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Bottled Water -- A Case of Pointless Trade?

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Bottled water – a case of pointless trade?*

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Abstract

Two-way trade in (almost) homogenous products has ambiguous welfare effects if entry is restricted. We examine Swedish imports of bottled water to investigate whether transport cost losses from trade outweigh the partial equilibrium gains from trade (stronger competition and more brands to choose from). Using monthly data for all brands sold in stores during 1998-2001 we estimate a structural model of demand. Assuming one-shot Bertrand competition by multibrand firms, we can use the estimated model to uncover marginal costs. We simulate the effect on consumer and producer surplus of banning imports, finding that banning imports would decrease overall welfare. Expanded choice is the main benefit of trade and disregarding this the net welfare effect of imports in this market are approximately zero - the pro-competitive effect is of the same size as the cost savings associated with replacing foreign, higher cost, suppliers with domestic. Given our choice of market this suggests we should not be overly concerned with the welfare effects of two-way trade in consumer goods that are close to homogenous.

Keywords: Reciprocal dumping, intra-industry trade, nested logit models

JEL: F12, F14, L13, L66

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1 Introduction.

More than 60 percent of the non-sparkling mineral water sold in Swedish stores is imported. Sweden also exports mineral water; in an average month in 2001 Sweden exported 791 metric tons of bottled mineral water and imported 1305 metric tons.[1] Does this shipping of water in both directions represent a good use of resources?

The theory of trade under imperfect competition that has developed from the 1980s onward (see for instance Helpman and Krugman, 1985) demonstrates that trade may have adverse consequences on welfare under certain conditions. In particular, following Brander and Krugman (1983) we know that when there is two way trade in a homogenous good ("reciprocal dumping") and important barriers to entry, the waste of transporting identical goods in opposite directions can dominate the positive, pro-competitive effect of trade. Is this result, that trade can hurt overall welfare, empirically relevant? Given the current debate about the merits of trade, and that a large share of world trade is generated by countries exporting and importing quite similar goods, this comes high on our "things we would like to know"-list. Particularly so since Feenstra, Markusen and Rose (2001) find that the global trade patterns for homogenous goods are consistent with a reciprocal dumping-type model with barriers to entry.

Theory is clear that trade is typically welfare enhancing – even the staunchest critic of international trade is likely to agree that some trade is good. The question is do we know of any cases when trade is bad? We can't know unless we look and we therefore wanted to choose an industry so as to stack the cards against the free trade case; bottled water suits that bill well – there is arguably little real product differentiation, low technological economies of scale, transport costs are high relative to the value of the product and Sweden is also an exporter of the same good.[2] A highly concentrated industry structure suggests that there are considerable barriers to entry. Furthermore, a close substitute, tap water, is available at a price close to zero. This should limit the pro-competitive potential for imports. If trade is welfare enhancing even in this setting the pro-trade case should be strengthened. If we find that trade can not be motivated here, then it becomes important to study less extreme cases.

[1] Bottled natural mineral water, sparkling and still, with no minerals or flavours added; KN22011011 and 22011019, source, statistics Sweden.
[2] In addition we saw our choice of the bottled water market as an opportunity to pay tribute to Augustin Cournot, his (1838) masterpiece used bottled water as the main example.

We use a structural model of competition on the Swedish market for bottled water to examine the welfare effects of bottled water imports. We make use of a detailed data set that includes monthly observations of prices and quantities of all 85 brands of bottled water sold in Swedish stores during 1998-2001. To our knowledge no other paper has attempted a similar exercise – most of the empirical literature that examines trade under imperfect competition has focused on measuring intraindustry trade and examining how well such trade theory can explain actual trade patterns (see Hummels and Levinsohn, 1995) or simply on testing if there is a pro-competitive effect of lower trade barriers (see Levinsohn, 1993 or Tybout, 2003). A somewhat closer precursor is Berry, Levinsohn and Pakes (1999) who examine the welfare impact of voluntary export restrictions on Japanese car exports to the US.

Even though one could argue that mineral water is a homogenous product, different prices of different brands demonstrate that brands are imperfect substitutes. Taking this seriously, we follow seminal work by Berry (1994) and Berry, Levinsohn and Pakes (1995) and estimate a model of demand for differentiated products. We model demand as being a function of product characteristics, using a multinomial nested logit (MNL) specification. Similar MNL formulations are also applied by for instance Verboven (1996) on European car markets, Ivaldi and Verboven (2001) on European truck markets and by Slade (2003) on the UK beer market.

The next section summarizes theoretical results on the welfare effects of trade that are relevant for our investigation. In Section 3 we describe the Swedish bottled water market, with particular attention to how it matches the assumptions of the Brander-Krugman model. In section 4 we estimate demand. We proceed to calculate the implied markups in Section 5 and provide a counterfactual experiment of calculating consumer surplus, and global producer surplus, under the assumption that only domestically produced waters can be sold on the Swedish market. Section 7 concludes.

2 Trade theory as it applies to bottled water

To answer if it makes sense for Sweden to import water we want to assess the global welfare implications of international trade. Let us briefly relate to the three explanations for (international) trade that economic theory has supplied (see for instance Krugman and Obstfeld , 2003).

The classical answer to the question if it makes sense for Sweden to import water is that by importing, rather than producing domestically, we free resources that can be used in the production of goods in which we have a comparative advantage. In the standard type of models (such as Ricardo or Heckscher-Ohlin), which rely on perfect competition, we would not observe the simultaneous exporting and importing of the same good however. We take as given that there exist some general equilibrium effect of trade in water – holding consumption and exports fixed, importing rather than producing domestically frees up resources (Sweden is a net importer of bottled water). The general equilibrium implications are outside the scope of the present study and are likely to be miniscule for this particular product category. For instance, the largest selling brand of still water in Sweden (and Norway) is the Norwegian water Imsdal. There are 17 people employed at the source where the water is bottled. The two other effects of trade rely on imperfect competition and can be studied in a partial equilibrium framework.

One class of models, where modeling has focused on monopolistic competition and increasing returns, yields gains from trade because of product differentiation and increasing returns to scale. International trade makes more varieties available and at a lower cost. For instance this can explain two-way trade in differentiated goods such as automobiles. Thus the import of water could be associated with an increased welfare compared to the case where only domestic varieties were available because of an expanded choice set. The last reason for trade, and the only one that can account for trade in literally homogenous goods is the one associated with Brander and Krugman (1983). In the simplest case, two firms are based in different countries and sell the same product. There are zero transport costs within countries but "iceberg" transport costs positive between countries. If markets are segmented, and transport costs are low enough, each firm has a unilateral incentive to sell onto the other firms market and we observe two way trade in the same good. Figure 1 below illustrates the welfare effects of trade, which are ambiguous. Let p_{trade} and Q_{trade} represent the market price and quantity under trade and $p_{no\ trade}$ and $Q_{no\ trade}$ represent the corresponding figures if imports are shut out. The gain from trade stems from the decreased deadweight loss associated with increased competition, while the loss is caused by high cost foreign firms, rather than domestic lower cost firms, supplying part of the market. From the diagram it is readily seen that the negative impact of trade is more likely to dominate when transport costs are high.

Figure 1 about here

If goods are close, but not perfect, substitutes the ambiguity remains but there is an additional positive effect since consumers value a greater choice.[3] If we assume free entry the ambiguous result disappears however, as shown in Brander and Krugman (1983) and elaborated on by Venables (1985). The reason is that, ignoring integer constraints, free entry implies zero profits in equilibrium. With zero profits it suffices to examine the consumer surplus to evaluate the welfare effects; consumer surplus is decreasing in price and trade lowers price. We do our simulations under the assumption that entry is restricted and thereby stay true to the main thrust of reciprocal dumping type models, which we see as the trade-off between stronger competition and transport costs. [4]

3. The market for bottled water

We study the Swedish market for bottled water sold in stores from November 1998 to the end of September 2001. The main source of the data is ACNielsen, who use scanner data from stores to assemble their estimates of monthly brand level prices and quantities for each of six different regions in Sweden. This data was complemented with product and producer characteristics as well as cost variables from a number of sources, data definitions are detailed in the Appendix. In 2000 Swedes consumed an average of 17.6 liters bottled water per person and year, similar to figures in for instance the Netherlands and Ireland, but considerably lower than in countries further south, for instance France (112 liters per year) or Italy (155 liters). There is a cyclical pattern to demand, with higher demand in the summer months. Over the period covered there are 62 brands of sparkling water and 22 brands of still water sold. There is considerable entry and exit of smaller brands, the number of brands sold in grocery stores is the same in the first and last period (37 brands of sparkling water and 12 brands of still water).

In the following we argue that the Swedish market for bottled water matches the assumptions of the Brander-Krugman model quite well. Firstly, the market is oligopolistic. The

[3] In our empirical model we assume that firms compete in prices rather than quantities. While product differentiation makes it more likely that the positive effects of trade dominate, the ambiguity remains both under price and quantity competition if products are close substitutes. If brands are perfect substitutes price competition would not imply two-way trade however, see Ben-Zvi and Helpman (1992).

[4] For instance Helpman and Krugman's (1985, p. 110) book give a relatively thorough treatment of the trade-off, while referring to the free entry case as "Free entry and exit will, however, eliminate for this particular model the possibility of losses from trade. The argument is stated fully in Brander and Krugman (1983)." Also, the undergraduate textbook Krugman and Obstfeld (2003) discusses the trade-off without stating the free entry result.

Swedish market for beverages is dominated by two firms; Pripps-Ringnes (owned by Danish brewer Carlsberg since 2000) and family-owned Spendrups. Let us first describe the still water segment, exemplifying with data from June 2000 and June 2001 as shown in Table 1. Prices are expressed in Swedish kronor per liter.[5] The market share (based on quantity) in this segment of the largest distributor, Carlsberg is above 50 percent. The Norwegian water Imsdal is its main brand, with a market share of 41 percent in 2001. Second is KF, a major grocery retail chain whose store brand Blåvitt has a market share of 17 percent. The international food chain Danone has 12.7 percent through its brand Evian and Nestlé has 10.5 percent through its brand Vittel. Both of these are imported from France. All of the leading brands, except Blåvitt, are imported and the average market share of imports for the whole period is 66.9 percent. All imports come from Europe, with Iceland representing the source furthest away from Sweden. There is some dispersion in prices, also between brands that can be expected to be quite close substitutes, such as Evian and Vittel.

Table 1 about here

Not all firms handle their own distribution, in particular Evian is distributed by Carlsberg and Vittel by Spendrups. The resulting Herfindahl-Hirschman Index (HHI) of concentration is 0.239 on the brand level and 0.320 using the distributor quantities. Thus, of the four main brands one is produced in Sweden by a Swedish firm, one is produced in Norway by a wholly owned subsidiary of a Danish firm, the same Danish firm also manages distribution for Europe's largest selling brand of mineral water and finally a Swedish firm manages distribution of another well known French brand. The facts of this market are thus somewhat more complex than in the model of Brander-Krugman (1983). We have no access to information about the contracts signed between Evian/Vittel and their local distributors. A reasonable assumption is that producers such as Nestlé and Danone have significant bargaining strength and that the price is mainly determined by the producer rather than by the distributor. In our estimation of markups we do consider profit maximization at the distributor and brand level, as well as at the manufacturing group level, which is our main specification.

Figure 2 below illustrates the development over the period of the market shares of the main brands. The stand out feature of the diagram is the developments of market shares during the late summer of 2000, when Spendrups started importing and distributing Vittel in July 2000.

[5] The mean exchange rate during the period is USD 1= SEK 9.06.

This coincided with a drastic reduction of sales of Evian and an increase in the market share of Imsdal. These brands are both distributed by Carlsberg. It would not be surprising if consumers view Vittel and Evian as close substitutes, and it appears that instead of meeting the harder competition head on, Carlsberg promoted its wholly owned brand Imsdal instead. Alternatively, Evian partly pulled back from the Swedish market when a particularly close competitor appeared on the stage.

Figure 2 about here

The market for sparkling water is much larger in Sweden than that for still water, in fact it constitutes 96.9 percent of the market for bottled water sold in stores.[6] The lower part of Table 1 details some variables for the leading brands. The sparkling segment is dominated by three brands that are produced in Sweden – Ramlösa, Loka and Vichy Noveau. The share of imports is low on the sparkling market, on average imports only make up 2.9 percent of the market. Despite this, there is a fairly large number of imported brands, in June 2001 the largest of these is Beber from Italy with a market share of 1.2 percent. Other imported brands in this period were Perrier from France, Verdiana and Acqua Paradiso from Italy, Irish Classic from Ireland, Premier from Germany, Harboe from Denmark and Fyresdal from Norway. All in all there are 17 imported brands that have sales in at least one period during the sample. Also the market for sparkling water is very concentrated with the largest player Carlsberg controlling some 60 percent of the market. Ramlösa and Vichy Nouveau are both owned by Carlsberg. LOKA is owned by Spendrups.

At first the high concentration of the industry is surprising given the continued operation of a number of very small local producers, which indicates that the fixed costs of production are low. Indeed, in John Sutton's (1991, p 104) investigation of different food retail markets, bottled water and soft drinks are estimated to have the lowest minimum efficient scale of the 21 industries examined. The market structure is consistent with (endogenous) sunk costs in marketing however. The advertising to revenue ratio over the period is 6.8 percent, which is quite high.[7] These marketing expenditures are highly concentrated, on the still segment Imsdal

[6] This is not true globally where 73 percent of bottled water sold is still. Markets with lower quality/less tasty tap water typically have a higher share of still water sales; for instance still water represents 94 percent of sales in Spain but only 8 percent in Germany (source: www.mineralwater.org).

[7] Indeed, the Swedish bottled water market would rank among the top places in terms of advertising intensity in Sutton's examination (Sutton 1991, p. 107). Comparing with advertising to sales ratios for 19 US food industries for instance, only ready to eat cereals (at 10.8 percent) has a higher advertising to sales ratio.

accounts for 78 percent of the marketing expenditures and Olden accounted for the rest. On the sparkling segment the top three brands accounted for 86 percent of the total marketing expenditures with Coca-Cola Company spending a further 12 percent on its brand Bon Aqua. It is likely that marketing expenditure needed for new large scale entry constitutes an important entry barrier.

Marketing is also likely to be an important element in why bottled water should not be seen as perfectly homogenous. Nevertheless, it is clearly easy to argue that water is an almost homogenous product, indeed in blind tests consumers frequently prefer tap water and are seldom able to identify brands. An important assumption in the reciprocal dumping type models is that national markets are segmented, this appears to hold well for bottled water as well. In a comparison of prices of supermarket products across 14 EU countries bottled water had the highest price dispersion *across* national markets of all products investigated while price dispersion within countries for bottled water was comparatively low (irrespective of whether Evian or local brands were used for the comparison, Commission, 2002).

Another attractive feature of the bottled water industry is that the production technology is very simple. Water classified as natural mineral water (such as all imported brands) has to be bottled at the source and we can thus calculate the distance "traveled" for each liter of water sold. We assume that the distance is zero for a liter that is both bottled and consumed in the same region (6 regions in all in Sweden). In all other cases we use the distance between the approximate population centers in the region of consumption and region of production. Foreign brands in addition have to cover the distance to the region closest to them from their location (for the foreign brands their exact location is used).

The imported share of the bottled water market over the whole period is 4.5 percent. The low overall share of imports is consistent with high transport costs and taken together all these features imply that the market is almost tailored to allow for the possibility of trade being welfare decreasing.

4 Demand for differentiated products.

We now turn to the estimation of demand, following Berry (1994) closely. Let there be N_r potential consumers in each region r at time t who each buy at most one of J_r products. Both time and regional indexes are suppressed in the following. Assume that the utility of consumer *i* from buying a product depends both on the characteristics of the product and of the consumer. Let each product belong to one of *G,* mutually exclusive, groups. We express the utility of consumer *i* if she purchases product *j* as

$$u_{ij} = \delta_j + \zeta_{ig} + (1-\sigma)\varepsilon_{ij} \qquad (1)$$

where δ_j is the mean valuation for product *j,* ζ_{ig} is individual *i*'s deviation from the mean valuation common to all goods in the group and ε_{ij} is individual *i*'s good specific deviation. We assume that ζ_{ig} and ε_{ij} are identically and independently distributed across consumers following an extreme value distribution. We also specify an outside good, tap water, and normalize so that δ_o is set to 0. The closer that σ gets to 1, the more perfect substitutes are the products within groups. The mean valuation is given by

$$\delta_j = x_j\beta - \alpha p_j + \xi_j \qquad (2)$$

where x_j is a matrix of product characteristics of product *j*, p_j is the price and ξ_j is a random component in the mean valuation. The consumer buys at most one product in each period and chooses the one that gives the highest utility. Following Berry (1994) it can be shown that the above setup implies that the market share of product *j* can be written as

$$s_j = \underbrace{\frac{\exp(\delta_j/(1-\sigma))}{D_g}}_{s_{j|g}} \underbrace{\frac{D_g^{1-\sigma}}{1+\sum_{g=1}^{G} D_g^{1-\sigma}}}_{s_g} \text{, where}$$

$$D_g = \sum_{k \in G_g} \exp(\delta_k/(1-\sigma)).$$

We thus express the market share of product *j* as the sum of its share within the nest, $s_{j|g}$ and the share of the nest in the total market, s_g. Using s_o to denote the market share of the outside good, taking logs and rewriting, the estimating equation becomes

$$\ln(s_j) - \ln(s_o) = x_j\beta - \alpha p_j + \sigma \ln(s_{j/g}) + \xi_j \,. \qquad (3)$$

Thus, observing market shares, prices and product characteristics allow us to estimate α and σ.

4.1 Estimation.

We estimate the demand equation with two stage least squares, using instruments for the prices. We use an unbalanced panel of sales covering brands sold in grocery stores in six different regions over 35 months. Table 2 below reports the results from estimation of equation (7). By specifying the number of liters per month that a person drinks we define the market share of the individual goods as well as of the outside good. In columns (1)-(7) the dependent variable DEP is created assuming a total market of 9.025 liters per person and month, the same level as in France. In columns (8) and (9) we examine the sensitivity of estimates to the assumptions on the total market.

Table 2 about here

All specifications include PRICE as an explanatory variable, this is the price per liter in Swedish kronor. All regressions also include a dummy for the high demand season; SUMMER. Also included are marketing expenses per month for the respective brand - MARMON. Column (1) reports results from a simple OLS regression with PRICE, MARMON, SUMMER and a constant term. The coefficient on PRICE is negative as expected.

Column (2) presents the results from our main specification. We use a nested logit specification and assume that there are three parallel nests; sparkling water, still water and the outside good. The market share within the nest is denoted by MSNEST1. We also use observable product characteristics as explanatory variables - a dummy variable for PREMIUM products, a dummy variable for natural mineral waters (NATUR) and dummies for the country of origin. Region and period dummies are also included. The two central coefficients are those on price (α) and on the log of the market share within the nest (σ). Consistent with theory, the price effect is negative and the estimated coefficient on LOG(MSNEST1), σ, lies between 0 and 1. A point estimate of σ of 0.63 as in column (2) indicates that products within nests are seen as much closer substitutes than products in different nests. PRICE is endogenous and we want to use instruments that are correlated with PRICE, but not with the error term. Following much of previous research

(Hausman, 1994, Nevo, 2001, Slade, 2003) we use PRICE in other regions as an instrument. We therefore use PRICINST, which is the price in the southernmost region, as instrument. This is arguably the market that differs the most from the others and we expect a relatively low correlation between local demand shocks. The coverage in product space is also very good in this region. For the southern region itself we use prices in the western region as PRICINST. The underlying assumption is that PRICE in all regions reflect cost shocks while demand shocks are local. The correlation between PRICINST and PRICE is 0.89. Importantly, the nationwide demand shocks that are correlated with nationwide marketing should be picked up by our inclusion of MARMON, national monthly marketing expenses. We also use the distance from producer to the consumers region multiplied by the change in the diesel price (DISTDIES). The correlation between DISTDIES and PRICE is low, only 0.08. Nevertheless DISTDIES is a significant predictor of PRICE and thus satisfies a criterion for a valid instrument. Our instruments also appear valid in the sense that a test for overidentifying restrictions could not reject that the instruments were uncorrelated with the error term.

In column (3) we use brand dummies to capture product characteristics. With only a few markets, including fixed effects for all products leaves little to be explained by price variation leading to a coefficient on price that is not significantly different from 0. Research that uses brand dummies typically have observations from a much larger cross-section of markets (as is the case in Nevo, 2001, for instance).

The regression reported in column (4) is the same as that reported in (2) but with prices in the region farthest away as instruments. Since the panel is unbalanced and there are fewer brands sold on the northern markets we loose many observations when instrumenting with prices in the furthest away region. The estimates are somewhat affected by this. Column (5) uses a different nesting assumption, further dividing the sparkling and still nests into premium and non-premium nests, yielding a total of five nests. The coefficient on within nest market shares defined in this way (LOG(MSNEST2)) is closer to 1 than for the main alternative, confirming that products are seen as closer substitutes within the more narrow nests. Mineral water is also differentiated in continuous characteristics space through for instance different mineral content. We collected data on the content of all in all 26 minerals as well as a measure of total solids in the water and acidity (ph). In column (6) we include the two continuous characteristics variables that consumers arguable care the most about - salt content and acidity. In general, the estimates are somewhat sensitive to which of the 26 minerals that are included, in essence many of them work as brand-specific dummies for the brands with a high content of that particular mineral. It also requires a stretch of the imagination to view a typical consumer as concerned with the mineral content in the way that we believe that consumers care about for instance the fuel efficiency of a car. The next column uses quarterly data rather than monthly and also tries nesting in two levels with consumers choosing whether to buy in a store or drink tap water in a first step and then in a second step choosing still or sparkling. For the results to be consistent with utility maximization the top level coefficient on market shares within nest (LOG(MSSTORE)) should be lower than the corresponding coefficient on the lowest level as is indeed the case in (7). Finally the last two columns check robustness with respect to the size of the total market. Our assumption of a total market of some 9 liters per person and month implies a quite large market share for the outside good since current Swedish consumption of bottled water is only about 1.5 liters per person and month. The larger the share of the outside market, the more important substitute is the outside good and the more elastic is the market demand for bottled water. Since a more elastic market demand will be associated with lower markups in the absence of foreign competition we are increasing the chance of finding that importing reduces overall welfare by having a relatively large outside market. Column (8) uses a total market of 4 liters per month and column (9) a very large share for the outside good, 30 liters. The estimates are not very sensitive to these changes.

As seen, the point estimates are however somewhat sensitive to the inclusion of different minerals as explanatory variables and to the choice of instruments. Nevertheless, the overall impression from the estimation of demand is that regressions are typically well behaved in the sense that the coefficients of interest are within the range consistent with theory, significant and explanatory power is respectable with adjusted R-square typically in the 0.7-0.8 range.

5. Supply – Bertrand competition in differentiated goods

We now use the estimated coefficients to solve for the implied marginal costs. We follow the standard practice in this empirical literature of assuming one-shot Bertrand competition in differentiated goods. The J products are being supplied by F firms, where each firm markets a subset of products F_f. Each firm sets prices to maximize

$$\Pi_f = \sum_{j \in F_f} (ep_j - c_j) M s_j(p) \tag{4}$$

where e is the exchange rate (producer currency price of Swedish kronor), p_j the price in Swedish kronor, c_j is the marginal cost of producing product j and bringing it to consumers, M is the size of the market and s_j is the market share of product j. For simplicity we exclude fixed costs. We simplify our problem by not explicitly considering VAT or the vertical relations between producers/distributors and retailers. Assuming the existence of a unique Nash equilibrium in pure strategies the price of each product has to satisfy the first order condition

$$s_j(p) + \sum_{r \in F_f} (p_r - c_r / e) \frac{\partial s_r(p)}{\partial p_j} = 0 \,. \tag{5}$$

Bertrand competition implies a conjecture of a zero response of other firms' market shares to price changes. The cross-price effects on brands operated by the same firm will depend on whether goods are in the same nest or not. We define the JxJ matrix Ω where each element takes on a value according to the following:

$$\Omega_{k,j} = \frac{\partial s_k}{\partial p_j} = \begin{cases} \alpha s_j \left(\frac{1}{1-\sigma} - \frac{\sigma}{1-\sigma} s_{j|g} - s_j \right) & \text{if } j = k \\ -\alpha s_k \left(\frac{\sigma}{1-\sigma} s_{j|g} - s_j \right) & \text{if } j \neq k \text{ and } j,k \in \text{same nest, same firm} \\ -\alpha s_k s_j & \text{if } j \neq k \text{ and } j,k \in \text{different nests, same firm} \\ 0 & \text{otherwise} \end{cases}$$

We can thereby express the first order conditions in vector notation and solve for marginal costs, which are given by the solution to the following system of equations

$$\frac{\hat{c}}{e} = p - \Omega(p)^{-1} s(p) \,, \tag{6}$$

where c/e, p and s all are Jx1 vectors,

5.2 Markups

Given observed prices, market shares and the estimates of α and σ from Section 5.1 it is straightforward to calculate the estimated marginal costs by solving the system represented by equation (6) for each market and each time period separately. In Table 3 we present some summary statistics on prices together with the estimated own-price elasticities, markups and marginal costs.

Table 3 about here

In general the estimates are of the expected signs and of magnitudes that make economic sense. In particular, theory requires that optimizing firms face own price elasticities that are greater than 1 in absolute value and have markups between 0 and 1. But for a handful of outliers our estimates are consistent with these requirements. The median own price elasticity is estimated to be –2.61, and median markups are somewhat below 40 percent. Prices and marginal costs are higher and markups lower for imports than for domestic brands. We defer a further discussion of this until our calibration exercise. The calculations in Table 3 are based on the parameter estimates from our main specification, column (2) in Table 2. We also calculated marginal costs based on specifications (8) and (9) in Table 3 which assumed different sizes of the total market. The estimated differences are negligible and in both cases the median markup is 0.38 as well.

The estimates are well in line with previous findings on relatively cheap, marketing intensive, branded consumer products such as beer or ready to eat cereal. The median own price elasticity is close to what Slade (2003) finds for the UK beer industry. In another related study (Nevo, 2001) a preferred estimate for the median markup in the US ready to eat cereal industry is slightly above 40 percent. The estimates are also roughly in line with estimates based on accounting data - the bottled water divisions of Nestlé and Danone report operating margins (for global sales) of around 12 percent before taxes and excluding capital costs. According to discussions with a retail manager, a good estimate of the average retail margin on bottled water is 25 percent. Combined with a value added tax of 12 percent this implies a total margin (retail+manufacturer) of 0.48, to be compared with our median estimate of 0.38. Given the well known difficulties associated with using accounting data to measure marginal cost, and that

Danone and Nestlé are likely to have considerable market power compared to the median firm, we do not see the relatively small discrepancy between the figures as a cause for alarm.

In the calculations above we assumed that prices were set by the manufacturing group (such as Carlsberg, Danone or Spendrups). The restriction that the same firm markets several brands has some impact on the estimated markups. Taking account of cross-ownership will matter the most for Carlsberg who operates many brands. Of particular interest for our purposes is that the pro-competitive effect of imported brands distributed by Carlsberg will be different depending on if we assume that prices are controlled by Carlsberg or by the manufacturer. For instance, the median markup of Evian is estimated to be 0.23 if prices are set by the manufacturer (Danone) and 0.26 if set by the distributor (Carlsberg). In our analysis of the welfare effects of banning trade we will examine the sensitivity of results to the two different assumptions.

6. The gains from international trade

We now use our estimated parameters to simulate an equilibrium without imports and with no new entrants.[8] Marginal costs of the domestically produced brands are assumed to be the same as those solved for above. Under these assumptions we can calculate a vector of counterfactual prices by, for each period and each region, solving an analogous system of equations as in (6) for the optimal counterfactual prices, p^*,

$$p^* - \frac{\hat{c}}{e} = \Omega(p^*)^{-1} s(p^*).$$

The market shares are now calculated according to

$$s_j(p^*) = \underbrace{\frac{\exp(\beta x_j - \alpha p_j^* / (1-\sigma))}{D_g(p^*)}}_{s_{j|g}^*} \underbrace{\frac{D(p^*)_g^{1-\sigma}}{1 + \sum_{g=1}^{G} D(p^*)_g^{1-\sigma}}}_{s_g^*} . \qquad (7)$$

where the set of products included are only the domestic brands. The predicted prices and market shares are then compared with the predicted prices and market shares given the observed

[8] We also examined the welfare effects of the one major introduction of a new brand during the sample period - that of Vittel. The picture that emerged is consistent with the view that the introduction of a new foreign brand was associated with welfare gains. The sum of producer surplus and consumer surplus on the still market in the month of introduction, July 2000 is 1.13 million kronor compared to .72 million in the proceeding month or .91 million in July 1999. However many other things apart from the introduction of Vittel affect these figures and the methodology below is a clearer path for examining the welfare effects of trade.

marginal costs and all current products being sold. Under the current assumptions the consumer surplus to one consumer generated by a set of products can be calculated as

$$CS = \frac{1}{\alpha}\ln\left(1+\sum_{g=1}^{G} D_g^{1-\sigma}\right).$$

Using the estimate of marginal costs from Section 5.1 the calculation of profits is straightforward. In table 4 we compare the resulting consumer surplus and producer surplus reporting descriptive statistics over the 35 time periods. All figures are monthly and consumer surplus and profits are aggregated to the national level. The first four columns represent our main specification.

Table 4 about here

As implied by theory, the banning of imports is associated with a lower consumer surplus - less choice and higher prices of the domestic brands imply that the median consumer surplus drops from is 14.5 million kronor per month to 14 million kronor per month in the no imports scenario. Also, as expected, domestic profits are higher when there is no foreign competition; the median, over the 35 periods, of aggregate domestic profits increase from 29.6 million kronor per month to 31.1 million. Foreign profits from Swedish sales drop from 1.37 million to zero. The net of these effects implies that aggregate welfare is some 0.53 million kronor lower when imports are banned. Setting this figure in relation to the sum of consumer and producer surplus under trade we conclude that welfare is 1.1 percent higher when imports are allowed. Thus, trade in bottled water can indeed be motivated on welfare grounds, even in this market that was chosen to minimize the possibility of finding this result. The relatively small effect is partly explained by the low overall market share of imports. The consumer surplus that stems from the still water segment decreases from 1.17 million kronor to 0.89 million if imports are banned. Examining the net welfare effect on the still water market only implies a median welfare gain of allowing trade that corresponds to 7.1 percent of the consumer and producer surplus stemming from the still market under trade.

As a robustness check we also calculated the above figures for the two other assumptions regarding the market share of the outside good as reported in columns (8) and (9) of Table 3. When the total size of the market is 4 liters per person and month (some 2.6 times larger than consumption of bottled water today), the median net welfare gain of importing is 1.4 percent with a minimum of -0.5 percent, a maximum of 3.2 percent and a mean of 1.5 percent (with standard deviation of 0.008 this is significantly greater than 0).[9]

As with any calibrated model the exact magnitude of results depend on modeling choices and assumptions. The benefits of trade for consumers are two: the value of having a greater set of products to choose from and a disciplining effect on domestic markups. How to model the welfare increase from an expanded set of products has been an important theme in the empirical literature on differentiated goods, see for instance Trajtenberg (1989), Hausman (1994) or Petrin (2002). As discussed by for instance Ackerberg and Rysman (2002) the nested logit model tends to overestimate the welfare gains of a greater choice set. The reason is that every good is associated with its own set of product specific individual valuations that are distributed i.i.d. This means that there is no tendency for the product space to "fill up". To understand if this is driving the net positive effect of trade we also compare the current consumer and producer surplus with the following scenario; we calculate consumer and producer surplus using the full set of products, letting imports having the same prices as currently, and letting domestic products having the prices that we simulated under the assumption that there were no imports. In this fashion we keep the positive welfare effect of all the foreign brands, letting all of them enter the calculations with the same prices in both the current situation and the counterfactual. At the same time we let consumer surplus be affected by the higher domestic prices that would result if imports were banned. This set of prices clearly does not represent an equilibrium outcome, but it allows us to isolate the pro-competitive effect of trade. These results are reported in column 5 of Table 4. Indeed, if we in this way take away all loss associated with a smaller choice set, the net welfare effect is essentially zero. Across the months the mean net welfare with the prices under trade is 26 000 kronor higher than the net welfare with the domestic prices at their simulated levels. This difference ranges from -103 000 kronor to 249 000, or expressed in percentage terms as above

[9] If we assume that the total market is 30 liters per person and month (thus some 20 times larger than current consumption of bottled water) the welfare effect of allowing imports is essentially zero, the median net welfare gain of importing is -0.6 percent. With good estimates of the market demand elasticity one can in principle back out the relevant market share of the outside good. For example, if we use a logit specification the market elasticity of demand should equal α*the average price*the market share of the outside good. The estimated α is -0.44 in the logit specification and the average price is 6.12. Our estimates for aggregate demand are quite uncertain given our three years of data. Using different specifications we estimated industry demand elasticities in the range of -0.28 to -1, suggesting inelastic demand. Thus, for instance using unit elastic demand the implied market share of the outside good is 0.37. Given the shaky estimates of the aggregate industry demand elasticity and that we, if anything, would like to err on the side of finding that trade is welfare decreasing, we assume the market share of the outside good to be large; some 0.62 and 0.83 respectively for our the two specifications reported above.

from -0.2 percent to 0.4 percent. The last column in Table 4 examines the welfare effects of banning trade under the assumption that prices are set by the distributor rather than by the manufacturing group. Most visible is that profits from imported brands are slightly higher reflecting the higher markups associated with the additional cross-brand considerations when price setting. The qualitative nature of the welfare results is unaffected with respect to the baseline case.

Taken together the above shows that the main benefit of trade in this setting comes from the expanded choice set and that the pro-competitive effect is relatively weak. Indeed, when we shut out imports the median markup of domestic firms increases only marginally from 0.4317 to 0.4365. There is considerable variation across firms however, in particular in the still water segment the major domestic player, Blåvitt, would take advantage of the weakened competition according to our estimates. We estimate that the price of Blåvitt would increase from a median of 7.41 kronor to 7.83 with an associated increase in markups from 0.48 to 0.58.

The main gain from banning imports comes from replacing foreign high cost production with domestic, lower cost, production. The median marginal cost for foreign producers is 6.28 kronor per liter compared to 3.87 for the domestic brands. This difference can stem from less efficient production, or from higher costs associated with higher quality as well as from transport costs. Less efficient production by foreign firms seems unlikely, given that most imports are large international brand names that sell in many countries. Higher foreign costs because of higher quality are also not likely to be an important explanation. At a first glance, transport costs also seem unlikely as an explanation however. Using transport cost estimates from a government agency (cost per kilometer) and assuming that all water is shipped in 1.5 liter bottles on truck imply that it on average costs 0.2 kronor to ship one liter 1000 kilometers.[10] This is transport costs "on the road" and thus does not include the costs associated with loading and unloading and local distribution. However in the absence of additional reloading for international transport this should be the relevant comparison. To exemplify with a long distance traveler like a bottle of Perrier sold in the northernmost region, which has traveled about 2600 kilometers, transport cost would be 0.50 kronor higher than for a local product. This seems very low compared to the price of 15.5 kronor or the estimated marginal cost of 13 kronor. The higher marginal cost may be related to that imports to a larger extent are sold in smaller and/or glass bottles, which would be

[10] SIKA (2002)

associated with higher transport costs. Even so, the transport cost share seems low. One way to estimate the transport costs is to run an ordinary least squares regression on the estimated marginal costs explained by distance to the border, distance within Sweden, period dummies and PREMIUM. The coefficients of interest are reported in equation (15) below with t-statistics in parenthesis.

$$\hat{c}/e = 5.27 \; +.0037^{*}\text{distbord} \underset{(18.72)}{} \; - .000087^{*}\text{dist} \underset{(.55)}{} \; - .9967^{*}\text{PREMIUM} \underset{(7.3)}{} \; + \text{time} \; + \text{error}$$

$$R2adj=.1723 \qquad (8)$$

The point estimate on distance to the border implies that the estimated cost of shipping one liter 1000 kilometers is 3.7 kronor whereas distance within Sweden is not significant. Using price quotes from Schenker, a major European transport firm imply a cost of 1.02 kronor to ship one liter 1000 kilometers, considerably lower than our estimate of 3.7, but much higher than the estimated cost of shipping domestically. The Schenker figure is five times as high as the cost of shipping domestically and it seems clear that higher costs of international transport are an important explanation for the higher foreign marginal costs. In addition to shipping costs there may be additional costs that are related to distance, for instance a need to keep a larger stock. Indeed, higher costs for international trade are consistent with much of the literature on border effects (see for instance Anderson and Van Wincoop, 2003). High trade costs are also consistent with the low overall market share of imports.

Our calculation of the welfare effects of international trade is based on the assumption that the private cost of transportation is equal to its social cost. However, to the extent that negative externalities of transport, such as pollution and congestion, are not corrected for by for instance diesel taxes, the private cost of transport under-estimates the social cost. Let us therefore note that much of the concern with two-way trade in very similar products regards the environmental impact of such trade, and the distance traveled by a bottle of water is interesting for that reason. While the average distance would fall if imports are banned the effect is small, partly because the overall import share is low but also because the difference in distance between supplier and consumer for domestic and foreign producers is surprisingly small. The quantity weighted average distance is 393 kilometers for domestic waters and 931 kilometers for imports. If we examine the still water segment only there is very little difference, the average quantity weighted distance is 719 kilometers for domestic brands and 840 kilometers for imports. Thus cost savings from banning imports on this market are not so much associated with less transports per se, but rather appear related to higher costs of international transport. To exemplify, the major domestic still water, Blåvitt, is bottled in the far north. From the south of Sweden this is about equidistant as producers in the French alps. Also, the major imported still water is produced in neighboring Norway.

7. Conclusions

This paper has investigated whether transport cost losses from trade can outweigh the partial equilibrium gains from trade (stronger competition and more brands to choose from). The results show that even in this case trade can be motivated. Expanded choice is the main benefit of trade and disregarding this the net welfare effect of imports in this market are approximately zero - the pro-competitive effect is of the same size as the cost savings associated with replacing foreign, higher cost, suppliers with domestic. Given our choice of market this suggests we should not be overly concerned with two-way trade in consumer goods that are close to homogenous.

Clearly, as with any model based on simulations the work should perhaps more be seen as a reality based calculation rather than a prediction of what would actually happen if Sweden decided to ban imports. For instance it is likely that we would see some domestic entry into the still water market if the experiment had been undertaken in reality. Free entry would make the pro-trade case even stronger though, so our main conclusion would not be overturned by free entry. At a deeper level one may wonder about the welfare effects of marketing in this industry - are consumers' tastes for different brands just an artifact of marketing? This is clearly a large and interesting issue in its own right and one that we have abstracted from (see Bagwell, 2002 for an overview of the welfare effects of advertising).

One conclusion that is not sensitive to our modeling is the fact that in terms of distance traveled per liter the difference between domestic production and imports is fairly small. One should thus exercise caution before equating international trade with more wasteful transportation than domestic trade. Lastly, one could argue that the drinking of bottled water uses up a lot of resources for little apparent benefit in a country where the tap water is of high quality. From an environmental perspective it is sure to be less important whether bottled water is imported than if bottled water rather than tap water is consumed.

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Table 1. Prices and market shares for leading brands and distributors. Still and sparkling segments.

		June 2000		June 2001	
Still water segment ***Brands***	*Share of marketing expenses over total period*	*price/liter*	*market share*	*price/liter*	*market share*
Imsdal (Norway)	0.78	9.65	0.30	11.37	0.41
Evian (France)	0	10.68	0.28	12.68	0.11
Vittel (France)	0			10.51	0.10
Blåvitt (Sweden)	0	6.34	0.14	6.23	0.17
HHI			0.188		0.239
Distributors					
Carlsberg			0.58		0.52
Spendrups			0		0.10
KF			0.14		0.17
HHI			0.35		0.32
Sparkling water segment					
Brands					
Vichy Noveau (Sweden)	0.20	7.19	0.28	7.23	0.26
Ramlösa (Sweden)	0.29	7.36	0.28	7.28	0.26
LOKA (Sweden)	0.37	6.87	0.21	6.83	0.21
Blåvitt (Sweden)	0	6.13	0.04	6.21	0.004
HHI			0.204		0.190
Distributors					
Carlsberg			0.62		0.58
Spendrups			0.24		0.25
KF			0.05		0.05
HHI			0.448		0.406

Table 2. Estimation of demand. (Standard errors in parenthesis.)[a]

VARIABLE	OLS POOLED	2SLS BRAND CHAR	2SLS BRAND DUMMIES	2SLS BRAND CHAR	2SLS BRAND CHAR	2SLS BRAND CHAR	2SLS BRAND CHAR	2SLS BRAND CHAR	2SLS BRAND CHAR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PRICE	-.2085**	-.1544**	-.0786	-.1911**	-.0583**	-.2354**	-.1507**	-.154**	-.1543**
	(.00639)	(.0096)	(.1504)	(.0094)	(.01)	(.0125)	(.0199)	(.0098)	(.0096)
LOG(MSNEST1)		.6258**	.9867**	.5035**		.6432**	.63**	.6277**	.626**
		(.0095)	(.0239)	(.0113)		(.01298)	(.0364)	(.0099)	(.0096)
LOG(MSNEST2)					.7067**				
					(.01)				
LOG(MSSTORE)							.4126**		
							(.5627)		
MARMON	.0012**	.00023**	-.000006	.000211**	.00058**	-.00006**	.00024**	.00024**	.00024**
	(.000036)	(.000022)	(.000007)	(.000022)	(.000022)	(.000016)	(.00004)	(.000024)	(.000022)
CONSTANT	-6.7082**	-2.0562**	-.0599**	-2.1413**	-4.972**	11.51**	-.4498	-.911**	-3.4412**
	(.06283)	(.1446)	(3.027)	(.1435)	(.1426)	(.337)	(1.332)	(.1496)	(.1444)
BRAND CHAR		Country dummies PREMIUM NATUR	brand dummies	Country dummies PREMIUM NATUR	Country dummies NATUR	Country dummies PREMIUM NATUR Na, PH	Country dummies PREMIUM NATUR	Country dummies PREMIUM NATUR	Country dummies PREMIUM NATUR
OTHER EXPL VARIABLES	SUMMER	Period and regional dummies SUMMER	Period and regional dummies SUMMER	Period and regional dummies SUMMER	Period and regional dummies SUMMER	Period and regional dummies SUMMER	Period and regional dummies SUMMER	Period and regional dummies SUMMER	Period and regional dummies SUMMER
INSTRUMENTS		DISTDIES PRICINST	DISTDIES PRICINST	DISTDIES Prices in region furthest away	DISTDIES PRICINST	DISTDIES PRICINST	DISTDIES PRICINST	DISTDIES PRICINST	DISTDIES PRICINST
Sample	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Quarterly	Monthly	Monthly
Total market: Liter per person and month	9.025	9.025	9.025	9.025	9.025	9.025	9.025	4	30
R2 ADJ	0.249	0.796	0.983	0.791	0.74	0.92	0.799	0.7972	0.7939
NOBS	6787	4898	4969	3872	4898	2639	1137	5027	5207

a) Variables starred with ** are significant at the 1 percent level, with * at the 5 percent level.

Table 3. Implied own-price elasticities and markups - one-shot Bertrand competition with prices set at manufacturer level. Descriptive statistics across all periods, regions and products.

	own price elasticity					*markup* $(p-\hat{c}/e)/p$				
	1st	10^{th}	*median*	90^{th}	*99th*	*1st*	10^{th}	*median*	90^{th}	*99th*
all brands	-9.34	-6.28	-2.61	-1.77	-1.26	.107	.157	.38	.605	.833
imported brands	-9.85	-7.66	-2.88	-1.89	-1.32	.101	.124	.288	.507	.74
domestic brands	-7.95	-5.19	-2.47	-1.74	-1.24	.125	.208	.405	.635	.852
	Price					$\hat{c}/e$, *marginal cost*				
	1st	10^{th}	*median*	90^{th}	*99th*	*1st*	10^{th}	*median*	90^{th}	*99th*
all brands	3.07	4.42	6.75	15.27	22.63	.55	1.79	4.18	13.05	20.24
imported brands	3.28	4.63	8.06	18.57	23.85	.85	2.37	6.28	17.14	21.54
domestic brands	3.04	4.31	6.51	12.6	19.25	.46	1.62	3.87	9.88	16.83

Calculations based on estimates from Table 2, column 2.

Table 4. Comparison of welfare under trade with simulated values when no imports and blocked entry. Descriptive statistics for all of Sweden over the 35 time periods.

	Prices set by manufacturer, counterfactual: no imports				*Prices set by manufacturer, counterfactual: traded prices for imports, no import prices for domestic*	*Prices set by distributor,* counterfactual: no imports
	mean (std. dev)	*min*	*median*	*max*	*mean (std.dev)*	*mean (std.dev)*
Consumer surplus under trade (per month, all of Sweden, million kronor)	15.4 (4.0)	10.1	14.5	19.9	15.4 (4.0)	15.4 (4.0)
Counterfactual consumer surplus (per month, all of Sweden, million kronor)	14.8 (3.9)	10.3	14.0	19.3	15.3 (3.9)	14.9 (0.4)
Counterfactual Aggregate domestic profits per period (per month, all of Sweden, million kronor)	32.6 (8.5)	21.8	31.1	44.5	31 (8.1)	32.6 (8.4)
Aggregate foreign profits per period under trade (per month, all of Sweden, million kronor)	1.49 (0.5)	0.99	1.37	1.99	1.73 (0.6)	1.52 (0.5)
Total difference in welfare (CS+PS) per month; Current-counterfactual	540 826 (192 096)	326 034	536 139	786 889	25 980 (89 384)	572 160 (192 232)
Total difference in welfare (CS+PS) per month in percent of welfare under current situation; Current-counterfactual	1.19 (0.5)	0.6	1.09	1.82	0.03 (0.19)	1.25 (0.5)
Prices of domestic products under current situation, still water only	7.40 (1.57)	5.66	7.36	8.82	7.40 (1.57)	7.40 (1.57)
Prices of domestic products under counterfactual, still water only	8.02 (1.93)	5.77	7.62	10.76	8.02 (1.93)	8.02 (1.93)

Calculations based on estimates from Table 2, column 2.

Figure 1. The welfare effects of reciprocal dumping.

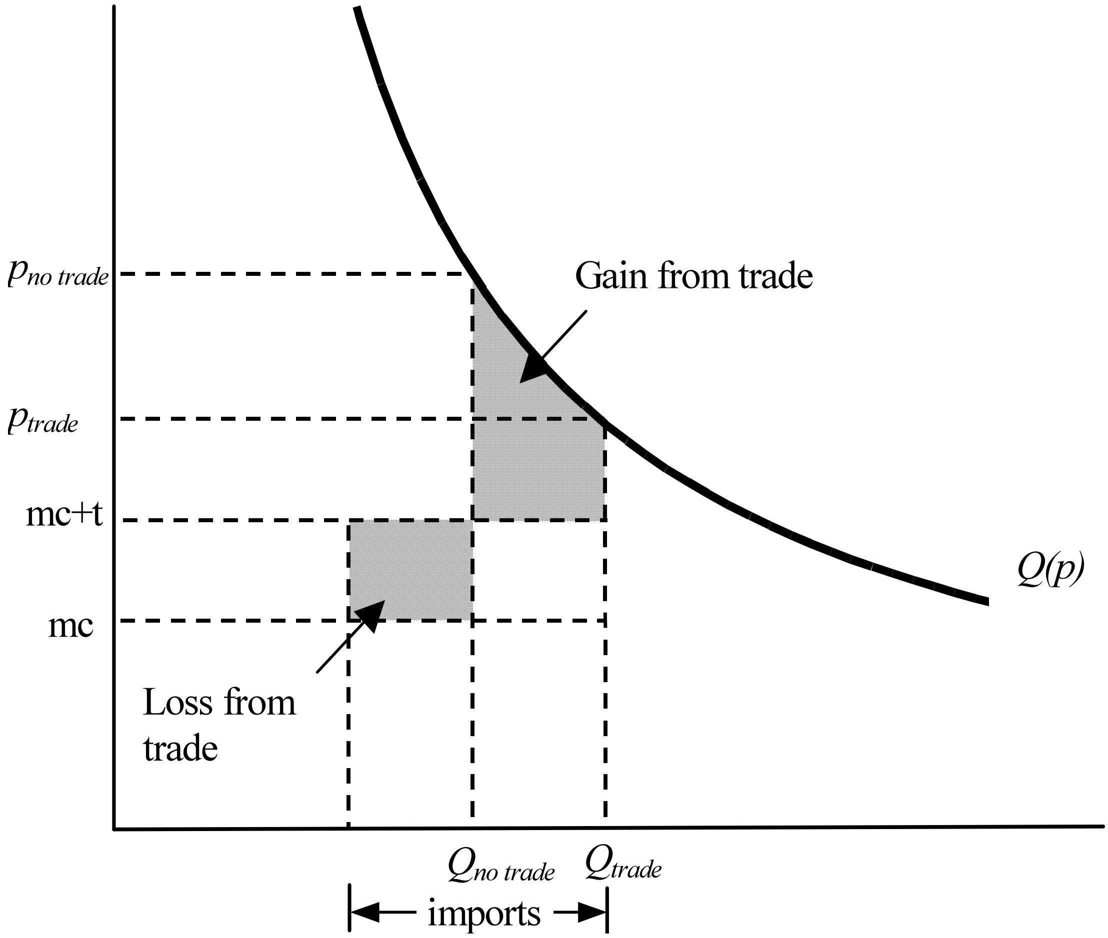
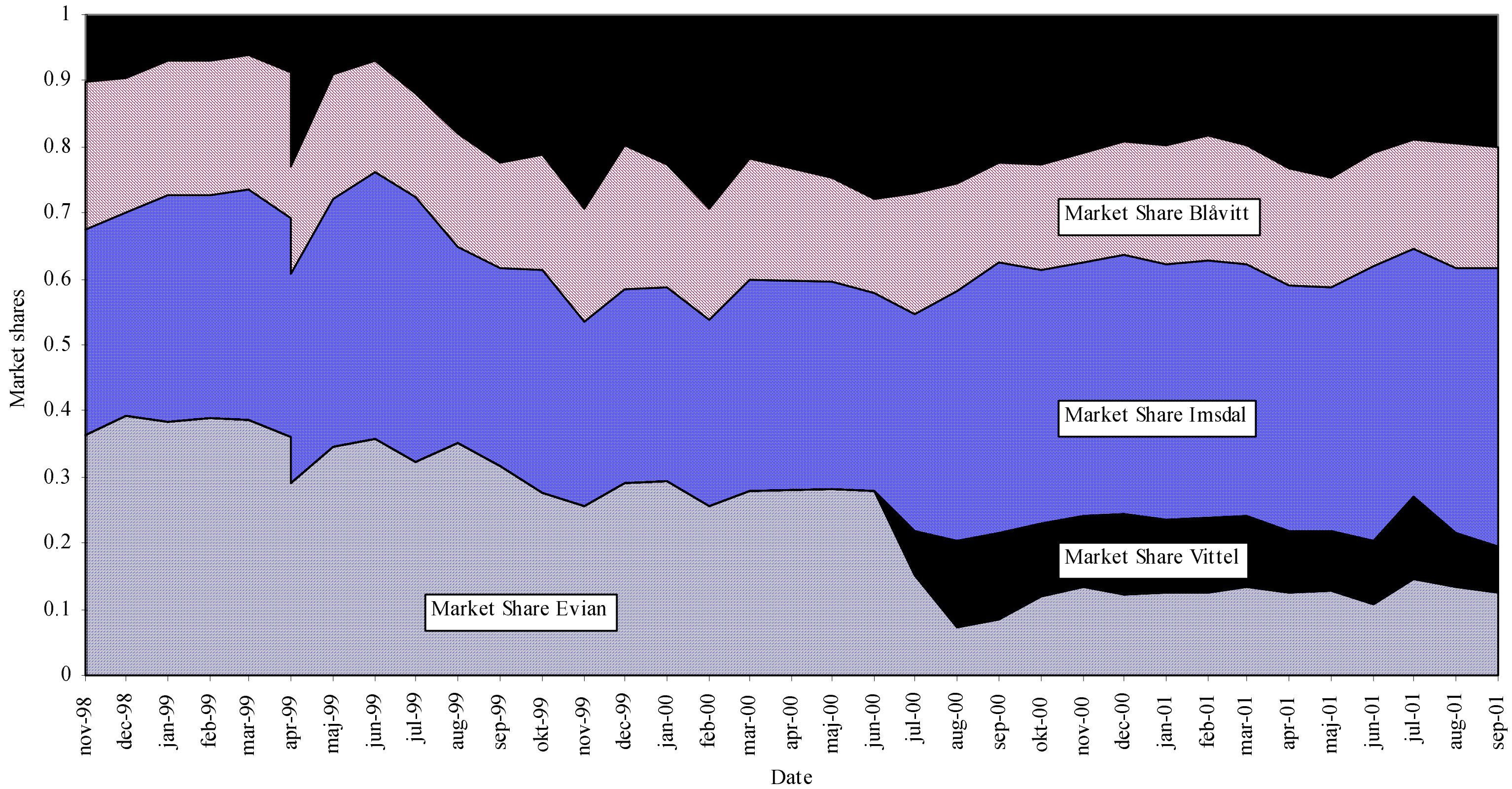


Figure 2. Still water segment, market shares of leading brands, 1998-2001.



Appendix. Data definitions and sources for some key variables.

Variable	*Description and source*
PRICE	Price per liter in Swedish kronor. Excludes cost of packaging for water sold in recyclable bottles, where a deposit system is in place. Source: AC Nielsen, Sweden
DEP	Market share in quantity terms of brand *j* in region *r* in period *t.* Total consumption set at 4, 9 and 30 liters per person and month. Population per region from Statistics Sweden, quantity from AC Nielsen, Sweden.
MSNESTX	Market share within nest in quantity terms of brand *j* in region *r* in period *t.* Nesting structure 1; three parallel nests: still, sparkling, outside good. Nesting structure 2; five parallel nests: still premium, still non-premium, sparkling premium, sparkling non-premium, outside good.
MARMON	National marketing expenditure for brand *j* in period *t*. Estimated cost for observed advertising in Swedish newspapers, magazines, Television and radio. Source: Marketwatch AB, Stockholm.
PREMIUM	Dummy variable equal 1 if brand is classified as a premium brand (if marketing expenditures are positive or a well-known international brand name such as Vittel, Evian, San Pellegrino).
DISTANCE	Distance in kilometers to approximate center of population in region *r* (Malmö, Göteborg, Eksjö, Stockholm, Ludvika, Umeå) from the corresponding center in the region of production. For imported brands distance from source to the closest Swedish region + further distance withing Sweden analogously to domestic brands. Distance is as the crow flies: locations from http://www.planetware.com and great circle distances from http://www.wcrl.ars.usda.gov/cec/java/lat-long.htm
BRAND CHARACTERISTICS	Mineral content, location and whether natural mineral water through labels, correspondence with manufacturers and the Swedish brewers association. Distribution, manufacturer and group details from AC Nielsen.