cournot competition proves more conservative an empirical test than Bertrand competition.

As shown in Appendix A, \( \theta=(1/N) \) reflects Cournot-Nash outcomes in prices/outputs among \( N \) symmetric players. When \( 1 \geq \theta > (1/N) \), then \( \theta \) reflects price levels beyond those implied by Cournot competition. This property can be exploited within empirical applications, where \( N \) is known, by conservatively increasing the threshold for tests of market power. For example, if \( N=4 \), then for market power to be implied, \( \theta \) need exceed \((1/4)=0.25\), rather than exceed 0.0; likewise, values statistically equivalent to or less than 0.25 reflect competitive outcomes. In marketing contexts, \( N \) can be considered the number of brands the consumer is likely to choose from at the point of purchase, or face on a shelf in an average shopping situation.

As the model can be used without measures of symmetry or the number of brands, applying the Cournot threshold 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 (if firms are playing Cournot), 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" as in Scenario #1. 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 for Cournot players may, therefore, be too stringent from the consumer's view (but not the manager's); i.e. again, \( \theta=(1/N) \) is more conservative a threshold than \( \theta=0 \) (Bertrand). In all cases, if we empirically cannot reject that \( \theta=1 \), yet reject \( \theta=0 \) (Bertrand outcome) and \( \theta>(1/N) \) (Cournot outcome) this will present strong evidence against the null hypothesis, irrespective of the game being played. In addition, we can conservatively assume that \( N \) 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 (i.e. a conservative test, irrespective of the game being played). 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 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. In all cases, we conservatively test \( \theta \) being significantly greater than 0.5 \((N>2)\).\(^{30}\)

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

\(^{30}\)Kreps and Scheinkman (1983) make the interesting point that many industries may superficially appear to operate under price or Bertrand competitive environments (e.g., as in grocery stores), but in reality, generate Cournot outcomes. As the authors point out (p. 327), the extent to which an industry player behaves as Cournot or Bertrand competitor "is an empirical question or one that is resolved only by looking at the details of the context within which the competitive interaction takes place." While the context of the industry study points to Cournot, we will reserve judgment in deference to the empirical conduct model which can shed light on this issue.
an inflated measure of market power (i.e. prices may reflect physical quality differences). We now turn to an empirical implementation of the base-case model.

4.3.3 Base-Case 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:

\[ \theta = 1 - \left[ \frac{1}{1+\exp(-k^*\ln(ADV_i))} \right] \]  

(8)

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

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). In this section we report a base-case specification. Later we discuss alternative specifications which allow for more complex or alternative functional forms. Market demand, Equation (1), is modelled as a Cobb-Douglas function of per capita output, \( Q_0 \), inflation-adjusted per capita sales of nonalcoholic beverages (NONALCOHOL), real consumer interest rates (INTEREST), and a dummy variable (DUMMY) signifying the period over which one of the advertisers changed a package design (during the second half of the series):

\[ P_t = e^{a0}Q_0^{a1}\text{NONALCOHOL}^{a2}\text{INTEREST}^{a3}e^{a4\text{DUMMY}}e^{\epsilon} \]  

(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. \( \text{NONALCOHOL}_t \) is used to control for any general shifts in tastes between alcoholic and nonalcoholic beverages (a potential factor for this particular category); \( \text{INTEREST}_t \) is used to control for possible shifts between savings and disposable income. \(^{31}\) \( \text{DUMMY}_t \) 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 base-case demand equation for two reasons: (1) the industry is several decades mature, and (2) when included, it shows no effect on industry sales; we relax this assumption later. 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, \( \text{WAGES}_t \) is an inflation-adjusted average hourly wage index per worker in the country studied\(^{32}\), and \( u_t \) is a disturbance term. It should be noted that we do not

\(^{31}\)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.

\(^{32}\)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.
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. In order to estimate $\theta$, we adapt models proposed in Rubinovitz (1993) and obtain the following market conduct model from equations (6), (9), and (11) (see Appendix B for a discussion of the derivation):

$$\ln(P_t) = -\theta a_t + b_t \ln(WAGES_t) + u_t$$  

(12)

where $u_t$ is a disturbance term. We estimate equations (10) and (12) simultaneously with $\theta$ 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 provides descriptive statistics for the model variables.

4.3.4 Results

We first apply the model in stages by analyzing competitors within specific groups. Models 1, 2, 3 and 4 in Table 5 report model estimates when the data (prices and quantities) are constrained to include all brands, only advertisers, only national brands (advertisers and minor brands), as well as only private labels, respectively. Across the other 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. Model 1 aggregates across all brands and indicates that prevailing prices across all brands reflect monopolistic outcomes. Across all of the other 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; all firms appear to collectively use cartel-like pricing strategies. This result is consistent with the argument that advertising serves to differentiate brands of
similar quality. It is interesting to note that the value of $k$ for private labels is marginally higher than for
the other levels of aggregation, the private label structure responds more to advertising than amongst
the advertisers themselves. Based on these estimates, we can reject Scenario #1 in favor of Scenario
#2: 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 ($\theta_1$, $\theta_2$ and
$\theta_3 > .999$). Again, based on the analysis of these sub-groups alone, we can reject the null hypothesis.
Our strong results naturally raise concerns over the validity of the models.\footnote{The Lerner values calculated from the econometric models are 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 (Bresnahan 1989).} In the next sections we
report validation tests before drawing definitive conclusions with respect to the conflicting scenarios.

4.3.5 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 6 reports the
correlation in advertising levels across advertisers over time; Figure 4 plots the advertising levels over
time. The statistically significant correlations in advertising across competitors, as shown in Table 6,
may indicate coordinated rivalry for this industry, though the correlations are low. Table 7 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 7, indicate
that the previous results are insensitive to the measure of advertising intensity ($\theta_5$, $\theta_6$ and $\theta_7$ are each
greater than .999); nonlinear estimation of $\theta$, 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 ($\theta_6>0.999$).

Our second validity test considers two additional null hypotheses based on Equation (8). While we have rejected Scenario #1, we may not be in a position to reject Scenario #2. The fit statistics reported in Tables 5 and 7 for k measure whether conduct is statistically different from $\theta=0.5$, or Cournot-Nash prices when the market is limited to two or more symmetric firms who play Cournot (i.e. when $k=0$, then $\theta=1/2=0.5$). A significant and negative $k$ implies that advertising generates market power, but this does not indicate a rejection of perfect competition (Bertrand), nor a failure to reject purely monopolistic pricing. Sixteen additional models were run by adding an intercept constant, $k_0$, to a conduct parameter, $k^*$, in order to estimate the alternative hypotheses ($k=k^*+k_0$). The intercept value forces the conduct parameter to measure deviations from $\theta=0$ or $\theta=1$. 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 ($\theta=0$; $k=k^*+1.5$; $k^*$ is sufficiently negative and significant), and eight tested the null for cartel strategies ($\theta=1$; $k=k^*-1.5$; $k^*$ is not significantly different from zero) using the variable definitions in the eight models reported in Table 5 and 7. 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.

4.3.6 Validation Test Using Alternative Specifications

Are the empirical results a function of the specifications used? To investigate this possibility, the following modifications across the demand, marginal cost, and conduct equations were considered:

**Demand:** The base-case demand specification assumed that advertising has no effect on aggregate demand, given the extreme level of category maturity. A number of alternative
demand specifications allowed advertising, the lag of advertising and various Koyck-type distributed lag models of advertising to affect demand.  

**Marginal Costs:** The base-case marginal cost function assumed that only wages affected supply; it also fixed a unitary intercept. Additional marginal cost functions were tested which allows two additional raw materials (energy and a commodity “ingredient”) and a free intercept.

**Conduct:** The base-line model assumed conduct to be a function of current advertising and relative advertising. Conduct was also modelled to vary using simple and distributed lag functions of advertising, similar to those used in the demand specifications.

In addition to implementing each of these changes independently, various combinations were tested, resulting in several hundred alternative specifications. The ultimate goal, given the base-case model and non-structural tests, was to uncover a specification which indicated competitive outcomes (e.g. $\theta=0$ or, more liberally, $\theta<.5$). Beginning with demand, in no case did advertising or lags in advertising enter the system and remain statistically significant; nor did advertising in the demand model affect estimates of $k$, which remained negative and statistically significant ($\theta$ remains virtually equal to 1.0).

In the supply function, we evaluated electricity and a raw material cost (summarized in Table 1); interviews with managers suggested that electricity is minor (compared to wages), while the raw material is hedged over time (e.g. has minimal temporal variance). Electricity proved problematic as it was highly correlated to wages (Pearson correlation = .9814; $p$-value>.0001); the resulting multicollinearity de-stabalized the estimation procedure preventing, in all cases, convergence. The raw material cost was measured from commodity exchanges and is considered, by consumers, to be the actual product purchased, as opposed to wages or electricity (e.g. the sugar, in sugar cubes), and is a major component in the total cost function. The raw material cost never entered the marginal cost equation and remained statistically significant. It is interesting to note that the simple Pearson

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34 Various models nested within the following general form of the second-order Koyck specification were tested (see Johnston 1991, p.347):  

$$P_t = \mu_0 + \mu_1 P_{t-1} + \mu_2 P_{t-2} + k_1^* ADV_t + k_2^* ADV_{t-1} + r_1^* Q_t + r_2^*Q_{t-1} + \varepsilon_t$$
correlations external to the model shows that raw material costs are negatively correlated with brands' prices, though the correlations vary from brand to brand (from -0.2632 \textit{p-value}<0.04 to -0.6450 \textit{p-value}<0.0001). These correlations are telling since retail prices increased during a period of raw material price declines. One reason for these costs not being significant in the supply equation is their multicollinearity with wages (0.4520, \textit{p-value}<0.0002). When included in costs, \(k\) continues to be negative in sign and statistically significant (\(\theta>99\)), though the direct effects on prices are insignificant. We also introduced into the marginal cost models an intercept (using \(e^{\theta}\) and testing whether \(\beta_0\) is statistically different from zero). Using a wide-area nonlinear search procedure, we were able to reject the intercept from be statistically different than 1.0 (\(\beta_0\) is not statistically different from zero).\(^{35}\) Otherwise, including an unrestricted intercept destabilizes the estimation procedure in some models; when \(k\) is estimable, it is negative (from -1.35 to -1.81 and statistically significant, \textit{p-values}<0.01) and \(\theta>.99\).

Using simple and distributed lagged functions of advertising we also evaluated the stability of \(k\), and \(\theta\) in the conduct equation. Several lagged functions of advertising converged and yielded results similar to those reported above (in models which were stable otherwise). For simple lags in advertising by one, two, three and four periods, \(k\) is always negative and significant (-1.37, -1.00, -1.99, -1.06, for example in Model 1 of Table 5; \textit{p-values}<0.01), and the resulting values of \(\theta\) are greater than 0.99. Similar results were obtained across alternative specifications of demand and marginal costs. Beyond 5 periods, \(k\) becomes insignificant (\textit{p-value}>.10), or the models fail to converge (leading to biased estimates). Distributed lag models generally failed to converge, although simple second order lags (including both a one-period and second-period lags in advertising) often yielded significant results and similar aggregate values of \(\theta\).\(^{36}\)

Finally, models were run at the brand-level for the national advertisers; data were unavailable at the brand level for the private labels. Unfortunately, data were not available for each brand's individual

\(^{35}\)A unitary intercept provides the lowest sum of squared errors; deviating above or below this level increases SSE.

\(^{36}\)Typical values for \(k_1\) was -.42, and for \(k_2\) was -.44 with both being statistically significant (\textit{p-values}<.01)
marginal costs, so these were assumed to equal the industry average, as used in the Models in Tables 5 and 7. Models were estimated using both the individual brand's advertising levels as well as the industry total. In cases where the models converged, \( k \) is negative and statistically significant. For example, in the base-case model, Brands A, B, C, and D have values of \( k \) equalling -1.60, -1.35, -1.48, -1.26, respectively, when advertising is measured at the industry level. When advertising is measured at the individual level, \( k \) equals -3.57, -2.66 and -1.43 for Brands A, B, and D, respectively (Brand C failed to converge due, perhaps, to it advertising in a limited number of periods).

Again, advertising appears to increase market power. This result stands to casual reasoning: why would marketing managers of high priced brands having no tangible quality differences spend substantial amounts on advertising unless this would result in higher levels of market power (or profits)?

Summarizing, the various specification checks either proved unworkable (due to collinearities and non-convergence) or do not substantially affect the results of the exercise: advertising does not lead to reductions in market power; market power appears to increase with advertising. Combined with the seven non-structural tests which provide convergent validity to this conclusion, we find support, therefore, for Scenario #2: the battle between private labels and national brands may not lead to reductions in market power, or profits for the national brands.

5. Concluding Remarks

Managerial Thoughts. Our introduction cited Quelch and Harding's (1996, p. 100) conclusion that private label competition will remain a serious threat to national brands. Our study asks whether defensive advertising will fail to prevent price wars against quality-equivalent private labels. Our empirical study suggests that 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. Is this
discrimination supported by a collusive arrangement between QEPLs and national brands which is masked by advertising? Industry interviews were conducted to shed additional light on this question. Two questions are of interest: does coordination take place (offering external validity to the results reported in the seven non-structural tests and Tables 5 and 7), 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. 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. The "losers" in this arrangement are smaller national brands or non-advertised brands who are gradually dropped by the retailers. This trend may explain why certain manufacturers have recently announced that they will discontinue brands unless they are the largest or second largest in their categories (Quelch and Harding 1996).37

It should be noted that these arrangements are not likely to be tacit in nature as the parties communicate on a regular basis in the course of normal operations. The two parties are simultaneously partners and competitors (retailing internalizes competition). 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.

37We would like to thank Mike Hanssens for this observation.
Contributions and Extensions. From a methodological perspective, our study contributes to the literature by proposing various tests which can be applied for any given industry facing similar forms of competition. The structural approach, in particular, 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, point of purchase, or 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.\textsuperscript{38} 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 typical to many which are based on standardized raw materials. The characteristics of this category have allowed us to make certain simplifying assumptions. 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 competitive 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.

\textsuperscript{38}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:

$$C_i = F_i + A_i + V_i(q_{it}, w_t),$$

(A1)

where $C_i$ is the total cost of brand $i$ in period $t$ ($t = 1, ..., T$), $F_i$ are the fixed costs of brand $i$ in period $t$, $A_i$ are lump-sum advertising expenditures, $V_i$ 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, $MC_i$ (the derivative of the total cost function with respect to $q_{it}$). Each firm faces the following market demand function:

$$P_t = f(Q_t, Z_t)$$

(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 (Bresnahan 1989):

$$P_t = -\lambda \left( \frac{\partial P_t}{\partial q_{it}} \right) q_{it} + MC_i$$

(A3)

where $MC_i$ is the marginal cost function for brand $i$, and $\lambda$ is a measure of market conduct. If we aggregate across brands, we obtain the following industry-level model of market structure:

$$P_t = -\lambda \left( \frac{\partial P_t}{\partial Q_t} \right) Q_t + \sum_i MC_i$$

(Equation 3.1)

(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:

$$P_t = -\theta \left( \frac{\partial P_t}{\partial Q_t} \right) Q_t + MC_i$$

(A5)

where $\theta = 1/N$ under Nash equilibrium. Equation (A5) is equivalent to Equation (6) in Section 4.3.1.
Appendix B. Econometric Development

From equation (9) we have,

$$\frac{\partial P_i}{\partial Q_i} = a_i (P_i/Q_i) \quad (B1)$$

From equation (11) we have,

$$MC_i = (WAGES_i)^{b_i} e^{u_i} \quad (B2)$$

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

$$P_i = -\theta a_i P_t + (WAGES_i)^{b_i} e^{u_i} \quad (B3)$$

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

$$\ln(P_t) = -\ln(1 + \theta a_i) + b_i \ln(WAGES_t) + u_t \quad (B4)$$

Since we note that $\ln(1 + \theta a_i)$ is approximately equal to $\theta a_i$ for the relatively small values of $\theta a_i$ (Rubinovitz 1993), equation (B4) can be simplified into equation (12) that is given in Section 4.3.3. In our empirical study, we were unable to estimate values of $\theta a_i > 1$.
References


Freeman, Laurie (1994), "Private Label Gains," Advertising Age, 65(41), September 28, 40.


Liesse, Julie (1993a), “Private-Label nightmare: Big name marketers are being stalked by high-quality store brands,” Advertising Age, 64(15), April 12, 1, 4.


Figure 1.

SALES ACROSS COMPETITORS (WITH INDUSTRY TOTAL)
Figure 4. Advertising Across Competitors (with Industry Total)
<table>
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<th>Std. Dev.</th>
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Table 3. Pearson Correlations Across Competitors: Price and Sales (*p*-values in parentheses, n=62)

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</tr>
<tr>
<td>Minor Brands</td>
<td>.54816 (.0001)</td>
<td>.54919 (.0001)</td>
</tr>
<tr>
<td>National Brands</td>
<td>-.56630 (.0001)</td>
<td>-.56700 (.0001)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Labels</td>
<td>.59097 (.0001)</td>
<td>.59182 (.0001)</td>
</tr>
<tr>
<td>Industry Total</td>
<td>-.12897 (.3178)</td>
<td>-.12918 (.317)</td>
</tr>
</tbody>
</table>
Table 4. Pearson Correlations Across Competitors: Advertising and Price (p-values in parentheses, n=62)

<table>
<thead>
<tr>
<th></th>
<th>Advertising</th>
<th>Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand A</td>
<td>0.08112</td>
<td>-0.21810</td>
<td>0.31045</td>
</tr>
<tr>
<td>Brand B</td>
<td>0.39008</td>
<td>0.32582</td>
<td>0.31223</td>
</tr>
<tr>
<td>Brand C</td>
<td>0.32696</td>
<td>0.32764</td>
<td>0.31535</td>
</tr>
<tr>
<td>Brand D</td>
<td>-0.21810</td>
<td>-0.21879</td>
<td>0.31223</td>
</tr>
<tr>
<td>Minor Brands</td>
<td>0.40922</td>
<td>-0.22236</td>
<td>0.32174</td>
</tr>
<tr>
<td>All National</td>
<td>0.36981</td>
<td>-0.22236</td>
<td>0.32174</td>
</tr>
<tr>
<td>Brands</td>
<td>0.33402</td>
<td>-0.22489</td>
<td>0.31597</td>
</tr>
<tr>
<td>Private Labels</td>
<td>0.33625</td>
<td>-0.18704</td>
<td>0.30825</td>
</tr>
<tr>
<td>Industry Average</td>
<td>0.34458</td>
<td>-0.22053</td>
<td>0.32414</td>
</tr>
</tbody>
</table>
Table 5. Summary of the Model Estimation
(with the impact of advertising across the whole industry)

<table>
<thead>
<tr>
<th>Model Variable (Coefficient)</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• $P_t$</td>
<td>Industry Price</td>
<td>Advertisers Price</td>
<td>Branded Price</td>
<td>Private-Label Price</td>
</tr>
<tr>
<td><strong>Supply Variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• $WAGES_t (b_j)$</td>
<td>1.4820***</td>
<td>2.6170***</td>
<td>2.6719***</td>
<td>-0.4045</td>
</tr>
<tr>
<td><strong>Demand Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• INTERCEPT $(a_0)$</td>
<td>-13.7254</td>
<td>-31.8350**</td>
<td>-15.6354</td>
<td>0.0456</td>
</tr>
<tr>
<td>• $Q_t (a_1)$</td>
<td>-3.3946***</td>
<td>-3.3435***</td>
<td>-3.3550***</td>
<td>-3.3618***</td>
</tr>
<tr>
<td>• NONALCOHOL$_t$ $(a_2)$</td>
<td>-1.3098</td>
<td>-3.3608*</td>
<td>-1.3481</td>
<td>0.8741</td>
</tr>
<tr>
<td>• INTEREST$_t$ $(a_3)$</td>
<td>0.0913</td>
<td>0.2249</td>
<td>0.3174*</td>
<td>-0.3567*</td>
</tr>
<tr>
<td>• DUMMY$_t$ $(a_4)$</td>
<td>-0.0328</td>
<td>-0.0893</td>
<td>-0.1886***</td>
<td>0.2770***</td>
</tr>
<tr>
<td><strong>Structure Variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• ADV$_t$ $(k)$</td>
<td>-1.3597***</td>
<td>-1.4851***</td>
<td>-1.4677***</td>
<td>-1.7115**</td>
</tr>
<tr>
<td>• Mean Value of $\theta$</td>
<td>0.9993</td>
<td>0.9996</td>
<td>0.9996</td>
<td>0.9998</td>
</tr>
<tr>
<td><strong>Model Fit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• MSE (Supply Equation)</td>
<td>0.0016</td>
<td>0.0026</td>
<td>0.0025</td>
<td>0.0008</td>
</tr>
<tr>
<td>• MSE (Demand Equation)</td>
<td>0.0243</td>
<td>0.0300</td>
<td>0.0267</td>
<td>0.0401</td>
</tr>
<tr>
<td>Lerner Index</td>
<td>0.966</td>
<td>0.965</td>
<td>0.965</td>
<td>0.965</td>
</tr>
</tbody>
</table>

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$
Table 6. Pearson Correlations Across Competitors: Advertising (*p*-values in parentheses, 
\( n=62 \))

<table>
<thead>
<tr>
<th></th>
<th>Brand A</th>
<th>Brand B</th>
<th>Brand C</th>
<th>Brand D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand A</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brand B</td>
<td>.26509 (.0373)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brand C</td>
<td>.05343 (.68)</td>
<td>.23006 (.072)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brand D</td>
<td>-.27645 (.0296)</td>
<td>-.29132 (.0216)</td>
<td>-.11545 (.3716)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>.70774 (.0001)</td>
<td>.64941 (.0001)</td>
<td>.55213 (.0001)</td>
<td>-.03840 (.767)</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 7. Summary of the Model Estimation  
(with the impact of the difference in advertising between Brand A and Brand B)

<table>
<thead>
<tr>
<th>Model Variable (Coefficient)</th>
<th>Model 5</th>
<th>Model 6</th>
<th>Model 7</th>
<th>Model 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P_t$</td>
<td>Industry Price</td>
<td>Advertisers Price</td>
<td>Branded Price</td>
<td>PG Tips and Tetley Price</td>
</tr>
<tr>
<td></td>
<td>1.3877***</td>
<td>2.5421***</td>
<td>2.5960***</td>
<td>2.3921***</td>
</tr>
<tr>
<td><strong>Supply Variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$WAGES_t (b_t)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Demand Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$INTERCEPT (a_0)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Q_t (a_1)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$NONALCOHOL_t (a_2)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$INTEREST_t (a_3)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$DUMMY_t (a_4)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$ADV_t (k)$</td>
<td>-4.0623***</td>
<td>-3.7033***</td>
<td>-3.6887***</td>
<td>-3.6975***</td>
</tr>
<tr>
<td>Mean Value of $\theta$</td>
<td>0.9998</td>
<td>0.9997</td>
<td>0.9997</td>
<td>0.9997</td>
</tr>
<tr>
<td><strong>Model Fit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSE (Supply Equation)</td>
<td>0.0016</td>
<td>0.0025</td>
<td>0.0025</td>
<td>0.0025</td>
</tr>
<tr>
<td>MSE (Demand Equation)</td>
<td>0.0244</td>
<td>0.0302</td>
<td>0.0269</td>
<td>0.0332</td>
</tr>
<tr>
<td><strong>Lerner Index</strong></td>
<td>0.967</td>
<td>0.951</td>
<td>0.965</td>
<td>0.966</td>
</tr>
</tbody>
</table>

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$
Please forward your requests for working papers to the following address:

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Hong Kong University of Science & Technology  
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Kowloon, Hong Kong

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