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Valuing intangible assets with a nested logit market share model

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Abstract

This paper develops an econometric method for valuing intangible assets using nested logit market share assumptions. Specifically, a method is developed to measure the value to a license holder of owning a branded consumer product. While it is well known that brands confer values to their owners, existing methods for establishing a brand's value via comparable, profit, or income methods are often fraught with imprecision or are frequently based on untested assumptions. An economic approach to brand valuation is developed in which the demand for branded goods is estimated and compared to the demand for comparable unbranded goods including both private label and generic commodities. The economic analysis relies on oligopoly pricing models and certain assumptions regarding the opportunity use of the brand holder's fixed investment. This paper extends the multinomial logit structure of preferences assumed in Dubin [1998a. *The Demand for Branded and Unbranded Products—An Econometric Method for Valuing Intangible Assets. Studies in Consumer Demand—Econometric Methods Applied to Market Data. Kluwer Academic Publishers, Massachusetts, Boston, pp. 77–127*] and derives trademark valuation fractions with a nested logit market share model. The market share demand model in Dubin [1998a. *The Demand for Branded and Unbranded Products—An Econometric Method for Valuing Intangible Assets. Studies in Consumer Demand—Econometric Methods Applied to Market Data. Kluwer Academic Publishers, Massachusetts, Boston, pp. 77–127*] is re-estimated under nested logit assumptions and results for the trademark fraction are compared.

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1. Introduction

In this paper I consider the economic value of certain intangible assets such as trademarks and brand values. Specifically I estimate the trademark value for Carnation Company's Coffee-mate circa 1985. Coffee-mate was among Carnation's best known brands and continues to be sold today by Nestlé Corporation. Coffee-mate had (and continues to have) a relatively large market share, and consistently commanded a price premium relative to its unbranded competitors. I calculate Coffee-mate's trademark value expressed as a percentage of operating income and sales.

In brief, there are two basic components to the economic analysis of trademark value. First, historical sales data on brands and their competitors are used to estimate the demand for these products. The demand function can be used, with knowledge of production costs to determine the profitability of a product under alternative pricing strategies. The demand function summarizes all relevant information about the market for a product such as special population segments that purchase a particular product, seasonal variations in purchases, levels of advertising spent, and characteristics of similar products in the same market.

The second component of the economic analysis is a method for calculating the value of a brand trademark from the demand functions for the brand and its competitors. From an economic perspective, the value of a brand trademark to a producer is the difference between the profits that it would earn operating with the trademark and the profits it would earn operating without that trademark.¹

A formula giving the appropriate split of total profit between the trademark and non-trademark components is derived in Section 2. The fraction of total profits attributable to the trademark, that is the "trademark fraction," is shown to depend on the market shares of the trademark brand versus that of the unbranded product (private label and generic goods) and their respective price elasticities.² In general, the greater the price elasticity of the branded good relative to the price elasticity of competing unbranded goods, the lower the fraction of profit which should be allocated to the brand trademark.

This paper extends the multinomial logit (MNL) structure of preferences assumed in Dubin (1998a). Logit models are commonly used in applied industrial organization (e.g. Werden and Froeb, 1994a, b; Werden et al., 1996; Shapiro, 1996) but have been criticized for their restrictive assumptions (e.g. Hausman et al., 1997). This paper derives trademark valuation fractions within a nested logit market share structure. The market share demand model for coffee creamers in Dubin (1998a) is re-estimated under nested logit assumptions and results for the trademark fraction are compared. In a similar fashion, Crooke et al. (1999) illustrated the effects of assumed demand form on simulated post merger equilibria. This paper is concerned with generalizing formulas for economic trademark values and with assessing the magnitude of the approximation error under logit diversion assumptions.

¹The value of a trademark can also include other attributes of value, such as long-term profit or growth potential, but the difference in current profits represents a useful floor on such overall values.

²The distinction between private label and generic commodities is discussed in Burke (1979). Burke notes that generics, while different from private label commodities in packaging and marketing, account for less than 1% of total food sales. In my analysis I do not distinguish between private label and generic commodities.

The remainder of this paper is divided into four sections. Section 2 describes the economic theory underlying my approach to brand valuation and shows how knowledge of the demand functions for a brand and its competitors can be used to determine the value for a trademark. The trademark valuation fractions under nested logit assumptions are derived and compared to those obtained in Dubin (1998a) under more restrictive “flat” logit assumptions. Section 3 describes the data while Section 4 presents the nested logit market share model for coffee creamer and the key parameter values and elasticities required for trademark value calculations. Section 5 concludes the paper with a discussion of the economic value calculations.

2. Brand valuation using econometric demand methods

The economic value of a brand or trademark reflects a manufacturer’s ability to command a higher selling price and/or market share for the branded good than it would attain for an essentially identical unbranded good. Uncertainty about the quality of, or lack of familiarity with unbranded alternatives makes many consumers reluctant to purchase such products even when they sell at a considerable discount to branded goods. This has two consequences which will be demonstrated below. First, because consumers prefer the branded good to its unbranded competitors, the branded good can be sold at a higher price than the unbranded good. Second, despite the price premium, the producer of the branded good is usually able to sell larger quantities than the unbranded producer. The combination of price premium and increased market share determines the relative profitability of branded and unbranded goods.

From an economic perspective, the appropriate value for a trademark relates to the loss in profit that would ensue if the branded producer were denied use of the trademark.³ Alternative approaches to brand valuation including price premium, consumer valuation, brand replacement cost, income and profit-split, comparables and value in acquisition, and financial are reviewed in Simon and Sullivan (1993) and in Dubin (1998a). The econometric method (Dubin, 1998a) determines a royalty or brand equity rate based on the market impact of the producer’s losing the right to use the trademark. The premise of this method is that the economic value of a trademark equals the difference between the economic profits a producer could gain with the trademark and the profits earned without the trademark.

The two items of relevant information for the branded producer if its trademark expired (or otherwise were unavailable) would be: (1) consumer demand for unbranded goods (which can be determined from historical data on unbranded sales) and (2) the branded producer’s own costs of production (*not* the costs or historical quantities sold by the unbranded producer). Demand analysis uses this information to estimate what the profits of the branded producer would be if it were forced to sell its goods without benefit of the brand trademark.⁴

³The long-run advantage created by a trademark is identical to that created by a patent. Trademarks and patents are analytically similar because they confer some degree of monopoly power to their owners. However, trademarks identify the origin or source of the products to which they are affixed while patents may be more generally applicable to technologies that apply to several products.

⁴The econometric method maintains two assumptions. First, that consumers would perceive that unbranded goods produced by the branded producer are identical to other private label goods. Second, that the branded producer’s unit costs are the same whether it produces branded or unbranded goods. If the branded product is, in

Generally, the holder of a brand trademark has a monopoly with respect to the differentiated demand for its branded product, though the existence of close substitutes—other branded and unbranded goods—constrains its ability to set prices. The maximum profit earned by the branded producer represents price (set to maximize profits) in excess of cost at a volume determined by the demand function. The profit, in this case, is $\pi = Q(P - C)$, that is, the quantity sold (Q) multiplied by the per-unit profit ($P - C$). However, the value of a brand trademark in contributing to operating profits generally will be less than the total operating profits from selling the branded good. The reason for this is that even without use of the brand trademark, the producer would still be expected to earn some economic profit. The profit earned by the branded producer while selling unbranded goods is given by $\pi' = Q'(P' - C)$, that is, the quantity sold (Q') multiplied by its per-unit profit ($P' - C$).

The economic value of the brand trademark is the difference between what the producer can earn selling the branded product (π), versus what the producer could earn without the trademark (π').⁵ This difference may be expressed as

$$V = \pi - \pi' = Q(P - P') + (Q - Q')(P' - C).$$

The first component, $Q(P - P')$, is the per unit price premium associated with the brand, ($P - P'$), multiplied by sales quantity, (Q), of the branded good. In effect, this first component equals the total value of the price premium for the brand. The second component, $(Q - Q')(P' - C)$, represents the increase in sales volume attributable to the brand trademark, ($Q - Q'$), times per unit profits of the unbranded producer, ($P' - C$). The second component therefore represents the value of increased market share. Using Lerner's rule, it follows that for the brand producer:

$$\frac{P - C}{P} = \frac{1}{\varepsilon}, \quad (1)$$

where ε is the differentiated demand price elasticity in brand market.

As noted above, if the branded producer were to switch to production of unbranded goods, it would no longer be a monopolist. The branded producer, because of the scale of its production, would still have market power in the unbranded market, but competition

(footnote continued)

fact, superior to private label alternatives, then the branded producer may be able to lower its costs by producing goods equivalent to those currently sold under private label. On the other hand, the branded producer may possess technological advantages which allow it to produce superior products at little or no additional cost, so that it could eventually reestablish its brand advantage over private label products. Quality differences in many goods are often in the eye of the beholder. To the extent that quality or technological differences exist or are perceived, the value of these is reflected in the valuation conclusions reached below, because any such differences are incorporated in consumer demand.

⁵A referee has noted that the calculation of trademark value in this paper relates to the spin off of a brand by an existing producer rather than the value to a new entrant in the market or even the value to an existing producer different from the brand holder. In effect the hypothetical in this article seeks the transfer price that a private label company might pay its parent company for the use of a trademark owned by the parent. This is a somewhat different calculation than that of a reasonable royalty paid by a licensee to a licensor. Nevertheless, this approach provides a useful guidepost to a reasonable royalty as it attempts to isolate the incremental profits that are earned by use of the trademark. It also has direct relevance when an appropriate transfer price (or royalty level) is sought in international taxation matters. The trademark valuation formula developed in this article could be modified for the case of new entrants or in other similar situations. Alternatively, a price simulation approach may be preferred as has been developed in quantitative merger analysis (Werden and Froeb, 1994a, b).

with other unbranded producers would tend to reduce its markup rate $(P' - C)/P'$. Under Cournot oligopoly, the markup rate for an oligopolist (producing an unbranded product) is

$$\frac{P' - C}{P'} = \frac{S'}{\varepsilon'}, \quad (2)$$

where S' is the branded firm's quantity share in the unbranded market and ε' is the price elasticity of demand in the unbranded market.⁶

The economic value of the trademark (R), determined as a percentage of sales equals

$$R = \frac{V}{PQ} = \frac{Q(P - C)}{PQ} \left[1 - \frac{Q'(P' - C)}{Q(P - C)} \right] \quad (3)$$

which represents the per period value of the trademark divided by the per period total sales revenue. As can be seen from the structure of Eq. (3), the value R is the product of two factors. The first factor, $Q(P - C)/PQ$, is the economic operating margin (total economic profits divided by total revenues). The second factor:

$$\begin{aligned} G &= 1 - \frac{Q'(P' - C)}{Q(P - C)} \\ &= 1 - \frac{P' Q' S' / \varepsilon'}{PQ / \varepsilon} = 1 - S' \frac{\alpha'_0 T' P' \varepsilon}{\alpha_0 T P \varepsilon'} \end{aligned} \quad (4)$$

is the proportion of economic profits realized due to the brand or trademark (i.e. the “trademark fraction”) and I have defined $\alpha_0 = Q/T$ and $\alpha'_0 = Q'/T'$ as the branded producer's shares of total industry unit sales (including other branded goods as well as unbranded goods) before and after its switch to unbranded production, and T and T' are total industry unit sales before and after the switch.⁷ Since:

$$\frac{P'}{P} = \frac{C/P}{C/P'} = \frac{1 - 1/\varepsilon}{1 - S'/\varepsilon'} \quad (5)$$

⁶In an analysis similar to mine Hausman et al. (1991, 1994) consider the elasticity of specific brands of beer using monthly transaction data collected at the metropolitan (SMSA) level. Their analysis is applied to the issues in a hypothetical merger. Hausman et al. rely on a Nash–Bertrand assumption, in order to calculate the equilibrium price levels that attain post-merger. Price–cost margins are discussed in relation to market structure in Cowling and Waterson (1976) and Nickell and Metcalf (1978). My model assumes Bertrand pricing with respect to the differentiated brand product and Cournot quantity setting with respect to the group of unbranded producers. The Cournot assumption seems particularly appropriate in this instance as products are undifferentiated (in the private label segment) and cost differentials in production should largely drive market shares and the marketing clearing price.

⁷As discussed in Dubin (1998a), Eq. (4) embodies several useful observations: first, the greater the price difference between the branded and unbranded products (i.e. the lower the ratio of P' to P), the higher is G . Second, the greater the difference between the branded producer's market shares before and after the switch to unbranded production, the higher is G . Third, the greater the branded producer's prospective share of unbranded production (i.e. the higher S'), the lower is G . Fourth, the greater the drop in total industry unit sales resulting from the switch to non-branded production, the higher is G . Fifth, the more elastic branded demand is to unbranded demand (i.e. the higher the ratio of ε to ε'), the lower is G . It is also important to note that Eq. (4) shows that merely comparing elasticities in the branded and unbranded markets may not be revealing of relative profits to the producer without also considering market share in the unbranded market.

we obtain

$$G = 1 - S' \frac{\alpha'_0 T' \varepsilon - 1}{\alpha_0 T \varepsilon' - S'} \quad (6)$$

The analysis is completed by making a few assumptions about aggregate market response to the elimination of a brand. The first assumption is that total industry sales are unaffected by a brand elimination, i.e. $T' = T$.⁸

Finally, I also make some assumptions about how relative market shares change in response to elimination of a brand. In Dubin (1998a) the market share model for branded and unbranded goods was assumed to be MNL. Specifically, that study assumed that when a specific branded alternative was eliminated, a proportional increase in the market share of the remaining branded and unbranded goods would occur.

Let α_1 denote the market share of unbranded alternatives. Then the MNL assumption implies that α_1 increases to $\alpha'_1 = \alpha_1 / (1 - \alpha_0)$ after brand zero is eliminated. Let S denote brand zero's quantity market share of its own sales and of unbranded sales prior to the hypothetical loss of the trademark (i.e. $S = \alpha_0 / (\alpha_0 + \alpha_1)$). I assume that the branded producer will continue to capture this relative market share after brand loss so that $S' = S$, where S' denotes the relative market share after brand expiration. Under these assumptions, brand zero's market share changes from α_0 to $\alpha'_0 = S' \alpha'_1 = S \alpha'_1$. Since $(1 - S) / S = \alpha_1 / \alpha_0$, we have

$$\frac{\alpha'_0}{\alpha_0} = \frac{S \alpha'_1 \alpha_1}{\alpha_1 \alpha_0} = (1 - S) \frac{\alpha'_1}{\alpha_1}$$

and under MNL:

$$\frac{\alpha'_0}{\alpha_0} = \frac{(1 - S)}{1 - \alpha_0}.$$

Hence

$$\begin{aligned} G &= 1 - S \left(\frac{\alpha'_0}{\alpha_0} \right) \left(\frac{\varepsilon - 1}{\varepsilon' - S} \right) \\ &= 1 - \frac{S(1 - S)}{1 - \alpha_0} \left(\frac{\varepsilon - 1}{\varepsilon' - S} \right). \end{aligned} \quad (7)$$

The MNL assumption implies that as brand zero is eliminated, unbranded products experience a percentage increase of $\% \Delta \alpha_1 = (\alpha'_1 - \alpha_1) / \alpha_1 = \alpha_0 / (1 - \alpha_0)$. Here the substitution of demand from good zero to good one depends only on the initial market share level for good zero. The MNL assumption for branded and unbranded market shares implies that unbranded products are equally good substitutes for the branded product that is eliminated. Since this substitution pattern is likely to be incorrect whenever consumers find alternative branded products better substitutes for the lost branded product, the assumed diversion (under MNL) into the unbranded market segment by

⁸A referee has noted that this assumption eliminates the usual “outside good” or “none of the above” alternative. For products that make up a small portion of a consumer's total expenditures (highly likely for Coffee-mate) and whose price varies in a narrow range, this assumption should provide an accurate approximation. Additionally, in Section 4, I show that this assumption is empirically reasonable (at least for coffee creamers).

former customers is too large and the profitability of becoming a new unbranded product is over-estimated.

To relax the MNL assumption and to allow for a richer pattern of substitution, I employ the nested logit model (McFadden, 1981).⁹

Suppose, for example, that brand zero customers find other brand products to be closer substitutes than unbranded products. Without loss of generality, suppose there is a single alternative branded producer. Let V_0 , V_1 , and V_2 denote the scale values (indirect utilities) associated with brand zero, unbranded alternative 1, and substitute brand 2, respectively. Assume that brands 0 and 2 are closer substitutes to each other than to unbranded alternative 1. Then a compatible nested logit structure assumes:

$$\alpha_{0|02} = e^{V_0} / (e^{V_0} + e^{V_2}),$$

$$\alpha_{02} = e^{\theta y_{02}} / (e^{\theta y_{02}} + e^{V_1}),$$

$$\alpha_1 = e^{V_1} / (e^{\theta y_{02}} + e^{V_1}),$$

where $y_{02} = \log(e^{V_0} + e^{V_2})$ is the inclusive value of branded alternatives 0 and 2. The log probabilities of choosing alternatives 0 and 1 are, respectively,

$$\begin{aligned} \log \alpha_0 &= \log \alpha_{0|02} + \log \alpha_{02} \\ &= V_0 - (1 - \theta)y_{02} - \log(e^{\theta y_{02}} + e^{V_1}) \end{aligned}$$

and

$$\log \alpha_1 = V_1 - \log(e^{\theta y_{02}} + e^{V_1}).$$

Key to development of the trademark fraction is the percentage change in alternative 1 (unbranded products) as alternative 0 is eliminated (i.e. after brand 0's loss of trademark). For the nested logit model these diversion levels may be derived from standard elasticity formulas. The elasticities are, respectively,

$$\varepsilon(\alpha_0, V_0) = \frac{\partial \log \alpha_0}{\partial \log V_0} = 1 - \alpha_{0|02}(1 - \theta) - \alpha_{02}\alpha_{0|02}\theta$$

and

$$\varepsilon(\alpha_1, V_0) = \frac{\partial \log \alpha_1}{\partial \log V_1} = -\alpha_{02}\alpha_{0|02}\theta.$$

The diversion ratio, $d_{10} = \varepsilon(\alpha_1, V_0) / \varepsilon(\alpha_0, V_0)$, measures the rate at which decreases in alternative 0 are captured by alternative 1.¹⁰ In this case:

$$d_{10} = \frac{\partial \log \alpha_1}{\partial \log \alpha_0} = \frac{-\alpha_0\theta}{1 - \alpha_{0|02}(1 - \theta) - \alpha_0\theta}. \tag{8}$$

⁹A referee has observed the similarity of the nested logit application in this paper to situations concerning lost profits in patent infringement cases. See e.g. Werden et al. (2000), Werden et al. (1999a, b).

¹⁰Diversion ratios, in the context of merger models, are discussed in Shapiro (1996).

Under our hypothetical in which brand 0 loses its trademark, we have: $\% \Delta \alpha_1 \cong -d_{10}$, so that

$$\frac{\alpha'_1}{\alpha_1} = \frac{1 - \alpha_{0|02}(1 - \theta)}{1 - \alpha_{0|02}(1 - \theta) - \alpha_0 \theta}. \quad (9)$$

Eq. (9) contains the MNL assumption of Dubin (1998a) as a special case. Under MNL, $\theta = 1$ and $\alpha'_1/\alpha_1 = 1/(1 - \alpha_0)$. At the other extreme, an inclusive value coefficient of $\theta = 0$ implies $\alpha'_1/\alpha_1 = 1$. In this case, as brand 0 is eliminated, the unbranded segment does not increase because current branded customers of brand 0 switch to brand 2 instead.

To complete the derivation of the trademark fraction under nested logit we find:

$$\frac{\alpha'_0}{\alpha_0} = (1 - S) \left(\frac{1 - \alpha_{0|02}(1 - \theta)}{1 - \alpha_{0|02}(1 - \theta) - \alpha_0 \theta} \right). \quad (10)$$

Substituting into Eq. (7) yields the conclusion:

$$G^* = 1 - S(1 - S) \left(\frac{1 - \alpha_{0|02}(1 - \theta)}{1 - \alpha_{0|02}(1 - \theta) - \alpha_0 \theta} \right) \left(\frac{\varepsilon - 1}{\varepsilon' - S} \right). \quad (11)$$

Eq. (11) may be written in a manner similar to Eq. (7). Let $\alpha_0^* = \alpha_0 \theta / (1 - \alpha_{0|02}(1 - \theta))$. Then:

$$G^* = 1 - \frac{S(1 - S)}{1 - \alpha_0^*} \left(\frac{\varepsilon - 1}{\varepsilon' - S} \right). \quad (12)$$

Here we see that the trademark fraction will be largest when $\theta = 0$ and smallest when $\theta = 1$ (MNL). Hence the trademark fractions in Dubin (1998a) were conservatively estimated. The next section presents the estimation of θ under nested logit assumptions and the calculation of the revised trademark fraction.

3. Data

There are three categories of variables used in the demand analysis: sales data, macro-economic and demographic indicators, and product specific variables. A complete discussion of data sources, variable selection, and variable transformations is provided in Dubin (1998a). Here I briefly review the main factors used in the nested logit analysis presented below.

3.1. Nielsen reports

The primary data source on selling prices and quantities is a series of surveys conducted by the A.C. Nielsen Company. Nielsen used a national probability sample of 1050 stores in the continental U.S. to calculate its estimates. The data are obtained bimonthly through in-store audits. Data are reported on total pounds sold, retail price, percent of volume sold with retail advertising support (local advertising, special prices, ad coupons, and displays), and total store sales for those selling the particular product or brand (called “all commodity volume” or ACV). Various measures can be derived from these such as product market share and sales per million dollars of ACV. Data on powdered non-dairy coffee creamer sales cover the time period from December 1978–January 1979 to October–November 1984. My analysis is limited to 16 and 22 oz sizes of Coffee-mate,

Cremora, and Private Label creamer. Sales are reported in thousands of pounds. Retail support is measured by the percentage of sales involving displays of the product, coupons, or special prices.

3.2. Socioeconomic data

Dubin (1998a) identified a number of demographic variables anticipated to affect demand. To account for these effects, as well as shifts in consumer demand caused by unemployment and population growth, area demographic and economic indicators were collected from various editions of the *State and Metropolitan Area Data Book* (U.S. Department of Commerce, Bureau of the Census 1982, 1986, 1991). These variables include: total population, and per capita personal income. The variables were collected for each metropolitan statistical area (MSA) for the period 1979–1984 on an annual basis and were matched to Nielsen regions as appropriate. Prices in this study were deflated using a monthly consumer price index for all urban consumers for four Census regions, published by the U.S. Department of Commerce, Bureau of Labor Statistics (1979–1984).

3.3. Advertising and coffee consumption

Leading National Advertisers (LNA) tracks multimedia advertising expenditures across the U.S. in six major media: consumer magazines, newspaper supplements, network television, spot television, network radio, and outdoor billboards. LNA publishes quarterly breakdowns of spending in these media by brand and company in its “LNA Multi-Media Report Service” (Leading National Advertisers, 1979–1984). LNA includes only companies which spend over 25,000 dollars in all six media combined. Bimonthly expenditures were interpolated from the quarterly totals.

Coffee consumption is derived from two sources of data: Nielsen Research (1979–1984) reports and the “United States of America Coffee Drinking Study—Winter 1987,” published by the International Coffee Organization (1987). The Coffee Drinking Study is conducted annually and the 1987 report, which was available for use, contains historical data for 1984.

4. Nested logit market share model

Dubin (1998a) estimated demand models for coffee creamer for 16 oz size products.¹¹ The purpose of these models was to determine the own-elasticities of demand for branded and private label commodities. The basic demand equation relates the logarithm of the bimonthly sales of creamer to the logarithms of the real price per pound for the creamer in question and to the logarithms of the real prices of substitute creamers.¹² The demand

¹¹While Nestlé/Carnation markets Coffee-mate in a variety of sizes, the 16 oz size is the highest sales volume commodity in the product line and, moreover, is marketed primarily in the retail distribution channel. The 16 oz commodity therefore provides the best basis for comparison between branded and unbranded consumer demand.

¹²The empirical specification in the basic demand model was similar to that used in Gius (1993). Gius considers the demand for branded liquor products. Using historical time-series data, he estimates the demand for both premium and non-premium liquors in order to determine the extent of the product market. Gius also uses LNA data as a measure of advertising, price divided by the consumer price index, and a trend term in his demand equations.

Table 1
Variable definitions for coffee creamer model

ls__16	log sales of 16 oz creamer (pounds) (cm,cr,pl)
ls__22	log sales of 22 oz creamer (pounds) (cm,cr,pl)
ls__	log sales of creamer (pounds) (cm,cr,pl)
lsb	log sales of Coffee-mate and Cremora (pounds)
rp__16	real price of 16 oz creamer (cm,cr,pl)
rp__22	real price of 22 oz creamer (cm,cr,pl)
Trend	linear time trend
seas1	December–January period
seas2	February–March period
seas3	April–May period
seas4	June–July period
seas5	August–September period
rinc	real personal income
cpd	cups of coffee consumed per day
acv16	all commodity volume
rs__dis	retail support displays creamer (cm,cr,pl)
rs__iac	retail support in-ad coupons creamer (cm,cr,pl)
rs__sp	retail support special prices creamer (cm,cr,pl)
radcar	real advertising expenditure for Coffee-mate (LNA derived)
radcrm	real advertising expenditure for Cremora (LNA derived)

equation also allows for trend and seasonality in the consumption pattern as well as for regional effects.¹³ The demand equation further specifies that creamer sales are potentially influenced by the level of real income per capita, the frequency of coffee consumption (measured in coffee cups consumed per day per capita), the total volume of all sales in the region (ACV), real advertising of branded creamers, and retail support, including in-aisle displays, in-ad coupons, or special pricing. In Table 1, I summarize the variables used in the coffee creamer nested logit demand models.

I previously found that the demand for Coffee-mate 16 oz dry creamer depends significantly on relative prices. As the price of 16 oz Coffee-mate creamer rises, consumers are predicted to purchase less 16 oz Coffee-mate creamer. The other price effects revealed that 16 oz Private Label and 22 oz Coffee-mate creamer are economic substitutes for Coffee-mate 16 oz creamer. As the prices of these goods rise, the demand for 16 oz Coffee-mate increases. A full discussion of the results for the basic demand model are given in Dubin (1998a). Elasticity results from the basic model are summarized in Table 2 along with market shares.

The results obtained using the basic demand model were suggestive of patterns of substitution but not refined enough to measure the degree of substitution. The estimation approach, in this study, relies on the aggregate nested logit model developed in Dubin et al.

(footnote continued)

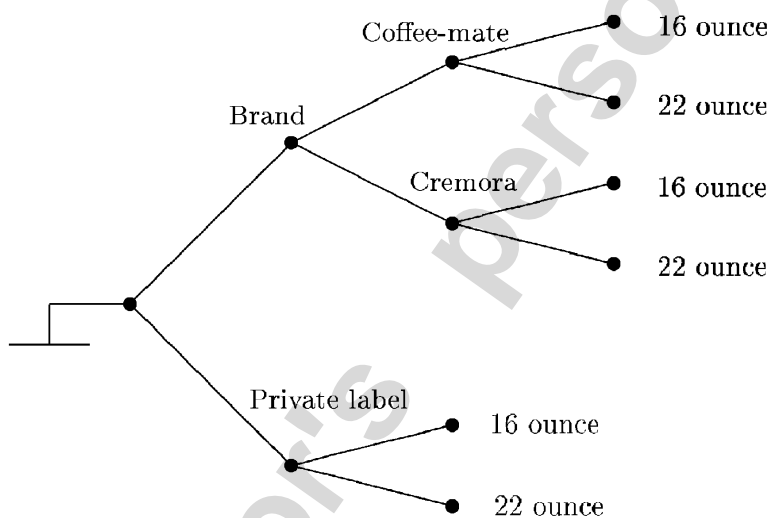
My empirical model is also similar that used in Hausman et al. (1994) and Hausman and Leonard (1997). Hausman et al. modeled the differentiated demand for beer in three stages with the first stage consisting of total beer demand, the middle stage consisting of beer segments (premium, light, imported, and non-premium) and the lowest stage consisting of brand of beer within beer segment.

¹³Price endogeneity was examined in the basic model using the method described in Hausman et al. (1994, 1997). Specifically, I exploited the panel nature of this data set to create instruments for price. This technique does not require the usual cost shifters that are sometimes employed as instruments but were nevertheless unavailable in this analysis. Price endogeneity was not detectable in the creamer demand models based on a Hausman test.

Table 2
Summary of price elasticities and market shares from basic model

Product	Market share (%)
16 oz CM CM	54.1
22 oz CM CM	45.9
16 oz CR CR	60.0
22 oz CR CR	40.0
16 oz PL PL	24.5
22 oz PL PL	75.5
CM (CM CR)	73.4
CR (CM CR)	26.6
(CM CR) total creamer	66.4
PL total creamer	43.6

(1992) and Dubin (1998b). I estimate a three-level nested logit structure for the coffee creamer market shares. Here, I assume that demand is differentiated by product size at the lowest level, brand choice at the middle level of the tree, and branded versus unbranded demand at the top level. Product size refers to the package (jar) size for the commodity (16 or 22 oz creamer). The nested logit tree is illustrated below.



To explain the nested logit approach, consider two levels of this tree with $i = 1, 2, \dots, I$ denoting choice at the upper level and $j = 1, 2, \dots, J_i$ denoting demand at the next lower level. The nested logit specification implies that the probability for alternative ij , P_{ij} , can be written as a conditional probability, $P_{j|i}$, and a marginal probability, P_i , with

$$\begin{aligned}
 P_{j|i} &= \frac{e^{\beta' X_{j|i}}}{\sum_{j'=1}^{J_i} e^{\beta' X_{j'|i}}}, \\
 P_i &= \frac{e^{\alpha' Y_i + \theta I_i}}{\sum_{i'=1}^I e^{\alpha' Y_{i'} + \theta I_{i'}}}, \\
 I_i &= \log \sum_{j'=1}^{J_i} e^{\beta' X_{j'|i}},
 \end{aligned}
 \tag{13}$$

where $X_{j|i}$ and Y_i are observed attributes of the alternatives at each level of the tree, β and α are vectors of unknown parameters, and θ is coefficient of inclusive value, I_i . The similarity of alternatives in the lower branch is measured by θ .¹⁴ With aggregate data (market shares for instance) we estimate using Berkson minimum chi-square. Log-odds transformations yield a system of equations that can be estimated by feasible GLS (Amemiya, 1985, Chapter 9)¹⁵:

$$\log\left(\frac{P_{j|i}}{P_{1|i}}\right) = \beta'(X_{j|i} - X_{1|i}), \quad (14)$$

$$\log\left(\frac{P_i}{P_1}\right) = \alpha'(Y_i - Y_1) + \theta(I_i - I_1). \quad (15)$$

Market shares calculated by geographic location and time period are employed as estimates of the log-odd probability ratios with differences in observed explanatory factors entering the model according to Eqs. (14) and (15).

4.1. Econometric results

The model specification and selection of explanatory factors largely follows Dubin (1998a). However, there are some important differences. Price differences affect demand for commodity size within brands (and private label) at the lowest level of the nested logit demand tree. Advertising factors including special prices, discounts, and “in-ad” coupons are not size specific but are brand (or private label) specific and therefore enter the model at the mid-level of the logit tree. Seasonality factors were only included at the lowest tree level (commodity size) as they proved to be insignificant at higher levels.

Advertising variables from LNA appear at the middle level of the tree and are omitted for private label alternatives since they were only measured by LNA for brand products. Other factors, including coffee consumption levels, real income, ACV, and trend levels were included at all levels of the tree using interactions with alternative specific constants. Market shares for the three-level nested logit model are given in Table 2. For instance, the market share of 16 oz Coffee-mate creamer within the Coffee-mate brand segment is 54.1%.

Table 3 presents the estimated creamer size choice model. Corresponding to the tree illustrated above, there are three market share models for the binary choices between 16 and 22 oz creamers given the brand/private label decision. These three models in log-odds form are presented in the table with t -statistics shown in parenthesis. Price effects were negative as expected and statistically significant e.g. as the real price of 22 oz creamer increases the demand for 16 oz creamer increases. This pattern is true for all three commodities (Coffee-mate, Cremora, and private label). Income effects vary by brand with positive income effects for Coffee-mate, no significant income effects for Cremora, and negative income effects for private label. This pattern is consistent with the notion that Coffee-mate is the premium creamer in the marketplace and that private label products

¹⁴This model is very similar to the multilevel demand system of Hausman et al. (1994). Inclusive values estimated at lower levels of the nested logit tree act as the price indices used in lower stages by Hausman et al. (1994).

¹⁵With appropriate choice of weights, the minimum chi-squared technique is asymptotically efficient (Amemiya, 1978).

Table 3
Creamer size choice model (bottom level)

	lscm22-lscm16	lscr22-lscr16	lspl22-lspl16
Constant	−6.11 (−9.46)	15.14 (9.35)	−4.47 (−1.98)
(rpcm22-rpcm16)	−1.74 (−13.50)	–	–
(rpcr22-rpcr16)	–	−1.63 (−7.27)	–
(rppl22-rppl16)	–	–	−1.52 (−6.07)
acv16	0.26 (0.19)	3.48 (1.10)	1.53(0.64)
cpd	0.40 (6.82)	−0.67 (−4.69)	0.29 (2.21)
Trend	0.056 (7.61)	−0.17 (−9.26)	0.060 (2.21)
rinc	0.0023 (2.78)	−0.0026 (−1.26)	−0.0044 (−2.30)
seas1	0.0060 (0.13)	0.21 (1.92)	−0.22 (−2.17)
seas2	−0.13 (−3.00)	0.17 (1.58)	−0.087 (−0.93)
seas3	0.094 (2.21)	0.080 (0.76)	−0.030 (−0.32)
seas4	0.25 (5.42)	−0.15 (−1.35)	0.062 (0.64)
seas5	0.26 (5.85)	−0.059 (−0.53)	0.10 (1.06)
Number of observations	996	859	313
R-squared	0.292	0.191	0.203

Table 4
Brand choice model (mid-level)

	lscm-lscr
Constant	0.70 (0.41)
(incvcmz-incvcrz)	0.36 (2.73)
(radcar-radcrm)	−0.0022 (−0.35)
(rscmdis-rsrdis)	0.016 (6.81)
(rscmiac-rscriac)	0.023 (5.12)
(rscmsp-rscrsp)	0.015 (11.98)
acv16	−4.37 (−1.98)
cpd	−0.16 (−1.28)
Trend	0.017 (0.93)
rinc	−0.0054 (−3.71)
seas1	0.11 (1.43)
seas2	0.029 (0.39)
seas3	0.033 (0.45)
seas4	−0.085 (−1.01)
seas5	0.065 (0.80)
Number of observations	879
R-squared	0.307

have somewhat inferior demand. Coffee consumption is positively correlated with larger package size Coffee-mate, smaller package size Cremora, and larger package sizes for private label. The level of ACV was not significant in the package size models while trend and seasonality factors were significant in these models but with coefficients which varied by brand and private label as to sign.¹⁶

¹⁶These empirical results are similar to the pattern observed in Dubin (1998a) for his basic demand model in which 16 oz creamer was differentiated by brand.

Table 5
Brand versus private label choice model (top level)

	lsb-lspl
Constant	−28.15 (−12.53)
(-incvpl)	0.46 (2.72)
(-rspldis)	0.0013 (0.45)
(-rspliac)	−0.030 (−2.47)
(-rsplsp)	0.0070 (2.66)
acv16	0.90 (0.39)
cpd	0.10 (1.23)
incvcmcr	0.44 (4.48)
Trend	0.33 (12.48)
rinc	0.010 (5.10)
Number of observations	404
R-squared	0.634

The estimated creamer size models lead to three inclusive value, **incvcmz**, **incvcrz**, and **incvplz** for Coffee-mate, Cremora, and private label, respectively. In Table 4, I present the results for the mid-level brand choice model. This model develops the choice between Coffee-mate and Cremora. The model contains the difference in inclusive values from the previous stage. The inclusive value coefficient for the commodity size branches among branded alternatives is estimated to be 0.358 and is statistically different from both zero and one at standard significance levels. This implies that commodity sizes form close substitutes for consumers and that the brand choice depends on the commodity size decision. The other explanatory variables have expected signs and demonstrate that increases in advertising through discounts, in-ad coupons or special prices lead to increased demand for the branded alternative being advertised. The income and coffee consumption per day factors have negative coefficients (although the latter is not significant).¹⁷ The brand choice model allows us to calculate the inclusive value of branded alternatives, **incvcmcr**.

Table 5 presents the top-level market share model for branded versus private label alternatives. This model includes the inclusive value for the brand choice market share model and the inclusive value from the private label commodity size model. Additional factors for advertising are included in the model with expected sign changes that reflect the use of “private label” as the normalizing alternative i.e. the model estimates the log-odds ratio of branded to private label market shares. Again the results are consistent with Dubin (1998a) with respect to such factors as real income, coffee consumption, advertising, and trend effects as they affect the choice of brands versus private label commodities.

The nested logit model also demonstrates significant inclusive value coefficients at higher levels of the tree. Of particular importance is the estimate of the inclusive value coefficient for the variable **incvcmcr**. This value is estimated to be 0.437 and is contained in the unit interval with 95% confidence. This value is needed to estimate the trademark fraction since

¹⁷These results are consistent with the findings in the basic demand model (Dubin, 1998a). He found positive and significant coefficients for these factors for Cremora demand but not for Coffee-mate (recall that the model specifies the log-odds comparison of Coffee-mate to Cremora).

it reflects the degree of similarity among branded alternatives. As all inclusive value coefficients in this tree were in the unit interval, statistically significant, and obey the relative stage inequality constraints (McFadden, 1981), the model is consistent with random utility maximization (RUM).

Other tree structures were explored and rejected by the data. For instance, I combined the private label and Cremora branches into one nest and compared these against a single branch for Coffee-mate. This structure tests whether Coffee-mate acts more like a “super-premium” brand and therefore whether its similarity to Cremora or private label alternatives is less strong than the similarity between Cremora and private label alternatives to each other. This tree structure produced inclusive value coefficients that were not consistent with RUM as they were either greater than one (when measuring the similarity of private label and Cremora commodity sizes) or negative (when measuring the similarity of Coffee-mate commodity sizes).

In another case, that was consistent with RUM, I re-specified the model to have the commodity size decision come before the brand decision. In this tree, consumers first choose the size of the commodity they prefer (16 oz versus 22 oz creamer) and then choose their preferred brand given the commodity size decision. This model produced inclusive value coefficients in the unit interval. The inclusive value for brand choice in this model was estimated to be 0.91 and thus implies a specification that is not dissimilar from a “flat” MNL specification. However, the fit of this nested logit model was much lower than the preferred specification discussed above based on AIC criteria.

4.2. Elasticity estimates

Elasticities for 16 oz Coffee-mate and 16 oz Private Label creamer were calculated using the elasticity formulae given in Section 2 with appropriate modifications for the three-level nested logit structure. For instance, the elasticity of 16 oz Coffee-mate creamer given the decision to buy some creamer depends on the inclusive value coefficient θ for commodity sizes among brand alternatives and the inclusive value coefficient ψ for brand alternatives. As discussed above, point estimates of these coefficients are 0.358 and 0.437, respectively. The elasticity formula for the conditional probability of choosing 16 oz Coffee-mate creamer (i.e. conditional on purchasing some creamer) is

$$\begin{aligned}\varepsilon(\alpha_0, P) &= P \frac{\partial V_0}{\partial P} \frac{\partial \log \alpha_0}{\partial V_0} \\ &= (1 - \alpha_{0|02}(1 - \theta) - \alpha_{02|021}\alpha_{0|02}\theta(1 - \psi) - \alpha_{021}\alpha_{02|021}\alpha_{0|02}\theta\psi)P\beta,\end{aligned}$$

where $\beta = \partial V_0 / \partial P = -1.74$ (Table 3). Also, from Table 2 we have $\alpha_{0|02} = 54.1\%$, $\alpha_{02|021} = 73.4\%$, and $\alpha_{021} = 66.4\%$. At the average price of 16 oz Coffee-mate of \$1.974 per pound (in 1984), the conditional elasticity is estimated to be -1.826 .

Price changes also affect the total creamer market but to a quite limited degree. To determine this effect an overall inclusive value was calculated for the nested logit tree. This inclusive value was then included as a price index in a regression model for total creamer sold. This latter model also included a time trend and seasonality factors.¹⁸ The elasticity of total creamer demand with respect to the price of 16 oz

¹⁸Essentially, this is a fourth stage of the demand model and measures the response of the outside good to changes in the coffee creamer index price.

Coffee-mate creamer was estimated to be -0.148 . Hence, the unconditional price elasticity is $-1.826 \pm 0.148 = -1.974$.¹⁹ A similar elasticity analysis was used to determine the price elasticity of 16 oz private label creamer. In this case, the nested logit structure has two levels (the differentiated brand layer is absent) and the commodity size inclusive value coefficient is estimated to be 0.465 (Table 5). The conditional elasticity was determined to be -1.626 at the average price of 16 oz private label creamer ($\$1.285$ per pound in 1984). The effect of private label price on total creamer demand is also found to be relatively small (elasticity = -0.078). The overall elasticity is calculated to be -1.704 .²⁰ Importantly, as the outside good elasticities are quite small in comparison to the total product elasticities, the assumption made earlier of a constant sized creamer market is reasonable from the perspective of the trademark valuation simulation.

4.3. Trademark valuation percentage

In order to calculate the trademark value as a percentage of revenues using the formulas derived in Section 2, it is necessary to calculate economic operating margins. For Coffee-mate creamer the 1984 economic operating margin as a percentage of sales was 36% (see Dubin, 1998a). Concentrating on the 16 oz creamer segment, Coffee-mate has a 60.3% market share while the market share for the unbranded private label segment is 18.9% (over the estimation period). Hence the relative market share of the brand whose trademark is hypothetically lost is $S = 0.603 / (0.603 + 0.189) = 0.762$. Since the brand market share $\alpha_0 = 0.603$, we have under MNL assumptions:

$$G = 1 - \frac{S(1-S)}{1-\alpha_0} \left(\frac{\varepsilon-1}{\varepsilon'-S} \right) = 1 - \frac{(0.762)(1-0.762)}{1-0.603} \frac{1.974-1}{1.704-0.762} = 0.528.$$

This trademark fraction is then multiplied by the economic operating margin of 36% to arrive at an economic royalty rate of 19% for Coffee-mate.

Under nested logit assumptions, we need two additional parameters. First, the relative share of Coffee-mate to Cremora $\alpha_{0|02} = 0.603 / (0.603 + 0.208) = 0.743$. Second, the inclusive value coefficient for similarity of branded alternatives was estimated at $\theta = 0.437$. Therefore the estimated trademark fraction is

$$G^* = 1 - \frac{S(1-S)}{1-\alpha_0^*} \left(\frac{\varepsilon-1}{\varepsilon'-S} \right) = 1 - \frac{(0.762)(1-0.762)}{1-0.453} \frac{1.971-1}{1.704-0.762} = 0.657$$

as $\alpha_0^* = (0.604)(0.437) / (1 - (0.743)(1 - 0.437)) = 0.453$. Hence the economic royalty rate increases from 19% under MNL to 24% under nested logit assumptions. At the other extreme, an inclusive value coefficient of $\theta = 0$ would imply a trademark fraction of $G^* = 0.812$ and an economic royalty rate of 29%. Hence the estimated economic royalty rates range from 19% to 29% depending on the degree of *assumed* substitution among branded commodities. The intermediate *estimated* degree of substitution essentially splits the difference in this empirical example and leads to a royalty rate of 24%. Similar results were obtained for estimated trademark fractions for the entire (as opposed to 16 oz only)

¹⁹This estimate is not greatly different than the elasticity level of -2.010 determined in the basic model of Dubin (1998a).

²⁰Dubin (1998a) estimated the 16 oz private label creamer elasticity at -1.440 in a log-linear specification. This result, therefore, shows more elasticity than had been previously found.

Coffee-mate segment but yielded slightly lower trademark fractions and estimated economic royalties.

5. Conclusions

This paper has developed an econometric approach to valuing trademarks. The resulting trademark factor depends on readily available data including historical sales information, market shares, and sales margins. Econometric analysis leads to royalty rates that can only be approximated by the simple rules-of-thumb employed by appraisers and others.²¹ Importantly, the econometric approach shows how the various factors previously discussed in the economic, marketing, and lay literature fit together to determine royalty rates for intangible assets.

I have also generalized the method of Dubin (1998a) to allow for flexible and more plausible patterns of substitution among branded and unbranded alternatives. The empirical results, in this study, revealed modest changes in the estimated economic royalty rates (on the order of 5%). This study has also demonstrated how nested logit models may be used to calculate diversion ratios and therefore should have applications in merger simulations where merging parties reconfigure the products being sold or in empirical settings with brand or patent expiration.

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References

- Amemiya, T., 1978. The maximum likelihood, the minimum chi-square and the non-linear weighted least-squares in the general qualitative response model. *Journal of the American Statistical Association* 71, 347–351.
- Amemiya, T., 1985. *Advanced Econometrics*. Harvard University Press, Cambridge, MA.
- Burke, C., 1979. Plain labels challenge the supermarket establishment. *Fortune* 3 (26).
- Cowling, K., Waterson, M., 1976. Price–cost margins and market structure. *Econometrica* 43 (171), 267–274.
- Crooke, P., Froeb, L., Tschantz, S., Werden, G.J., 1999. Effects of assumed demand form on simulated postmerger equilibria. *Review of Industrial Organization* 15, 205–217.
- Dubin, J., 1998a. The Demand for Branded and Unbranded Products—An Econometric Method for Valuing Intangible Assets. *Studies in Consumer Demand—Econometric Methods Applied to Market Data*. Kluwer Academic Publishers, Massachusetts, Boston, pp. 77–127.
- Dubin, J., 1998b. The Demand for Commercial Fishing in California. *Studies in Consumer Demand—Econometric Methods Applied to Market Data*. Kluwer Academic Publishers, Massachusetts, Boston, pp. 159–196.
- Dubin, J.A., Graetz, M.J., Udell, M.A., Wilde, L.L., 1992. The demand for tax return preparation services. *Review of Economics and Statistics* 74 (1), 75–82.
- Gius, M., 1993. The extent of the market in the liquor industry: an empirical test of localized brand rivalry, 1970–1988. *Review of Industrial Organization* 8, 599–608.
- Goldscheider, R., Jarosz, J., Mulhern, C., 2002. Use of the 25 percent rule in valuing IP. *Les Nouvelles* 37 (4), 123–133.

²¹For instance, the theoretical development in this paper provides a practical replacement for the Goldscheider et al. (2002) rule-of-thumb. In this commonly used rule, the royalty rate is assumed to be between one-quarter and one-third of net economic margin.

- Hausman, J.A., Leonard, G., 1997. Economic analysis of differentiated products mergers using real world data. *George Mason Law Review* 5 (3), 321–343.
- Hausman, J.A., Leonard, G., Zona, J.D., 1991. A proposed method for analyzing competition among differentiated products. *Antitrust Law Journal* 60 (3), 889–900.
- Hausman, J., Leonard, G., Zona, J.D., 1994. Competitive analysis with differentiated products. *Annales D'Économie et de Statistique* 34, 159–180.
- Leading National Advertisers, 1979–1984. LNA multi-media report service. *Class/Brand Reports*, New York, NY.
- McFadden, D., 1981. Econometric models of probabilistic choice. In: Manski, C.F., McFadden, D. (Eds.), *Structural Analysis of Discrete Data with Econometric Applications*. MIT Press, Cambridge, MA.
- Nickell, S., Metcalf, D., 1978. Monopolistic industries and monopoly products or are Kellogg's cornflakes overpriced. *Economic Journal* 88 (June), 254–268.
- Nielsen Research, 1979–1984. Nielsen Research Report to Carnation Company Inc. (reports on Non-Dairy Creamer and Evaporated Milk). Hardcopy printed from microfiche which is located in the Nestlé Marketing Research Library, Glendale, CA.
- Shapiro, C., 1996. Mergers with differentiated products. *Antitrust* 10 (2), 23.
- Simon, C., Sullivan, M., 1993. The measurement and determinants of brand equity: a financial approach. *Marketing Science* 12 (1), 28–52.
- U.S. Department of Commerce, Bureau of the Census, 1982. *State and Metropolitan Area Data Book 1982*. Government Printing Office, Washington, DC.
- U.S. Department of Commerce, Bureau of the Census, 1986. *State and Metropolitan Area Data Book 1986*. Government Printing Office, Washington, DC.
- U.S. Department of Commerce, Bureau of the Census, 1991. *State and Metropolitan Area Data Book 1991*. Government Printing Office, Washington, DC.
- Werden, G.J., Froeb, L.M., 1994a. The effects of mergers in differentiated product industries: logit demand and merger policy. *Journal of Law, Economics, and Organization* 10, 407–426.
- Werden, G.J., Froeb, L.M., 1994b. The effects of mergers in differentiated products industries: logit demand and merger policy. *Journal of Law, Economics, and Organization* 10 (2), 407–426.
- Werden, G.J., Froeb, L.M., Tardiff, T.J., 1996. The use of the logit model in applied industrial organization. *International Journal of the Economics of Business* 3 (1), 83–105.
- Werden, G.J., Froeb, L.M., Beavers, L.W., 1999a. Economic analysis of lost profits from patent infringement with and without noninfringing substitutes. *American Intellectual Property Law Association Quarterly Journal* 27, 305–333.
- Werden, G.J., Beavers, L.W., Froeb, L.M., 1999b. Quantity accretion—the mirror image of price erosion from patent infringement. *Journal of the Patent and Trademark Office Society* 81, 479–482.
- Werden, G.J., Froeb, L.M., Langenfeld, J., 2000. Lost profits from patent infringement: the simulation approach. *International Journal of Economics and Business* 7 (2), 213–227.