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EU merger control in differentiated product industries

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EU MERGER CONTROL IN DIFFERENTIATED PRODUCT INDUSTRIES

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Abstract

EU Merger Control Regulation No 4064/89 tended to rely on a dominance test, based on the market share of undertakings, to indicate the level and potential changes in market power. The use of such in differentiated product industries is questionable. New EC Merger Regulation No 139/2004 introduces a substantive test to ensure that all post-merger scenarios posing a threat to competition, even amongst small undertakings, are detected. We propose the use of a simple structural approach to undertake a substantive test. We illustrate our point over 28 periods, 178 products (13 companies), for Retail Carbonated Soft Drinks. We estimate company (product) mark-ups using a “simple” Nested Logit model, Berry (1994) and a more “sophisticated” model, Berry, Levinsohn and Pakes (1995). While the dominance test may fail to identify damaging mergers in differentiated products industries, this technique will not.

JEL Code: K2, L11, L25, L40, L81.

Keywords: market shares, market power, differentiated products industries, mergers.

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1 Introduction

EU Merger Control Regulation No 4064/89, covering the period 1990-2003, tended to rely on a dominance test, based on the market share of undertakings, to indicate the level and potential changes in market power in the market. After defining the relevant product and geographic market, defined in terms of demand side substitutability, high concentration (measured by the Herfindal-Hirschmann Index (HHI) on company output (sales)) was taken to indicate a lack of competitive pressure in the market.¹ The HHI was considered a good indicator of market power in homogeneous goods industries. Thresholds based on the level and changes in the HHI due to a merger provided the Commission with screening rules on whether the merger justifies investigation.² Thresholds are outlined in Table I.

<u>HHI (post-merger)</u>	<u>Change in HHI as a result of merger</u>
<i>A: Not likely to have adverse competitive effects*</i>	
Less than 1000	Any
Between 1000 and 2000	Less than 250
Above 2000	Less than 150
<i>B: Significant competitive concerns</i>	
Between 1000 and 2000	Greater than 250
Above 2000	Greater than 150

Table I: EC Screening Thresholds

A post-merger HHI of less than 1000 are unlikely to be investigated.³ Mergers leading to a HHI of between 1000 and 2000 and an increase in HHI greater

¹The HHI is the sum of the squares of firm percentage market share, which gives proportionately greater weight to larger players in the market. It ranges from close to zero (in an atomistic market) to 10000 (in the case of monopoly).

²The post-merger HHI assumes the current market shares of the merging parties remains the same. This does not allow for strategic reaction in terms of quantity, price and non-price competition, entry or exit. The change in the HHI can be calculated simply by doubling the product of the market shares of the merging firms. This just assesses a problematic merger in terms of two companies coming together with ex-ante market power (market shares).

³There are exceptions to these A rules.

- (i) If a merger involves a potential entrant or a recent entrant with a small market share.
- (ii) If one or more parties are important innovators that is not reflected in market share.
- (iii) If there are significant cross-shareholdings among the market participants.
- (iv) If one of the merging firms is a maverick firm with a high likelihood of disrupting coordinated conduct.
- (v) If indications of past or ongoing coordination, or facilitating practices, are present.
- (vi) If one of the merging parties has a pre-merger market share of 50% or more.

than 250, or a HHI of greater than 2000 and an increase in HHI greater than 150, are likely to raise competitive concerns and be investigated. In differentiated goods the Commission, in addition to the HHI would also encourage the estimation of cross price elasticities or diversion ratios (sales lost due to one product due to a price change in another). Yet, even though it was recognised that the HHI would give an imperfect indication of the intensity of competition in differentiated product market, they still felt that concentrations leading to a limited combined market share would be unlikely to result in a level of economic power that could impede competition significantly. This use of the dominance test as a necessary condition is debatable. We provide an example in this paper that shows that a potential merger in undertakings with limited combined market share can result in a substantial increase in market power. New EC Merger Regulation No 139/2004 addresses this point by introducing a substantive test to make it clear that all post-merger scenarios posing a threat to competition would be captured by the screening process.⁴ We propose the use of a simple structural approach in differentiated products industries to undertake a substantive test of changes in market power that arise from mergers of undertakings. We estimate company (product) mark-ups using a “simple” Nested Logit model based on Berry (1994) and a more “sophisticated” model pioneered by Berry, Levinsohn and Pakes (1995). Using an industry study as an example, we argue that the use of Herfindal-Hirschmann Index in merger screening, using company output (sales), will fail to identify some damaging mergers. We propose one should use simple (or advanced) structural models to back-out estimates of company (by product) market power in differentiated products industries. The use of Herfindal-Hirschmann Index using estimates of company profit shares (rather than market shares), would help to identify damaging mergers, particularly amongst smaller companies. While the dominance test may fail to identify damaging mergers in differentiated products industries our “simple” structural methodology technique will not. We propose it should be used a part of a substantive test to identify all anti-competitive mergers, even among small in market share undertakings.

⁴Turnover thresholds, or other criteria, may result in a merger been assessed in an individual EU country. Most individual EU countries still rely strongly on the dominance test. The European Commission has exclusive jurisdiction for mergers between firms with a combined worldwide turnover of at least 5 billion euros and a turnover within the European Economic Area of more than 250 million euros for each of them. If the companies concerned have more than two-thirds of their European turnover in one and same EU country, the merger is examined by the competition authority of that country because the latter is better placed than the Commission to examine its potential effects.

We base our example on the Industry and data outlined in section 2. In section 3 we outline a “simple” structural methodology to estimate mark-ups based on Mariuzzo, Walsh and Whelan (2003), a nested logit model of demand, with an estimation procedure based on Berry (1994). We also outline a comparable but more “sophisticated” model of demand (and supply) based on Mariuzzo, Walsh and Whelan (2004), using the estimation procedure in Berry, Levinsohn and Pakes (1995) (BLP). Section 4 we compare our results and estimates of mark-ups from both these procedures. We illustrate the benefits of using a structural approach (substantive test) over and above a simple market share analysis (dominance test) in the screening stage of a merger by undertaking a hypothetical merger in our data. Finally, we summarize our main conclusions in section 5.

2 Industry and Data

AC Nielsen, an international marketing research company, has collated a panel database of all brands in Carbonated Soft Drinks distributed throughout all 12,000 Irish retail stores for use in our empirical analysis. The database provides bi-monthly population data spanning October 1992 to March 1997 for 178 brands, identified for 13 firms and 40 product characteristics within the particular “business” of Carbonated Soft Drinks. The data record the retail activities of both Irish and Foreign owned brands/firms selling throughout the stores of the Irish retail sector. The evolution of the Irish grocery market from the early 1970s to its present day structure is described in Walsh and Whelan (1999).

We have brand level information on the per litre brand price (weighted average of brand unit prices across all stores selling the brand, weighted by brand sales share within the store), quantity (thousand litres), sales value (thousand pounds), store coverage (based on pure counts of stores, and size weighted by store size in terms of carbonated drinks in which the brand retails to measure effective coverage), inventories (number of days to stock out on day of audit given the current rate of purchases), firm attachment and product (flavor, packaging, diet) characteristics.

An interesting feature of the AC Nielsen data is their identification of various product characteristics within the market for Carbonated Soft Drinks, which group clusters of brands by 40 characteristics: 4 flavors (Cola, Orange, Lemonade and Mixed Fruit), 5 different packaging types (Cans, Standard Bottle, 1.5 Litre, 2 Litre and Multi-Pack of Cans) and 2 different sweeteners, Diet and Regular. The number and size of the product characteristics was very stable

throughout the period of this study. To allow for flavor segments (Cola, Orange, Lemonade and Mixed Fruit) is standard in the analysis of Carbonated Soft Drinks [see Sutton (1991)]. To see why packaging format is recognized as a crucial feature of this market, in Figure I we graph the seasonal cycles of carbonated drink sales by packaging type.

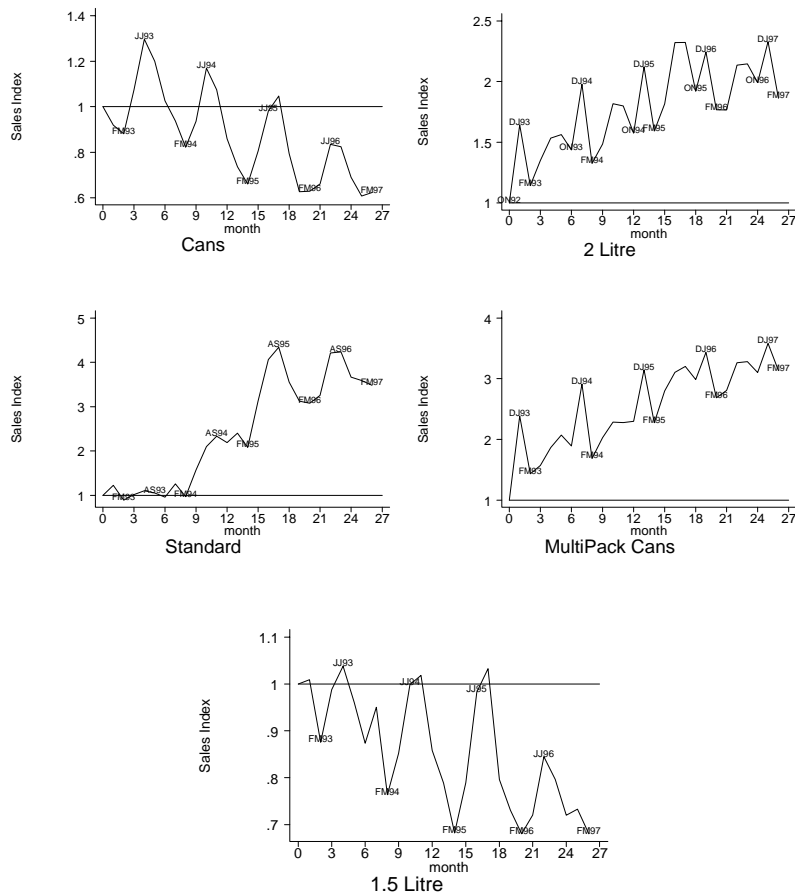


Figure I: Bi-Monthly sales of Carbonated Soft Drinks by Packaging Type

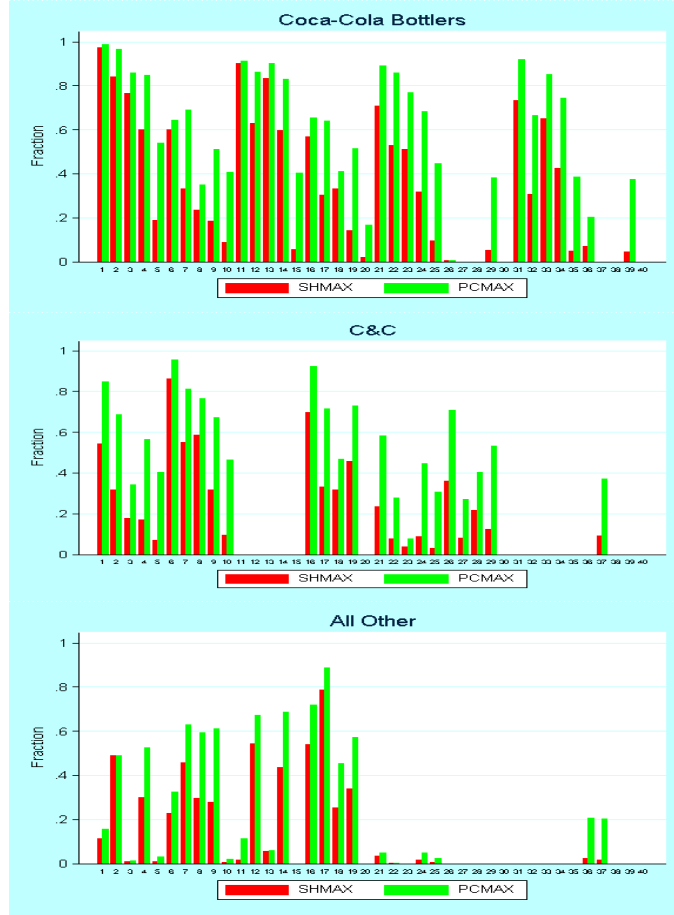
Cans peak in the summer months of June and July and 2 Litre bottles sales peak over the winter months of December and January. One must realize that 90 per cent of cans and standard bottles are distributed through small stores rather than chain stores. In contrast, the majority of 2 litre and multi-pack

cans are distributed through chain stores. Firms may, or may not, place brands across various product characteristics of the market. Details of the product characteristics and associated number of firms and brands they host are set out in Table II.

Segments	Mean Size (IRF000)	Mean Share of Total Carbonated Drinks	Total Firms over period	No. Brands over period	Average Price Per Litre
Cans					
Regular Cola	2040	8.7	4	7	1.30
Diet Cola	519	2.3	3	5	1.28
Regular Orange	848	3.7	4	6	1.34
Diet Orange	100	0.5	1	3	1.25
Regular Lemonade	665	3.0	2	4	1.16
Diet Lemonade	256	1.1	1	2	1.40
Regular Mixed Fruit	988	4.3	6	8	1.39
Diet Mixed Fruit	17	0.1	1	2	1.24
Standard					
Regular Cola	1633	6.3	6	11	1.47
Diet Cola	417	1.6	2	3	1.27
Regular Orange	911	3.5	5	13	1.44
Diet Orange	19	0.1	1	1	1.19
Regular Lemonade	556	2.2	3	7	1.32
Diet Lemonade	96	0.3	1	1	1.29
Regular Mixed Fruit	3137	11.6	7	21	1.26
Diet Mixed Fruit	19	0.1	1	1	1.15
1.5 Ltr.					
Regular Cola	640	2.8	3	3	0.67
Diet Cola	212	0.9	2	4	0.75
Regular Orange	510	2.2	4	6	0.70
Diet Orange	51	0.2	1	1	0.71
Regular Lemonade	892	4.0	2	4	0.60
Diet Lemonade	394	1.8	1	2	0.71
Regular Mixed Fruit	447	1.9	6	7	0.75
Diet Mixed Fruit	1	0.02	1	1	0.72
2 Ltr.					
Regular Cola	1883	7.6	4	5	0.49
Diet Cola	518	2.1	3	5	0.54
Regular Orange	1320	5.6	4	5	0.52
Diet Orange	136	0.6	2	3	0.56
Regular Lemonade	1851	8.1	2	4	0.46
Diet Lemonade	671	2.8	1	2	0.57
Regular Mixed Fruit	2539	10.3	5	9	0.48
Diet Mixed Fruit	21	0.1	1	1	0.53
Multipack Cans					
Regular Cola	630	2.5	2	6	0.98
Diet Cola	206	0.8	2	5	1.05
Regular Orange	165	0.7	3	5	1.03
Regular Lemonade	117	0.5	1	2	0.97
Diet Lemonade	67	0.3	1	2	0.96
Regular Mixed Fruit	6	0.05	1	1	0.83
	24305	100	100	178	

Table II: Bi-Monthly Segment Characteristics, Averaged over Oct.92-May 97

In Figure II we document company coverage of our forty product characteristics: product coverage of stores based on pure counts of stores, and effective product coverage where the store is weighted by its share of Retail Carbonated Soft Drinks turnover.



Segments: 4 flavour X 5 packaging types (Cans, Standard, 1.5 Litre, 2 Litre, and Cans Multipacks)
1-5: Cola Regular X 5 packaging 21-25: Cola Diet X 5 packaging
6-10: Orange Regular X 5 packaging 26-30: Orange Diet X 5 packaging
11-15: Lemonade Regular X 5 packaging 31-35: Lemonade Diet X 5 packaging
16-20: Mixed Fruit Regular X 5 packaging 36-40: Mixed Fruit Diet X 5 packaging

Figure II: Company Coverage of Stores by Product Segment

We undertake our analysis by comparing the top two companies, Coca-Cola Bottlers (Coca-Cola Co. franchise) and C&C (Pepsico franchise), with the group of smaller companies (mainly Irish/British owned). The top two companies

have broad coverage of the product segments. We see that store coverage is not company but product specific. For example, Coca-Cola Bottlers clearly has wide distribution with Regular Cola Cans (segment 1). As we move up regular Cola segments by package size, to segments 4 and 5, the number of stores covered declines dramatically, but effective store coverage declines by much less: distribution is targeted at big shops. While these trends are true across other flavors owned by Coca-Cola, both regular and diet, we see that distribution is less aggressive in regular Orange and Mixed Fruit characteristics (segments 6-10 and 15-20). This is where competition from the small companies is greater (see product distribution of all other companies in Figure II). The important point for our econometric analysis is that (effective) store coverage is product (brand) and not company specific.

3 Estimating Market Power

There is a long history of mapping market share structure into market power.⁵ In the case of a non-cooperative Cournot oligopoly homogeneous good industry one can show with N firms that the average price-cost margin in the industry is written as,

$$\sum_j s_j \left(\frac{p - c_j}{p} \right) = \frac{\sum_j s_j^2}{\eta} = \frac{HHI}{\eta} \quad (1)$$

where s_j is the firm j market share, η denotes the industry demand elasticity, p is the industry price and c_j is the marginal cost firm j faces. Market power in an industry with homogenous goods is directly and positively linearly related to the HHI. While the HHI may be a good rule of thumb to use in deciding whether or not to investigate mergers in homogenous industries, once one introduces differentiated goods, mapping HHI to market power becomes more problematic.

In differentiated products industries, market share is no longer a good approximation of the ability to mark-up price over cost. The market is now made up of a number of products that are differentiated, either by location or some product attributes. Some products are more similar than others in terms of these attributes. The competitive constraint on a firm's pricing is now determined by the degree of substitutability between the various goods in the market. Things become even more complex in the case that firms produce multiple products

⁵This idea is evident with the structure-conduct-performance paradigm of Bain in the 1950s, positing a one-way mapping from structure (concentration of market share) to conduct (treated as a 'black box') to performance (average price-cost mark-up across companies in an industry).

in the market. Firms may specialize in producing goods with very similar attributes, or have a portfolio of goods with very different attributes, and may or may not locate alongside other multi-product firms producing similar or different goods. The HHI for the market tells us little about the underlying structure of such markets or the market power of firms. Firms with small market share may well be able to extract high price-cost mark-ups by being specialised in their product characteristics and location. The question now arises as to how we may map this complexity of multi-product firms operating over product characteristics and locations into market power?

In order to evaluate market power where products are differentiated, it is necessary to estimate the degree of substitutability between the various goods in the market. However, estimating demand for differentiated products has a dimensionality problem. A linear demand system for J brands has J^2 price parameters to estimate. One must therefore place some structure on the estimation. A number of alternative demand specifications have been developed to deal with this dimensionality problem by reducing the dimensionality space into a product space. We focus our attention in this paper on the discrete choice models in product characteristics used in estimating demand for differentiated products, which allow for consumer heterogeneity (including consumer taste for location).⁶

3.1 Nested Logit Model of Demand

Berry (1994) uses a nested logit model to estimate differentiated demand systems. His main contribution is to correct for possible price endogeneity, due to the fact that researchers never observe all product characteristics. This was the approach undertaken in Mariuzzo, Walsh and Whelan (2003), where they estimated the brand price-cost mark-ups for Irish retail carbonated soft drinks (and subsequently firm market power by aggregating over firms' brands) on product characteristics, prices, and the log of within group share. They enriched the model by allowing for the location convenience dimension. In what follows we outline their model.

The nested logit model has a demand equation that is based on a random-utility model in which an individual consumes one unit of the product that yields the highest utility, where products include the outside good. As opposed to the ordinary logit model, the j brands or products are partitioned into $G + 1$

⁶As an alternative one could use representative consumer choice. These models include the Distance Metric model (Pinkse, Slade and Brett, 2002; Pinkse and Slade 2002), or the Multi-Stage Budgeting model (Hausman, Leonard and Zona, 1994).

groups, $g = 0, 1, \dots, G$, with the outside good j the only one present in group 0. We use the 40 segments outlined in Table II. We define the utility of consumer i for product j that faces no transportation costs and for consumer l that faces a transportation cost t , respectively as,

$$\begin{aligned} u_{ij} &= x_j\beta - \alpha p_j + \xi_j + \zeta_{ig} + (1 - \sigma)\varepsilon_{ij} \\ u_{lj} &= x_j\beta - \alpha_1(p_j + t) + \xi_j + \zeta_{lg} + (1 - \sigma)\varepsilon_{lj} \end{aligned} \quad (2)$$

where x_j is a vector of observed characteristics of product j ; p_j is the price of product j (we allow for a different response from the two consumer groups) and t is a per unit disutility; and ξ_j is a vector of unobserved, to the econometrician, product characteristics. The variation in consumer tastes enters only through the terms $\zeta_{ig} = \zeta_{lg}$, ε_{ij} and ε_{lj} . ε_{ij} and ε_{lj} are specific to product j , which is assumed to be an identically and independently distributed extreme value. For consumers, ζ_{ig} is utility common to all products within a group g and has a distribution function that depends on σ , with $0 \leq \sigma < 1$. As the parameter σ approaches one, the within group correlation of utility levels across products goes to one (products within groups are perfect substitutes). As σ tends to zero, so too does the within group correlation.⁷ We aggregate over fraction $(1 - D_j)$ of consumers i , and aggregate over the fraction D_j of consumers k to define the unknown parameter vector δ (describing the mean utility level of a product),⁸

$$\delta_j = x_j\beta - \alpha p_j + (\alpha - \alpha_1)p_j * \ln(D_j) - \beta_1 \ln(D_j) + \xi_j \quad (3)$$

As shown in Berry (1994), from equation (3) we can derive the product market shares which depend upon the mean utility level of a product, and we can treat these mean utility levels as known non-linear transformations of market

⁷When $\sigma = 0$ this reduces to the ordinary logit model, where substitution possibilities are completely symmetric, for example as when all products belong to the same group.

⁸Our empirical proxy for D_j , or distance to a product, is one minus the effective product coverage of stores. That is to say, rather than just taking the percentage of the 12,000 stores that carry brand j , we take a weighted sum where each store is weighted by its share of Carbonated Soft Drink sales in the market to get a measure of effective coverage. The greater the effective product coverage of stores, the higher the fraction of consumers that face no transportation costs in buying the product (which, at a product level, can be interpreted as lower distance to the product). The property of the nested logit model that leads to *independence of irrelevant nested alternatives* will thus be partly relaxed. We use $\ln(D_j)$ in our econometric work. The fraction of the consumer populations with transportation costs will thus be $\ln(D_j)/(\ln(D_j) + (1 - \ln(D_j)))$ and without transportation costs will be $(1 - \ln(D_j))/(\ln(D_j) + (1 - \ln(D_j)))$.

shares such that δ_j can be written as the following linear demand equation,

$$\ln(s_j) - \ln(s_0) = x_j\beta - \alpha p_j + (\alpha - \alpha_1)p_j * \ln(D_j) - \beta_1 \ln(D_j) + \sigma \ln(s_{jg}) + \xi_j \quad (4)$$

where s_j is product j 's (the brand) share of the entire market (inside plus outside goods total). We define the entire market as the sum of carbonated sales over all brands (inside goods) and total sales of the outside good, as 330ml carbonates per day for the population of Ireland.⁹ The outside goods' share of the entire market is s_0 . The variable D_j can also be interpreted as the distance to a product j . $\ln(D_j) * p_j$ augments the price effect by our distance measure per product. s_{jg} is j 's segment share of the group g to which it belongs. We need estimates of $\alpha_j = (\alpha + (\alpha - \alpha_1) * \ln(D_j))$ and σ to get our corresponding nested logit own-price and cross-price elasticities,

$$\begin{aligned} \varepsilon_{jj} &= \alpha_j p_j \left[s_j - \frac{1}{1-\sigma} + \frac{\sigma}{1-\sigma} s_{jg} \right] \text{ if } k = j \\ \varepsilon_{jk} &= \alpha_k p_k \left[s_k + \frac{\sigma}{1-\sigma} s_{jg} \right] \text{ if } k \neq j \text{ and } j, k \in g \\ \varepsilon_{jk} &= \alpha_k p_k s_k \text{ if } k \neq j \text{ and } k \notin g \end{aligned} \quad (5)$$

It is important to note that the elasticities here refer to the percentage change in market share in response to a change in p_k . Estimates of α_j and σ from equation (4) are obtained using instrumental variables since the product price and the within group share are endogenous variables and must be instrumented.

We estimate the demand side primitives and, via an equilibrium pricing system of equations, to be defined, we can back out the price cost mark-up (Lerner Index) for each brand. Firms maximize the sum of profits accruing from firm brands, f_j . In brand price setting, p_j , a firm takes the price of all other firms' brands as given. The firm internalizes the cross-price effect on market share of the brands it owns in the price setting of an individual brand. The first order condition for each brand will have the general form,

$$s_j + \sum_{b \in f_j} (p_b - c_b) \frac{\partial s_b}{\partial p_j} = 0 \quad b, j \in f_j \quad (6)$$

Given marginal costs c_j , a multi-product Nash equilibrium is given by the system of J first order conditions.¹⁰ Given the primitives of the demand system

⁹This is a reasonable approximation. It should be noted that the largest bi-monthly carbonated sales in our data is equivalent to each person in Ireland consuming 220ml per day.

¹⁰We assume that a Nash equilibrium exists. Caplin and Nalebuff (1991) prove existence for a general discrete choice model, assuming single product firms. Anderson and de Palma (1992) prove existence for the nested logit model with multiproduct firms, assuming symmetry.

we will be able to calculate a mark-up for each brand. Even though we impose no structure on marginal cost, the primitives are likely to be estimated with error so in this approach we will back out a mark-up with error.

For simplicity, one can assume single product price settings and symmetry in the market. Given the marginal costs c_j , the first order condition (6) can be rewritten as:

$$\frac{p_j - c_j}{p_j} = \frac{1}{p_j} \left[\frac{1 - \sigma}{\alpha_j} / (1 - \sigma s_{jg} - (1 - \sigma) s_j) \right] \quad (7)$$

The markup depends in this particular case upon the substitution parameter σ and within group share. The bigger the within group product share the higher will the product price-cost markup. If $\sigma = 0$ (no segmentation) we have the ordinary logit result, such that the mark-up depends on product market share, s_j , and not within group market shares. The effect of the location convenience enters into the α_j parameter and forces us to adopt a matrix notation to solve for the markup. We refer to relations (13-14) in the next subsection for a more general computation of mark-ups (which is the one we use in our estimates).

3.2 BLP Approach

Going a step further, one may extend the analysis to adopt a fully structural approach to estimating market power by specifying a cost function to be estimated,

$$\ln(c_j) = w_j \beta + \omega_j \quad (8)$$

where w_j is a vector of observed product characteristics, and ω_j is a vector of product characteristics that are unobservable to the econometrician. BLP propose the simultaneous estimation of a demand equation with a specified supply equation.¹¹

BLP has a demand equation based on a random utility model in which individuals consume the product that give them the highest utility (including the utility for the outside option). We write individual i indirect utility for product j as

$$u_{ij} = \underbrace{-\alpha_1 p_j + x_j^1 \beta + \xi_j}_{\delta_j} + \underbrace{\sigma_A x_j^2 \nu_i^A + \sigma_C x_j^2 \nu_i^C + \sigma_N x_j^2 \nu_i^N}_{\mu_{ij}} + \epsilon_{ij} \quad (9)$$

¹¹Employing a fully structural approach has the advantage that one can, other than gaining efficiency, undertake various counterfactuals.

where x^1 are observed product characteristics that enter linearly in our estimates, whereas x^2 those that enter nonlinearly, in our model the constant and prices. The subscripts A, C, N stand for, *Age*, *Closeness*, and *Normal distribution*, respectively, which individualise our consumers (observed and unobserved) characteristics. This *three – upla* defines each consumer taste for quality and sensitivity to prices (product characteristics that enter x^2). The assumption that individuals react to a price change differently when product j is present in their nearest store compared to the case when it is not underlies the sensitivity to price. Some of the product characteristics (ξ_j) are unobserved to us but are observed by our consumers in their choices. We use proper instruments to control for their correlation with prices and store coverage, two endogenous variables.¹² Equation (9) shows that the indirect utility function can be decomposed in a mean utility δ_j and a deviation from the mean μ_{ij} . This latter term represents the main difference from the previous model.

Our utility for the outside good is written as,

$$u_{i0t} = \underbrace{\xi_{0t}}_{\delta_{0t}} + \underbrace{\sigma_0 \nu_{i0}}_{\mu_{i0t}} + \epsilon_{i0t} \quad (10)$$

We normalize $\xi_{0t} = \sigma_0 = 0$. Finally, $\{\alpha, \beta, \sigma\}$ are the parameters of the demand that are going to be estimated.

The BLP specification of demand allows different individuals to have different tastes for different product characteristics. In addition, the model can allow for consumer heterogeneity in terms of their response to prices. The random coefficients are designed to capture variations in the substitution patterns.

Aggregating over the error component one recovers a logistic form that defines the probability that individual i buys product j ($\phi_{ij}(\cdot)$). The next step is to aggregate over individuals and calculate each product's estimated market shares. The non-closed solution of this integral requires the use of a simulation procedure. In addition, the computation of the optimal parameters requires the use of a contracting mapping technique together with a non linear two-step GMM estimator. Although more realistic than the logit or nested logit model, the estimation procedure is not so straightforward. Estimation requires simulation and numerical methods. We refer to BLP for details regarding the computational method.

¹²In the table of results we outline the set of instruments that we use to jointly estimate demand and supply.

Given the number of consumers in the economy I and integrating over the distributions of individual characteristics we derive each brand demand function as,

$$q_j(\cdot) = Is_j(p, x, \xi; \theta), \text{ for } j \in J \quad (11)$$

Given the demand system in (11), the profits of multiproduct firm f are,

$$\Pi_f = \sum_{j \in J_f} (p_j - c_j) q_j \quad (12)$$

the maximization of which leads to the first order conditions in (6), from which we get our price equilibria.

In order to derive the markup relation, we define,

$$\Delta_{jb} = \begin{cases} \frac{-\partial s_b(\cdot)}{\partial p_j}, & \text{if brands } b, j \in J_f \text{ are produced by the same firm} \\ 0, & \text{otherwise.} \end{cases} \quad (13)$$

which allows us to write the following price-cost mark-up explicitly as,

$$p = c + \underbrace{\Delta^{-1} s}_{markup} \quad (14)$$

Our interest in substitution effects is captured by the own and cross-price elasticities which can be derived from

$$\begin{aligned} \frac{\partial s_j(\cdot)}{\partial p_j} \frac{p_j}{s_j} &= \left(\frac{1}{ns} \sum_{i=1}^{ns} \phi_{ij} (1 - \phi_{ij}) \underbrace{(-\alpha_1 + \alpha_2 n_i + \alpha_3 a_i + \alpha_4 c_{ij})}_{\frac{\partial u_{ij}}{\partial p_j}} \right) \frac{p_j}{s_j} \\ \frac{\partial s_j(\cdot)}{\partial p_b} \frac{p_j}{s_b} &= \left(-\frac{1}{ns} \sum_{i=1}^{ns} \phi_{ij} \phi_{ib} \underbrace{(-\alpha_1 + \alpha_2 n_i + \alpha_3 a_i + \alpha_4 c_{ib})}_{\frac{\partial u_{ib}}{\partial p_b}} \right) \left(\frac{p_j}{s_b} \right) \end{aligned} \quad (15)$$

where n_i , a_i , c_i are, respectively, simulated values from *Normal*, *Age* and *Closeness* (to shops) distributions.¹³

¹³See Mariuzzo, Walsh and Whelan (2004) for details on these simulations.

Unfortunately, as noticed by Berry Levinsohn and Pakes (2003) and Petrin (2002), a reliance on the market-level distributions of consumer characteristics, do not give us the degrees of freedom associated with micro-level data on individual choices. Moreover, the distribution of consumer characteristics relevant to products inside the market may well be different to those purchasing the outside option (see Mariuzzo, 2004). Likewise the distribution of relevant consumer characteristics may also vary dramatically across products inside the market. In our example we improve our estimates of demand primitives by randomizing over data on store coverage to create a distribution of consumer disutility reflecting distance to each brand (product). We have a distribution of consumer preferences that reflects the likely convenience of the location of retail stores that carry the product in question. The interaction of this product (j) specific distribution with prices can be estimated with far greater degrees of freedom when compared to interactions using market level distributions of consumer characteristics. This will result in a very rich set of demand primitives. The more traditional form of product differentiation, consumer taste for location, turns out to be important. Within a structural model of equilibrium we allow for product differentiation on two dimensions, distribution of consumer tastes for product characteristics and location convenience.

4 Comparing Results of Nested Logit and BLP Models

We estimate the Nested Logit demand system in equation (4). Estimates of the vector β , β_1 , α , α_1 , and σ can be obtained from a GMM estimation procedure. The variables p_j , $\ln(D_j) * p_j$ and $\ln(s_{j/g})$ are endogenous variables and must be instrumented. Our results are presented in Table III.

Dependent Variable: $\ln(S_j) - \ln(S_0)$	I		II	
	Coefficient	(t-stat)	Coefficient	(t-stat)
Constant	-0.8	(1.0)	-3.7	(10.1)*
Default Cola				
Orange	1.1	(12.5)*	0.59	(9.6)*
Lemonade	0.14	(1.6)	-0.01	(0.2)
Mixed Fruit	0.45	(5.3)*	0.04	(0.6)
Default Cans				
Standard	2.7	(7.9)*	1.2	(6.7)*
1.5 Litre	3.4	(9.7)*	1.7	(8.9)*
2 Litre	-0.3	(1.1)	-0.11	(0.7)
Multi-Pack Cans	0.2	(0.5)	0.8	(3.8)*
Default Regular				
Diet	2.2	(3.5)*	1.6	(4.2)*
$-\beta_1 \ln(D_{jt})$			1.2	(9.6)*
$\sigma \ln(s_{git})^a$	0.91	(13.1)*	0.65	(9.6)*
$(\alpha - \alpha_1) \ln(D_{jt}) p_{jt}^a$			0.63	(7.5)*
$-\alpha p_{jt}^a$	5.9	(9.1)*	2.9	(7.4)*
Company Dummies	Yes		Yes	
Packaging \times Month Dummies	Yes		Yes	
R^2	0.61		0.81	
Numbers of Observations	4,645		4,645	
Over-identification IV Test	$\chi^2(5) = 0.99$		$\chi^2(5) = 0.99$	

^a Instruments for Regression I include all the regressors, with the exception of p_{jt} and $\ln(s_{git})$. Inventories_{jt}; Hausman-Taylor instrumental variables (brands of the same firm in other segments) with respect to p_{jt} , and Inventories_{jt}; and BLP instruments (brands of the other firms in the same segment) with respect to mean and standard deviation of Inventories_{jt}.
Instruments for Regression II include all the regressors, with the exception of p_{jt} , $\ln(s_{git})$ and $\ln(D_{jt})p_{jt}$. Inventories_{jt}; Hausman-Taylor instrumental variables (brands of the same firm in other segments) with respect to p_{jt} , $\ln(D_{jt})$, and Inventories_{jt}; and BLP instruments (brands of the other firms in the same segment) with respect to mean and standard deviation of $\ln(D_{jt})$ and Inventories_{jt}. *Significantly different from zero at the five percent level in a two-tailed test.

Table III: GMM Estimation of the Nested Logit Demand System

In column I we present a nested logit model using no data on distance (location convenience) in the regression or in the instrument set. In column II we estimate the full model in equation (4). In both specifications, the Chi-squared test rejects the null that the moments (instruments) are invalid. We estimate $\alpha_j = (-2.9 + .63 * \ln(D_j))$. This implies from equation (5) that corresponding nested logit own-price and cross-price elasticities will be augmented by product specific share of consumers that have distance to the product¹⁴. In addition,

¹⁴These estimates are slightly different compared to Mariuzzo, Walsh and Whelan (2003) as we use packaging X month dummies instead of packaging X season dummies. In addition we

we estimate $\sigma = 0.65$, for our corresponding nested logit own-price and cross-price elasticities, this will imply that within segment market shares will get a higher weight than the overall market share. These estimates provide a matrix of nested logit own-price and cross-price elasticities, of which there are J^2 in each bi-monthly period.

The results of the BLP procedure, jointly estimating the demand and cost equations are presented in Tables IV.

		Demand		Cost	
	Variables	Coefficient	(t-stat)	Coefficient	(t-stat)
Means					
	Constant	-6.2	(6.1)*	0.13	(.70)
	Inventories			-.20	(2.7)*
	Store Coverage			.11	(2.8)*
	α_1 Price	-7.3	(6.8)*		
<i>Default Cola</i>	Orange	1.3	(15.6)*	.02	(.40)
	Lemonade	.69	(6.4)*	.16	(2.7)*
	Mixed Fruit	1.7	(6.5)*	-.22	(2.9)*
<i>Default Cans</i>	Standard	4.5	(3.6)*	.33	(3.2)*
	1.5 Litre	4.8	(3.5)*	.39	(5.1)*
	2 Litre	.78	(3.4)*	-1.1	(4.3)*
	Multi-Pack Cans	-3.4	(12.2)*	-1.2	(6.2)*
<i>Default Diet</i>	Regular	.71	(11.8)*	.08	(1.3)
Interactions					
Parametric Distribution	Constant	3.4	(3.4)*		
	α_2 Price	-0.65	(.61)		
Age Distribution	Constant	-11.6	(2.8)*		
	α_3 Price	-2.1	(0.32)		
“Closeness to Stores” Distribution	Constant	29.1	(18.6)*		
	α_4 Price	-11.2	(7.8)*		
R^2		.82			
GMM Objective		.0073			
# Negative Predicted Mark-Ups				0	
# of Simulations		100			

Demand and Cost Side include Firm and Packaging X Month Dummies. Observations 4,645. Instruments for Demand: Flavour, Packaging and Diet characteristics and Inventories; Hausman-Taylor instrumental variables (brands of the same firm in other segments) with respect to price, store coverage and inventories; and BLP instruments (brands of the other firms in the same segment) with respect the Mean and Standard Deviation of store coverage and inventories. Instruments for Supply: Same as demand expect the Hausman-Taylor instrumental variables.

Table IV: Estimation of Demand and MC Equation: BLP Specification

The standard errors have been corrected for potential correlation between demand and supply unobservables. With reference to utility, we estimate the mean effect of our product characteristics, the coefficient on price, the parameters that define individual variability in taste for a benchmark quality and price, the interaction terms. Our specification of the utility and cost function, choices of demand and supply side instruments and our structural model of equilibrium

use a different set of instruments. This makes our nested logit model including the interaction term for distance to a product comparable to the Demand model of BLP.

produce good results, we predict 80 per cent of the variation in the actual market share of each product in each time period. It is important that we get good estimates of the demand primitives. The coefficient on price and interaction of price with consumer taste distributions will be the focal point. Yet, it will be the quality of the other controls and the instrument set that will give us efficient estimates of our coefficients on price and consumer taste distributions interactions with price. These determine our estimates of the own-price and cross-price elasticities (15). The coefficient on price and the interaction of price with our consumer taste distributions that reflect consumer taste for closeness are highly significant. The market level consumer taste distributions interactions with price are not significant. This will imply that own and cross-price elasticities will be more responsive when the distribution of consumers distance to stores that carry the product reflects closeness to consumers. We see clearly a trade off between covering the market and the nature of price competition that a brand faces. Less coverage is not a good attribute in terms of market share but can potentially lead to higher price cost mark-ups by making own- and- cross price elasticities less responsive to the prices of other brands. Even though the market level interactions do not come in, we see that our product level consumer taste distribution for geography induces rich demand primitives.

In Table V we compare the demand primitives that come out of the Nested Logit demand system and the BLP demand model, estimated jointly with supply.¹⁵

¹⁵*Nested Logit Demand Model; **BLP Demand and Supply Model

Segment	Own Price Elasticity *	Sum of Cross Price Elasticity*	Own Price Elasticity **	Sum of Cross Price Elasticity**
Cola Cans	-13.408	2.9194	-13.296	6.63
Cola Standard	-11.384	2.4329	-8.3307	3.5272
Cola 1.5 Litre	-5.8557	1.3155	-6.3414	5.6982
Cola 2 Litre	-4.1667	0.82662	-5.4398	7.1344
Cola Cans Multipacks	-7.9963	1.7595	-9.8501	6.8057
Orange Cans	-11.621	2.5775	-13.45	6.9458
Orange Standard	-11.315	2.4595	-14.791	7.2123
Orange 1.5 Litre	-5.8679	1.2974	-8.2648	7.9649
Orange 2 Litre	-4.4812	0.93835	-6.0833	7.4632
Orange Cans Multipacks	-8.8926	2.0043	-12.798	8.3505
Lemonade Cans	-8.9282	2.0273	-7.2687	4.5024
Lemonade Standard	-11.926	2.6369	-15.899	8.1024
Lemonade 1.5 Litre	-5.6547	1.2635	-5.7796	5.7165
Lemonade 2 Litre	-3.9762	0.81921	-5.2258	7.1708
Lemonade Cans Multipacks	-8.1858	1.8823	-6.8013	4.7672
Mixed Fruit Cans	-12.276	2.7094	-16.43	8.2662
Mixed Fruit Standard	-14.400	2.9623	-12.723	6.2424
Mixed Fruit 1.5 Litre	-6.3776	1.4034	-8.2566	6.6438
Mixed Fruit 2 Litre	-4.0611	0.73015	-5.4653	6.9214
Mixed Fruit Cans Multipacks	-5.3052	1.2756	-9.4387	6.0243
<i>Diet Segments</i>				
Cola Cans	-11.817	2.6649	-11.757	6.4163
Cola Standard	-12.303	2.8268	-15.268	8.3488
Cola 1.5 Litre	-5.7972	1.3042	-5.023	3.5868
Cola 2 Litre	-4.2643	0.93494	-6.3843	7.6129
Cola Cans Multipacks	-8.7069	1.9573	-12.888	8.173
Orange Cans	-10.997	2.6402	-14.889	8.5435
Orange Standard	-9.9561	2.3916	-14.792	8.0678
Orange 1.5 Litre	-5.4339	1.3054	-8.4619	8.2154
Orange 2 Litre	-4.6477	1.0488	-6.9119	7.4193
Lemonade Cans	-13.181	3.0485	-9.5058	4.6999
Lemonade Standard	-12.029	2.883	-15.778	8.3728
Lemonade 1.5 Litre	-6.9400	1.6513	-8.5238	8.0661
Lemonade 2 Litre	-4.7671	1.0658	-3.9351	4.2408
Lemonade Cans Multipacks	-7.5778	1.8211	-11.733	7.9479
Mixed Fruit Cans	-9.0504	2.0883	-14.292	8.1215
Mixed Fruit Standard	-9.2219	2.1273	-14.234	8.4596
Mixed Fruit 1.5 Litre	-4.8644	1.4551	-6.8668	7.4791
Mixed Fruit 2 Litre	-4.1952	1.0073	-11.757	6.4163

Table V: Segment (Weighted Averages over Brands) 1992-1997

We average over the brands within each of our flavor, packaging and diet segments. This in turn is averaged over our 28 bi-monthly periods. The elasticity of market share with respect to the own-price elasticities are similar in trends for both models. The BLP estimates tend to be more elastic. In addition, both models estimate that the own price elasticity is more elastic for Cans relative to other packaging types, while 2-litre packing is the most inelastic. We also report the sum of the cross-price elasticities for each brand, averaged by segment. The BLP model clearly estimates these to be larger.

Given these primitives, assuming multi-product price setting firms without symmetry in the market, a multi-product Nash equilibrium is given by the system of J first order conditions. Using the first order conditions in equation (6), one can get estimates of a Lerner Index per brand/product j . Aggregating these estimates over different sets of brands gives an indicator of firm or segment market power. In Table VI we compare estimates of bi-monthly mark-ups and profits, averaged over the period, by segment. The key characteristic is packaging type. Packaging with 1.5 and 2-litre bottles earns greater markups than cans and the standard bottle. Diet drinks seem to also get a premium and the mark-ups are very similar when one compares the simple and more sophisticated frameworks.

*Nested Logit Demand Model
** BLP Demand and Supply Model

Segment	Segment Share of Output	Price per Litre	Estimated Mark-Up*	Estimated Bi-Monthly Profit in £IR(000)*	Estimated Mark-Up**	Estimated Bi-Monthly Profit in £IR(000)**
Cola Cans	4.22	1.43	0.05	93.50	0.09	185.31
Cola Standard	3.78	1.26	0.07	112.22	0.10	167.56
Cola 1.5 Litre	2.53	0.75	0.12	77.99	0.16	103.19
Cola 2 Litre	11.1	0.50	0.19	364.01	0.22	435.13
Cola Cans Multipacks	1.92	0.96	0.14	89.51	0.14	83.62
Orange Cans	1.85	1.38	0.07	59.18	0.08	67.11
Orange Standard	2.10	1.27	0.07	67.52	0.08	72.22
Orange 1.5 Litre	2.22	0.68	0.14	73.98	0.13	69.35
Orange 2 Litre	8.51	0.46	0.22	281.45	0.20	270.2
Orange Cans Multipacks	0.49	0.97	0.12	20.10	0.11	19.12
Lemonade Cans	1.41	1.41	0.06	39.91	0.09	61.4
Lemonade Standard	1.38	1.16	0.11	57.89	0.09	52.43
Lemonade 1.5 Litre	3.75	0.71	0.13	119.56	0.17	151.19
Lemonade 2 Litre	11.8	0.47	0.25	447.55	0.23	429.55
Lemonade Cans Multipacks	0.36	0.97	0.15	19.18	0.13	15.36
Mixed Fruit Cans	2.13	1.39	0.06	63.92	0.07	71.1
Mixed Fruit Standard	6.29	1.37	0.07	175.61	0.07	208.64
Mixed Fruit 1.5 Litre	1.80	0.74	0.15	62.42	0.12	56.62
Mixed Fruit 2 Litre	18.8	0.41	0.25	666.68	0.22	565.8
Mixed Fruit Cans Multipacks	0.02	0.83	0.15	0.89	0.28	1.05
<i>Diet Segments</i>						
Cola Cans	1.11	1.39	0.08	43.44	0.09	47.23
Cola Standard	0.93	1.30	0.07	30.61	0.11	43.84
Cola 1.5 Litre	0.83	0.75	0.13	28.42	0.16	35.33
Cola 2 Litre	2.85	0.55	0.24	130.86	0.22	118.13
Cola Cans Multipacks	0.63	0.6	0.15	32.02	0.14	27.56
Orange Cans	0.23	1.27	0.08	9.02	0.07	7.64
Orange Standard	0.05	1.19	0.10	1.67	0.26	1.68
Orange 1.5 Litre	0.21	0.71	0.15	7.88	0.13	6.56
Orange 2 Litre	0.72	0.56	0.18	26.13	0.18	23.89
Lemonade Cans	0.53	1.44	0.08	20.22	0.08	22.5
Lemonade Standard	0.21	1.29	0.08	7.76	0.10	9.91
Lemonade 1.5 Litre	1.62	0.73	0.14	56.39	0.18	66
Lemonade 2 Litre	3.40	0.59	0.19	133.94	0.22	141.25
Lemonade Cans Multipacks	0.21	0.96	0.16	11.49	0.13	8.71
Mixed Fruit Cans	0.04	1.27	0.09	1.49	0.09	1.59
Mixed Fruit Standard	0.04	1.17	0.09	1.51	0.08	1.31
Mixed Fruit 1.5 Litre	0.01	0.83	0.14	0.08	0.54	0.22
Mixed Fruit 2 Litre	0.11	0.55	0.20	4.45	0.22	4.78

Table VI: Segment (Weighted Averages over Brands).

In Table VII we compare estimates of bi-monthly mark-ups and profits, averaged over the period, by company. Again the mark-ups are very similar when one compares the simple and more sophisticated frameworks.

Companies	Brands	Market Share of Output	Mark-Up*	Market Share of Profit*	Mark-Up**	Market Share of Profit**
Rank 1	51	0.4792	0.15	0.3693	0.14	0.46927
Rank 2	36	0.2337	0.22	0.2655	0.13	0.20297
Rank 3	20	0.0928	0.28	0.1326	0.18	0.10642
Rank 4	4	0.0589	0.30	0.0911	0.25	0.17699
Rank 5	3	0.0553	0.32	0.0907	0.29	0.02206
Rank 6	7	0.0343	0.16	0.0285	0.10	0.00947
Rank 7	3	0.0229	0.05	0.0054	0.05	0.01142
Rank 8	5	0.0196	0.14	0.0144	0.10	0.00077
Rank 9	6	0.0028	0.15	0.0022	0.13	0.00018
Rank 10	1	0.0001	0.10	0.0001	0.10	0.00024
Rank 11	2	0.0002	0.10	0.0001	0.25	0.00004
Rank 12	1	0.0002	0.09	0.0001	0.06	0.00014
Rank13	1	0.0001	0.07	0.0000	0.29	0.46927
HHI		3014		2420		2892
Merge 4 &5						
New HHI		3079		2585		3048**
Change HHI		65		165*		156**

*Nested Logit Demand Model. ** BLP Demand and Supply Model.

Table VII: Estimated Company Bi-Monthly Mark-ups.

In Table VII we document the price cost mark-ups and market shares by company for the retail carbonated soft drinks market using estimates of demand primitives from our simple nested logit and more sophisticated BLP frameworks. Clearly a monotonic relationship between market power and market share does not exist in this industry. Companies with a smaller share of the carbonated soft drinks market extract rents, within the product segments and stores of the market they operate in, comparable to that of multinationals who operate across most stores and product segments. It seems that inferring market power from the distribution of market shares is ill advised in multi-product firms

differentiated goods industries.

4.1 Implications for EU Merger Control

In Table VII we document the HHI measures of concentration in terms of the normal output based market share and in terms of a profit based market share for each company. This is done for the simple nested logit and BLP model. We take a hypothetical merger in our data, companies ranked 4 and 5, to illustrate that merger screening based on a dominance test may fail to identify a damaging merger without any market power considerations. Using the rules outlined in Table I we observe that both models suggest that the proposed merger between the companies ranked 4 and 5 should be investigated on the basis of the HHI on profit shares. This is not the case if one only used information on the market share of companies output. Using the profit share estimated from the simple logit framework the post merger HHI is 2585 and the change is 165. The proposed merger between the companies ranked 4 and 5 should be investigated. In contrast, the HHI for output post-merger is 3079 and the change due to the merger is only 65, no merger investigation is recommended. Results from the BLP framework similarly recommends investigation.

New EC Merger Regulation No 139/2004 calls for a substantive test to ensure that all post-merger scenarios posing a threat to competition would be investigated. We argue that one should use at least a simple structural model to estimate company mark-ups (aggregated over products) as part of a substantive test. This framework incorporates multi-product firm behaviour and product differentiation in terms of product characteristics and consumer taste for location convenience. Any anti-trust authority with good data should be capable of estimating mark-ups using the simple nested logit model of demand. Merger screening may fail to identify damaging mergers using the market share of companies output without any market power considerations. In most industries we see waves of mergers among small companies that go unchecked. In differentiated goods industries such mergers may have competitive implications and should be checked on the basis of market power, and not market share, considerations.

5 Conclusions and Recommendations

This paper illustrates that the HHI measures of output concentration is not a good indicator of market power in differentiated product industries. The complex operation of multi-product firms over different segments and stores in

these industries means that there is no theoretical foundation for the mapping of market concentration into market power. This clearly has implications for the use of the HHI on output as a screening device for proposed mergers. We show a proposed merger between two firms that has little impact on the overall HHI measure of output concentration for an industry, and thus would not be likely to undergo an investigation by anti-trust authorities using dominance tests. Yet, we show a big increase in market power as the companies, small in output, are specialized into geographic and/or product segments. In the event that a merger results from the aggregation over companies with high mark-ups, irrespective of their overall share in the market, our profit share indicator of market power using the HHI is clearly desirable in the screening stage of mergers in differentiated products industries.

This paper compares a simple to an advanced structural approach in the estimating market power. Our simple model is straightforward to implement, not requiring cumbersome estimation procedures or a heavy data burden.¹⁶ More importantly the results are similar to that estimated in the BLP model. Using estimates of market power to construct HHI in profit shares allows more accurate and informed decisions in the screening stage as to which mergers should undergo investigation. The wording of the new EC Merger Regulation No 139/2004 would allow such an approach to be part of a substantive test to ensure that all post-merger scenarios posing a threat to competition are covered even if the traditional dominance test fails to identify such a scenario.

¹⁶For the use of the structural models using a model of supply and demand (nested logit) in the investigation stage of a merger, see Ivaldi and Verboven (2000) on the Volvo/Scania case.

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