Food prices and market structure in Sweden [*]

Marcus Asplund

Göteborg University, London Business School and CEPR

Richard Friberg

Stockholm School of Economics

Abstract

This paper examines retail grocery price levels with a large panel of stores in Sweden. We explain price variation across stores by market structure variables to capture differences in competition intensity and a number of store and region specific factors. Most of the explained variation in prices can be attributed to store specific factors such as size and chain affiliation. Overall, the relation between market structure variables and food prices is weak, and effects are small in percentage terms. Nevertheless, higher local concentration of stores, higher regional wholesaler concentration and a lower market share of large stores are all correlated with higher prices.

Keywords: Food prices, firm concentration, market structure, price competition, grocery retail, grocery wholesale.

JEL codes: D43, L13, L81.

---

[*] e-mail: masplund@london.edu, Richard.Friberg@hhs.se. We would like to thank Lena Edlund, Tore Ellingsen, Mikael Sandström, the editor, two anynomous referees and seminar participants at the E.A.R.I.E. Conference 1999, the Stockholm School of Economics, the Swedish Competition Authority, and Sveriges Riksbank for valuable comments. We gratefully acknowledge financial support from the Research Department at Sveriges Riksbank, The Swedish Competition Authority, Jan Wallander's Research Foundation and The Swedish Research Institute of Trade (HUI). We are grateful to Torsten Lundborg, PRO, for providing us with price data and DELFI for giving us access to their data base.

I. Introduction

Can differences in food prices across stores, regions and countries be solely attributed to costs or does market power play a role? If market power matters, are the effects quantitatively important? We examine these issues using a rich data set with price information from a large number of Swedish grocery stores.

Theories of oligopolistic conduct generally agree that as the number of firms rises so does the intensity of competition, in the sense that equilibrium prices fall. However, exactly how equilibrium prices are related to firm numbers (or more generally, market structure) hinges crucially on details of the game analyzed. The relation will depend not only on the nature of the short-run interaction (e.g., Bertrand vs Cournot competition) but also on the potential for implicit collusion. See Fisher (1989) and Sutton (1990) for critical views on the ability of oligopoly theory to generate testable hypotheses.

One response to the large number of unobservable factors is to empirically study competition in different geographical markets within the same industry, as done in the present work. The motivation for this approach is that the nature of competition can be assumed to be similar across markets while the market structure differs due to market size differences and/or historical reasons. Some examples that rely on the geographical markets approach to identify aspects of market power in various industries include Asplund and Sandin (1999), Berger and Hannan (1989), Borenstein and Shepard (1996) and Bresnahan and Reiss (1991); Weiss (1989) surveys early studies. In agreement with the basic prediction, most find a negative relation between price levels and the number of firms. Also as anticipated, the magnitude of the price effect differs such that results from one industry can not be directly applied to another.

Our data allows a study that in most respects is different from previous studies of competition in food retailing. First, our primary price information contains prices of specific products that are available at essentially each store that sells groceries. Out of roughly 8000 stores in Sweden we have price information from approximately 1000 stores on four occasions - a vastly greater sample than previous studies. Second, we have access to store specific information (e.g., revenue, chain affiliation, store type). With detailed information on location we are able to delineate a large number of markets where stores compete. These, in turn, can be aggregated to reflect regional competition among chains. This is particularly important as the sector, in Sweden and most other European countries, is dominated by a few chains and may become even more so through further consolidation. We are also able to evaluate the claim that large stores exert a downward pressure on prices in the area.

A number of studies have examined the impact of market structure on grocery prices on U.S. data, Cotterill (1993) provides a survey. Most closely related to ours are studies that make use of variation in prices across geographical markets. In almost every case the number of observations is quite limited, price indexes for areas rather than store level prices are used, and market definitions are broad. Some examples are illustrative of the problems and results. An often-cited study by Cotterill (1986) uses a cross-section of prices of a product basket from 35 supermarkets in rural Vermont. He finds that prices are higher in markets where supermarket concentration is high. Newmark (1990) questions the validity of the then existing literature on the grounds that it had not controlled for regional differences in income and used small non-random samples. Controlling for income, and with data on the price of a basket of goods in 14 cities across the U.S. and 13 cities in Florida, he does not find any correlation between chain concentration and price levels. Claycombe and Mahan (1993) regress a price index of beef to market structure and also find little in terms of correlation. Marion (1998) relates the rate of change in a price index from 15 U.S. metropolitan areas to the presence of warehouses, and finds lower price increases where their market shares are increasing. To our knowledge the present study is the first econometric analysis relating price variation across local markets to market structure in European food retail markets.[1]

Overall, our results point to a statistically significant effect from market structure on price levels. We use Herfindahl indexes as our measures of market structure. A relatively concentrated market is therefore one with few stores(chains) and/or with relatively large market shares for a few stores(chains). A higher regional concentration of chains and a higher concentration of stores in the local market are both correlated with higher prices at the store level. There is also support for the hypothesis that a significant presence of large stores in an area tends to depress price levels. We conclude the paper with a discussion of the economic importance of these findings.

II. Data

We study prices across grocery stores in Sweden over the period 1993-1998. Table 1 details the variable definitions and the data sources.

Table 1 about here

Prices

Our primary data is store level prices of specific products, collected by the Pensioners' National Organization. Its surveys of food prices cover approximately 1000 stores across the country and are conducted by the members twice annually during a single week. The members check the prices on roughly thirty items in the stores where they regularly shop. Since the survey forms were only available in paper format it was necessary to limit the number of surveys and products. We selected the surveys for 1993 (fall), 1995 (fall), 1996 (spring) and 1997 (fall).[2] The products are washing-up detergent (Yes, 0.5 liter), castor sugar (no specific brand, 2kg), crisp bread (Wasa Husman, 500g), spread (Kalles Kaviar, 190g), and cocoa (Fazer, 200g). Our choice of products was motivated by a desire to have well-defined products with different characteristics that were included in each survey.

The recorded price of a product in our data set is its "normal" price, so that lower prices due to temporary rebates are not visible. This has an advantage since, with only a handful of chains, and a small basket of products, a promotion campaign from a chain on one product could seriously distort our index.[3] From these a price index for each store and survey is constructed, denoted PRICE.

The range of products in a typical grocery store is large and prices are often adjusted which raises the issue whether our small basket can be informative of the price level in a store. The first check is to study the correlation between PRICE for stores included in two adjacent surveys; a large stochastic element in the pricing policy at the store level would result in a low correlation. The correlation coefficients $\rho_{93,95}$ =0.70, $\rho_{95,96}$ =0.85, and $\rho_{96,97}$ =0.77 are high. However, the possibility remains that the few included products give a misleading picture of the general price level in a store. This can be a particular worry in the light of recent evidence on variations in pricing policies for different product categories in grocery retailing (see Giulietti and Waterson, 1997, Walsh and Whelan, 1999).

We therefore employ a second source of price data. Between 1995 and 1998 the Swedish government consumer agency conducted six surveys, giving us 743 price observations. There are several important differences compared to the price data described above. The geographical coverage is much narrower - only 40 towns are included in any of the surveys (mostly medium sized towns in the western and middle regions of the country). Most price observations are from the town's largest stores. The agency's basket contains a large number of products as it is constructed to reflect the monthly cost of food for a representative family. The products are generally not specified precisely (e.g. mustard 200g), and if several brands of the same "product" are available, the one with the lowest price is included in the basket. Goods that are on sale are recorded at the sale price, rather than at the "normal" price as in the data set described above. The number of products varies across surveys (between 107 and 157 products) and between stores. Only the total price and the number of products in the store are available and from this information we construct a price index for each store included in a survey, denoted PRICE_BB.

Comparing PRICE with PRICE_BB in stores where we have information from both sources in a given year (327 observations) yields a correlation of 0.56. Bearing in mind the differences in data sources a correlation of 0.56 must be considered high. Below we compare the two data sets in more detail.

Firms

The store specific data contains yearly observations on a number of variables for all Swedish stores that sell groceries. Altogether there are 8360 stores that were active at least in one of the years. The information contains revenue, sales space, store type (for example large supermarket or convenience store), primary wholesaler, and the exact location. The identity of a store is based on its address; a change in name does not alter the identity.

The Swedish food retailing sector is dominated by three groupings; ICA, KF and DAGAB. Each of these has a particular structure. The largest group is ICA (45 percent national market share), which is a cooperation of independent stores who presently are allowed to cooperate on purchasing, transport and marketing. The vast majority of stores operate under the ICA-brand. Importantly, the individual stores are by competition laws prohibited to cooperate on prices, except for occasional special offers. KF is a centrally coordinated group of regional consumer cooperatives (25 percent market share). In contrast to ICA, KF can centrally decide on prices at the individual store. Some 2150 stores, most of them independent convenience stores, are affiliated with DAGAB, which has a 24 percent market share.[4] In addition to these groups there are a number of independent chains that in some regions (primarily in the southwest) make up a significant share of sales but at a national level have a joint market share of only six percent. Somewhat loosely, we will refer to ICA, KF, and DAGAB as "chains" although "wholesaler" might be more appropriate.

Market structure and competition

In our data, a narrowly defined market is the locality (roughly equivalent to a postal area) where, generally, stores are closely situated. Under the hypothesis that each store is operated independently with its own pricing policy, the level of prices should depend on the market concentration of stores at the locality. As a measure of this concentration we use the Herfindahl index, HERF_STORE, where market shares are calculated from store revenues.

It is plausible that prices also reflect the composition of chains in the locality. If all stores that belong to a given chain cooperate in their pricing decisions, PRICE would be explained by the market concentration of chains at the locality. Again we use the Herfindahl index, HERF_CHAIN.

Although chains may be unable to directly control prices at the store level they can let wholesale prices vary across regions in the country. The hypothesis is that regions where chain concentration is high tend to have high prices due to higher wholesale prices. We use the chain concentration in the A-region (in total 70), HERF_REGION, to test this hypothesis.

The final market structure variable that is expected to explain PRICE is the presence of large stores. Although consumers rarely travel significant distances to reach another grocery store they may do so if prices are sufficiently low or if it offers a wide product range. This implies that the market boundaries for large stores are wider than for other grocery stores and we define the market share of the largest stores on the municipality level, rather than at the more narrow locality level. Thus, MSBIGSTORE_A and MSBIGSTORE_B are the market shares of hypermarkets and large supermarkets, respectively, in the municipality.

Other factors

Variation in prices will also depend on cost- and demand factors as well as store-specific factors such as store type, store size, and chain affiliation. As in most previous works on prices and market structure, we partly have to resort to aggregate measures.

The municipality is the smallest area for which income and population statistics are available. Statistics on wages and costs of floor space, two costs of primary importance to grocery stores, are not reported at the municipality level however. We let the average income proxy for both differences in demand per capita and wages across markets, although wages exhibit very little variation across Swedish regions. More troublesome are the costs of floor space, which clearly differ significantly even within towns. We use the population density in the municipality as a proxy for the cost of floor space. Differences in transport costs can to a large extent be captured by dummy variables for the most remote areas. In the daily press, there is a common understanding that prices are low in the area around Gothenburg and high in Stockholm. To capture this we add some regional dummy variables, which are further discussed below.

In addition to these geographical measures we also add store specific variables such as chain affiliation, store type, and size of store. Needless to say, an unobservable component in costs remains.

Descriptive statistics

Table 2 presents some summary statistics of PRICE and PRICE_BB. It also gives the distribution of some market structure variables corresponding to the sample of stores for which we have information on PRICE.

Table 2 about here

It is clear that there is considerable variation in prices across stores, albeit smaller than might have been expected. In the 10:th percentile, PRICE is roughly 13 percent lower than the average and in the 90:th percentile 11 percent higher. The distribution of PRICE_BB is similar; in the 10:th percentile the price is 10 percent lower and in the 90:th percentile it is 10 percent higher. Both distributions are approximately symmetric.

Most observations on PRICE are from localities with only a few stores where it is reasonable to assume that stores are in direct competition. In fact, 25, 50 and 75 percent are from markets with no more than 4, 8 and 23 stores, respectively.[5] Competition is most likely localized with several overlapping submarkets in some of the larger markets. At the chain level the markets are far more concentrated. Here roughly 50 percent of the observations are from markets with HERF_CHAIN above 0.4. The dominance of a limited number of chains is also evidenced by the chain concentration at the regional level, HERF_REGION, which ranges between 0.25 and 0.56. However, about 80 percent of price observations are from regions with chain concentration between 0.31 and 0.45; the standard deviation of the variable is only 0.05.

To provide a first view of the relation between prices and market structure, Table 3 gives summary statistics for stores with a price quote that are active in a locality with fewer than twenty stores.

Table 3 about here

Overall, there is a negative relation between PRICE and the number of stores. The mean prices in markets with one, two, three and four stores are on average 3.3, 3.7, 1.8 and 1.4

percent higher price than the average, respectively. Strikingly, there is substantial variation in prices for markets with any given number of stores, as evidenced by large standard errors and wide differences between minimum and maximum price.

III. Results

As noted in the Introduction, oligopoly theories provide little guidance as to exactly how the intensity of competition changes with market structure. For this reason, most empirical work is non-structural, in the sense that broad predictions rather than specific theories are tested.[6] We follow this line of research and specify reduced form regressions with the store price as the independent variable, which is explained by market structure variables while controlling for factors that may affect the store's cost and demand conditions.

We employ random effects estimators to explain the variation in prices, since there is little or no variation in the explanatory variables over time. We use generalized least squares to estimate

$$y_{it} = b\mathbf{W}_{it} + u_i + e_{it}, \qquad (1)$$

where y_{it} = PRICE, PRICE_BB or PRICE_X, respectively, $\mathbf{W}_{it}$ is the matrix of exogenous explanatory variables including a constant term. The disturbance term u_i is specific to the individual store ($E[u_i]=0$, $E[u_iu_i]=\sigma_u^2$ and $E[u_iu_j]=0$), and e_{it} a classical disturbance ($E[e_{it}]=0$, $E[e_{it}e_{it}]=\sigma_e^2$, and $E[e_{it}e_{is}]=0$, $E[e_{it}e_{js}]=0$, $E[u_ie_{it}]=0$).

Store price level: small basket

Columns (1)-(4) in Table 4 present the estimated coefficients from PRICE regressions. Column (1) is an OLS regression where all observations have been pooled and the other columns use the random effects methodology outlined above. We begin by discussing the regressions on the full sample (the first two columns) where the point estimates are similar but as Lagrange multiplier tests strongly favor the random effects specification we focus on (2). The results in (3) and (4) are for subsamples with few stores and non-urban areas.

Table 4 about here

The coefficient on HERF_STORE is positive and significant at the 5 percent level. A higher store concentration in a market increases the store's price level, as anticipated from Table 3. On the other hand, the coefficient on HERF_CHAIN is insignificant. Hence, controlling for store concentration, at the market level the composition of chains does not affect prices.[7] This suggests that there is price competition between stores, irrespective of chain affiliation. Given that the ICA stores, and many of those affiliated with other chains than KF, are operated independently, this may not be surprising. The price effects arise however at the regional level; HERF_REGION is positive and highly significant. This indicates that the chains' wholesale prices vary with the regional concentration, which indirectly leads to different store prices. The coefficients on MSBIGSTORE_A and MSBIGSTORE_B are both negative and statistically significant.

The point estimates of HERF_STORE and HERF_REGION in the second column suggests that retail monopoly at the store level and a chain monopoly at the regional level would lead to 3.1 and 10.7 percent higher prices compared to where concentration is near zero, respectively. However, for HERF_REGION this amounts to beyond sample inferences as the variable takes only values between 0.25 and 0.56. To evaluate the price effects of regional chain concentration we instead compare prices at the 20:th and 80:th percentile from Table 2; 0.31 and 0.40. Such a hypothetical increase in concentration is associated with a 1.0 percent increase in prices. From this simple experiment we conclude that the price effects of regional chain concentration are small over most of the range covered in the sample. Similar calculations with the 20:th and 80:th percentile of MSBIGSTORE_A (0.00 and 0.13) and MSBIGSTORE_B (0.24 and 0.55) gives 0.4 and 0.8 percent lower prices.

For the store specific variables we find that large stores have, as expected, lower prices as evidenced by the negative coefficients on BIGSTORE_A, BIGSTORE_B and LOG(REVENUE).[8] Coupled with the negative coefficients on MSBIGSTORE_A and MSBIGSTORE_B, the popular notion that a presence of large stores exerts a downward pressure on prices in other stores is supported. Only the dummy variable for the largest chain (ICA), CHAIN_1, is significant. The higher prices could be due to that ICA stores are perceived to be of higher quality, have a higher cost level, or extra market power due to being the largest chain, but with the data at hand we are unable to distinguish between the hypotheses.

Regional variables are also significant and conform to our prior expectations. LOG(POPDENSITY), our primary proxy for differences in costs of sales space, has the expected positive influence on prices. Both the proxy variables for transport costs, the dummy variables COUNTRYSIDE and DISTANTREGION, are positive and significant. INCOME is positive but insignificant in (2).

Prices in the Gothenburg region are about 10 percent lower than in Stockholm, and 5 percent lower than in the rest of the country. This difference in prices between Sweden's two largest urban areas stands out, as one would expect the costs of sales space to be similar. Furthermore, prices are low in the area between Gothenburg and Norway, as evidenced by the negative coefficient on WEST. Below we argue that this is not due to lower transport costs. Instead, this can be explained by the area's closeness to Norway, which allows some large stores to buy from alternative suppliers and thereby undermine the market power of the Swedish chains. However, the same effect is not found for the area nearest to Denmark, SOUTH, where prices are slightly higher than the rest of the country. This finding goes against our prior that this would be the region where it is the easiest for large stores to take delivery from foreign suppliers.

Overall, the adjusted R-square of the regressions is about 0.35. In regressions (not reported) with a constant and only market structure-, store specific-, and regional demand/cost variables, the adjusted R-squares are 0.06, 0.25, and 0.11, respectively. This strongly suggests that most of the variation in prices is due to other factors than our measures of market structure. Indeed, the marginal increase in adjusted R-square from adding market structure variables to a specification with both store specific and regional variables is only 0.02.

In (3) and (4) we test if the results are sensitive to our definition of a local market. In particular since one could argue that competition between stores is localized in large markets, which would imply that HERF_STORE and HERF_CHAIN are measured at a too high level of aggregation. Overall, the most coefficients change only to a minor extent when markets with more than 20 stores or urban markets are excluded. While the coefficient on HERF_STORE is robust to exclusion of markets with many stores, it fails to be significant when one also excludes the urban markets. HERF_REGION remains highly significant in both subsamples.

Store price level: big basket

In (5) we use PRICE_BB as the dependent variable. Since there are no observations from Gothenburg and the south, the corresponding dummy variables are omitted. Most of the coefficients on store specific variables are statistically significant and similar to those in (2). For instance, prices are three percent lower in BIGSTORE_A and two percent higher at CHAIN_1, and prices are falling in LOG(REVENUE). The coefficients on the crude geographical dummy variables (COUNTRYSIDE, DISTANTREGION, STOCKHOLM, WEST) are also similar in magnitude. However, the coefficients on the continuous measures of market structure and population density are statistically insignificant. The differences between (2) and (5) need some comments.

We argue that it is the narrow coverage of the PRICE_BB data that precludes tracing any effect of market structure on price levels in (5). As noted above, PRICE_BB is collected in only 40 municipalities (out of 288), mostly in towns with 20000-50000 inhabitants in the west and middle of Sweden. This gives a limited geographical variation compared to PRICE, which is from localities of all sizes in 261 municipalities that represent all 70 regions. Hence, there will be much less variation in market structure variables to estimate the interesting coefficients in (5). In contrast, the fact that both PRICE and PRICE_BB are from a large number of different stores (1565 and 357, respectively) provides sufficient variation to estimate store specific coefficients, which were also found to be similar in (2) and (5).

Under this explanation, it is the selection of areas in (5) that is unrepresentative rather than the selection of products in (2). Thus, restricting attention to the 40 municipalities in (5) but using the stores for which we have information on PRICE should give results that are similar to those in (5). The results are found in (6). Most importantly, none of the market structure variables are significant (with the exception of MSBIGSTORE_B which is weakly significant). At the same time, most store specific variables are similar to (5). This lends support to the argument that it is the few geographical areas that is behind the differences between (2) and (5). The importance of having a large geographical variation in tracing relatively small effects of market structure on prices also sheds some light on why previous studies of retail food prices that have relied on samples with little geographical variation (e.g. Newmark, 1990, and Claycombe and Mahan, 1993) have had problems obtaining statistically significant results.

As a further test of whether the two prices are systematically different, column (7) uses the ratio of PRICE_BB to PRICE as the dependent variable. As noted in Section 2, PRICE_BB is constructed using actual transaction prices for less well-defined products while PRICE contains the normal prices for few but very specific products. One could make the argument that the wider selection in large stores gives the consumer greater flexibility in choosing the cheapest brand of a product, which would imply e.g. a negative coefficient on LOG(REVENUE). Moreover, if there are more occasional sales in localities where there is intense competition we expect a negative coefficient on HERF_STORE. In (7), only the three coefficients on BIGSTORE_A, BIGSTORE_B, and LOG(REVENUE) are statistically significant. However, the first two coefficients are positive and the third negative although all were expected to be negative. Excluding LOG(REVENUE) from the regression (results not shown) makes the other two variables insignificant, and vice versa. This suggests that the significance of the three variables in (7) is due to multicollinearity - both store formats are to a large extent defined by the revenue. Overall, the pattern is consistent with the notion that the prices of the five well-defined products used for PRICE are sufficient to give an unbiased picture of the price level in a store.

Store price levels: individual products

In Table 5 we use prices of individual products, PRICE_X, as the dependent variables. The signs and magnitudes of most coefficients correspond closely to those in Table 4.

Table 5 about here

HERF_STORE has a positive coefficient, except for sugar, but is only significant for one product (bread). As in Table 4, HERF_CHAIN tends to be negative but is never significant. The concentration at the regional level is positive and significant for all products except cocoa. Again, large stores hold lower prices, which has a downward pressure on prices although the indirect effect is only occasionally significant.

Prices of four products are significantly lower in the Gothenburg and western areas (the effect is insignificant for detergent). As indicated above, one could argue that this is due to Gothenburg being the largest harbor such that transport costs, for imported goods, are lower than in the rest of the country. However, it is difficult to believe that transport costs for most products motivate 3-7 percent lower prices at the same time as prices are only occasionally higher in the most distant regions. Moreover, even prices for domestically produced products (e.g., crisp bread) are low in the area. We therefore argue that the low prices are due to more intense competition.

Since the signs and magnitude of other coefficients are similar to those reported in Table 4 we refrain from discussing them further. Taken together these results point to that, qualitatively, the impact of market structure for variation in grocery prices is not very sensitive to the product characteristics.

IV. Conclusions

In this paper we have examined variation in food prices across a panel of Swedish stores. We found that differences in competition intensity, measured by market structure variables, can explain part of the variation in food prices. However, most of the variation in prices is explained by store specific factors (e.g., store size and chain affiliation) and, to a lesser extent, factors related to cost levels in the area (costs of sales space and transport costs). These conclusions are based on the price of a basket with few, but well-defined, products. The effects of market structure on prices are not significant when we examine a basket with many, less specific, products. We argue that the geographical coverage of this alternative data set is insufficient to trace the relatively small effects of market structure on prices.

We found that although high store concentration in local retail markets is associated with higher prices this effect is, in percentage terms, small. Stated differently, you pay only a few percent higher prices for groceries at a local 'monopoly' than in a comparable store in a large market. The small percentage effects we find also shed some light on why previous studies have had problems in establishing any links between concentration and prices in food retailing - small coefficients and small samples make it difficult to detect statistically significant effects. At a more aggregate regional level, however, a higher degree of concentration of chains is associated with higher prices. The magnitude of the effect of regional chain concentration is 1-1.5 percent for the sample. One could speculate that the greater price effect of chain concentration is due to greater entry barriers at the chain level.

A final finding is that large stores keep low prices, which exerts some downward pressure on prices (less than one percent for most of the sample) in their vicinity. Our own prior, we believe shared by many, was that hypermarkets and large supermarkets would have a strong competitive effect on retail food prices. The reason is that the large stores take their sales from other stores that must respond, either by meeting price competition or by exiting the market. The results point to the latter response, which is also supported by the long downward trend in the number of grocery stores. This has lead to calls from some interest groups for stricter application of zoning regulations to limit the number of hypermarkets and other large store formats (i.e. to raise entry barriers). It is an open question whether local differences in the enforcement of zoning regulations cause differences in market structure and contribute to the observed price variation. Although the measurement of such entry barriers is difficult, it would be an interesting topic for future research.

Throughout the paper we have stressed that in percentage terms the price effects of changes in market structure seem small. Nevertheless, given that food is a highly important part of most households' expenditures (about 15 percent in Sweden) it is necessary to look at the aggregate effect. Total food consumption in Sweden amounted to SEK 117 billion (approximately USD 15 billion) in 1997 which implies that one percent higher prices corresponds to SEK 1170 million. Thus even though the price effects of concentration are small in food retailing they may have nontrivial welfare implications.

References

Asplund, M and Sandin, R. (1999), Competition in Interrelated Markets: An Empirical Study, *International Journal of Industrial Organization 17*, 353-369.

Berger, A. N. and Hannan, T.H. (1989), The Price-Concentration Relationship in Banking, *Review of Economics and Statistics 71*, 291-299.

Borenstein, S. and Shepard, A. (1996), Dynamic Pricing in Retail Gasoline Markets, *RAND Journal of Economics 27*, 429-451.

Bresnahan, T. F., and P. C. Reiss, (1991), Entry and Competition in Concentrated Markets, *Journal of Political Economy 99*, 977-1009.

Claycombe, R.J., and Mahan, T.E. (1993), Spatial Aspects of Retail Market Structure: Beef Pricing Revisited, *International Journal of Industrial Organization 11*, 283-291.

Cotterill, R. W. (1986), Market Power in the Retail Food Industry: Evidence from Vermont, *Review of Economics and Statistics 68*, 379-386.

Cotterill, R. W. (1993), Introduction and Methodological Overview, in R.W. Cotterill (ed), *Competitive Strategy Analysis in the Food System*, Westview Press, Boulder, 3-22.

Fisher, F.M. (1989), Games Economists Play: A Noncooperative View, *RAND Journal of Economics 20*, 1-16.

Giulietti, M. and Waterson, M. (1997), Multiproduct Firms' Pricing Behaviour in the Italian Grocery Trade, *Review of Industrial Organization 12*, 817-832.

Gripsrud, G. (1982), Price Behavior and Store Size in Grocery Retailing, *Scandinavian Journal of Economics 84*, 471-482.

Marion, B. W. (1998), Competition in Grocery Retailing: The Impact of a new Strategic Group on BLS Price Increases, *Review of Industrial Organization 13*, 381-399.

Nevo, A. (2001), Measuring Market Power in the Ready-to-eat Cereal Industry, *Econometrica 69*, 307-342.

Newmark, Craig M. (1990), A New Test of the Price-Concentration Relationship in Grocery Retailing, *Economics Letters 33*, 369-373.

Sutton, J. (1990), Explaining Everything, Explaining Nothing? Game Theoretic Models in Industrial Economics, *European Economic Review 34*, 511-530.

Walsh, P. and Whelan, C. (1999), Modelling Price Dispersion as an Outcome of Competition in the Irish Grocery Market, *Journal of Industrial Economics 47*, 325-343.

Weiss, Leonard, 1989, *Concentration and price*, The MIT Press, Cambridge, Mass.

Table 1. Definitions and data sources.

Variable	MEAN (ST.DEV)[a] where applicable	Definition and source [b]
PRICE_X	1: 100.0 (10.9) 2: 100.0 (8.83) 3: 100.0 (17.5) 4: 100.0 (11.2) 5: 100.0 (10.1)	Store level price index of product X in year t. It is defined as the nominal price of product X at the store divided by the average nominal price for the product. X=1: washing-up detergent (Yes, 0.5liter), X=2: sugar (no specific brand, 2kg), X=3: bread (Wasa Husman, 500g), X=4: fish roe spread (Kalles Kaviar, 190g), and X=5: cocoa (Fazer, 200g). Source: PRO, Pensionärernas Riksorganisation.
PRICE	100.0 (9.07)	Store level price index in year t. The index is the average of PRICE_X, X=1,..,5. Where the price of one or more products is missing the index is based on fewer observations.
PRICE_BB	100.0 (8.12)	Store level price index for big basket of products in survey t. It is the ratio of the nominal price of the basket, Z, to the number of products included, N, normalized by the average Z/N at t. Source: Konsumentverket ("Hushållens Matinköp", various issues).
REVENUE	4.37 (4.42)	Store revenue in 10,000,000*SEK, grouped in 19 classes. In 1996 the upper bounds on the first 18 size classes are: 0.075, 0.15, 0.25, 0.35, 0.45, 0.55, 0.7, 0.9, 1.25, 1.75, 2.25, 2.75, 3.50, 4.50, 5.50, 6.75, 8.75, 10.0. Store revenue greater than 10.0 are recorded as is. Source: DELFI. (In Jan 1996 6.95 SEK= 1.00 USD)
STORETYPE		Each store is classified according to type. The types are: hypermarket, department store, large supermarket, small supermarket, other grocery store (two different), convenience store, traffic store, and seasonal store. Source: DELFI.
BIGSTORE_X	A: 0.035 (0.184) B: 0.345 (0.475)	Dummy variables for the two largest store formats. If STORETYPE is hypermarket (in a Swedish context roughly stores with annual revenue exceeding SEK 100 million and with a sales space greater than 1000 square meters) then BIGSTORE_A equals one. BIGSTORE_B takes the value one if STORETYPE is department store or large supermarket (annual revenue exceeding SEK 50 million).
CHAIN_X	1: 0.440 (0.496) 2: 0.365 (0.481) 3: 0.179 (0.384)	The store's primary wholesaler. In most cases wholesaler corresponds to chain affiliation, although a wholesaler may also sell to some stores that operate under different brand names. From information in Små företag och konkurrenslagen, Ds 1998:72 Bilaga 3, we get the following chains: ICA (X=1), KF (X=2), DAGAB (X=3), KIAB, Bergendahl, Rudolf Persson, and other or unknown. Source: DELFI.
HERF_STORE	0.304 (0.237)	Herfindahl index (the sum of squared market shares) of store concentration, calculated from REVENUE in the LOCATION. We assume that store revenues are at the upper bound.
HERF_CHAIN	0.477 (0.183)	Herfindahl index of chain concentration, calculated from REVENUE, in the LOCATION.
HERF_REGION	0.365 (0.054)	Herfindahl index of chain concentration, calculated from REVENUE, in the REGION.
MSBIGSTORE_X	A: 0.063 (0.108) B: 0.390 (0.198)	Market share of the largest store formats, BIGSTORE_A and BIGSTORE_B, in the MUNICIPALITY, calculated from REVENUE.
INCOME	1.45 (0.151)	Per capita income for 1996, measured in 100000*SEK, in the MUNICIPALITY. Source: Statistics Sweden.
POPDENSITY	306.7 (814.4)	Population density, measured by the ratio of population to square kilometers, in the MUNICIPALITY. Source: Statistics Sweden.
COUNTRYSIDE	0.170 (0.375)	Dummy variable taking the value one if MUNICIPTYPE is farm area or rural area.
DISTANTREGION	0.084 (0.277)	Dummy variable taking the value one if REGION is in the northern inland (A-regions 63, 64, 66, 67, 68, 69 and 70).
URBAN	0.185 (0.388)	Dummy variable taking the value one if MUNICIPTYPE is city or suburb.
STOCKHOLM	0.153 (0.360)	Dummy variable taking the value one if REGION=1.
GOTHENBURG	0.016 (0.126)	Dummy variable taking the value one if REGION=33.
WEST	0.061 (0.239)	Dummy variable for the area north and east of Gothenburg (A-regions 34, 35, 36, and 37).
SOUTH	0.058 (0.233)	Dummy variable for the area near the Danish border (A-regions 26, 27, 28, 29, 30, 31, and 32)
LOCALITY		Name of the locality ("ort") where the store is located. In total there are 1396 localities in the data. (The locality usually corresponds to a postal area.) Source: DELFI.
MUNICIPALITY		Standard municipality ("kommun") classification as of 1996, in total 288. Source: Statistics Sweden.
MUNICIPTYPE		Each municipality is classified according to type. The types are: city (Stockholm, Gothenburg, Malmoe), suburb (36), big town (25), medium town (41), industrial (51), farm area (40), rural area (31), big other (28), and small other (33). Source: Statistics Sweden.
REGION		Standard region ("A-region"). An A-region is an aggregate of nearby municipalities, in total 70. Source: Statistics Sweden.

a) The means and standard deviations correspond to the sample of stores for which PRICE are recorded.

Table 2. Descriptive statistics. For the non-price variables the data corresponds to the stores for which PRICE is recorded.

	PRICE	PRICE_BB	STORES	HERF_ STORE	HERF_ CHAIN	HERF_ REGION
MEAN	100.0	100.0	23.9	0.305	0.477	0.365
ST.DEV	9.07	8.10	41.4	0.237	0.237	0.0541
NOBS	3714	743	3714	3714	3714	3714
MIN	77.2	74.2	1	0.0145	0.220	0.252
10^{th}	87.4	89.6	2	0.0519	0.324	0.307
20^{th}	92.2	93.4	4	0.102	0.344	0.314
25^{th}	94.0	94.6	4	0.124	0.355	0.320
30^{th}	95.8	95.9	5	0.142	0.363	0.328
40^{th}	97.6	98.6	6	0.195	0.383	0.338
MEDIAN	100.2	100.8	8	0.265	0.413	0.355
60^{th}	102.6	102.8	13	0.324	0.458	0.373
70^{th}	104.5	104.6	18	0.377	0.503	0.392
75^{th}	105.4	105.6	23	0.411	0.524	0.394
80^{th}	107.4	106.6	33	0.460	0.560	0.401
90^{th}	111.4	109.7	56	0.580	0.722	0.449
MAX	148.9	135.6	234	1.000	1.000	0.562

Table 3. Relation between the number of stores in the market and PRICE.

STORES	PRICE MEAN	PRICE MEDIAN	PRICE STDEV	PRICE MAX	PRICE MIN	NOBS
1	103.3	103.9	6.7	127.5	87.7	171
2	103.7	102.9	7.7	133.8	84.1	235
3	101.8	101.8	7.2	125.6	80.7	249
4	101.4	101.7	7.2	130.6	77.2	337
5	100.8	100.8	7.2	121.1	81.8	302
6	101.0	100.9	8.3	131.7	81.5	243
7	99.8	101.1	8.9	123.9	82.0	178
8	100.0	101.1	8.3	130.9	81.6	163
9	99.9	99.3	8.4	124.9	81.7	104
10	97.8	97.8	8.8	118.0	81.9	79
11	100.7	100.4	10.2	126.1	82.9	67
12	95.6	95.4	9.2	125.6	77.4	79
13	98.2	94.9	11.8	148.9	79.3	101
14	98.2	97.0	11.1	129.7	79.8	91
15	96.1	96.3	9.1	117.6	82.3	47
16	98.4	97.4	9.4	120.3	80.0	62
17	98.4	99.8	8.3	115.1	81.5	57
18	95.9	94.7	10.8	122.5	81.5	47
19	100.9	102.4	9.5	131.9	82.4	42
20	94.8	93.2	8.1	110.4	81.4	26
>20	98.7	98.1	10.2	137.2	78.3	1034

Table 4. Regressions results. (Standard errors in parenthesis.)[a]

VARIABLE	LS POOLED PRICE	RANDOM EFFECTS PRICE	RANDOM EFFECTS PRICE	RANDOM EFFECTS PRICE	RANDOM EFFECTS PRICE_BB	RANDOM EFFECTS PRICE	RANDOM EFFECTS PRICE_BB/ PRICE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HERF_STORE	2.14**	3.11**	3.01*	2.00	3.81	1.05	0.0950
	(1.07)	(1.38)	(1.55)	(1.60)	(3.89)	(3.06)	(0.0982)
HERF_CHAIN	-1.33	-1.26	-1.25	0.187	-6.54	0.506	-0.136
	(1.35)	(1.70)	(1.74)	(1.84)	(5.16)	(3.53)	(0.126)
HERF_REGION	9.26***	10.8***	12.3***	10.9***	-8.23	-1.99	0.101
	(2.86)	(3.53)	(3.85)	(3.79)	(8.21)	(8.14)	(0.170)
MSBIGSTORE_A	-1.65	-2.81*	-2.56	0.0420	1.61	-2.26	0.0485)
	(1.27)	(1.64)	(1.93)	(2.43)	(3.71)	(3.89)	(0.0872)
MSBIGSTORE_B	-1.34*	-2.58***	-2.72***	-2.35**	0.0670	-4.22*	0.00529)
	(0.728)	(0.937)	(0.986)	(1.04)	(2.63)	(2.53)	(0.0579)
BIGSTORE_A	-4.67***	-4.04***	-4.19**	-4.41**	-3.31**	-3.37*	0.0850**
	(0.798)	(1.05)	(1.63)	(1.75)	(1.64)	(1.84)	(0.0336)
BIGSTORE_B	-1.92***	-1.65***	-1.84***	-1.82***	-1.04	-2.56***	0.0427**
	(0.358)	(0.452)	(0.537)	(0.575)	(0.821)	(0.85)	(0.0189)
LOG(REVENUE)	-3.71***	-3.53***	-3.40***	-3.48***	-4.08***	-3.66***	-0.0360***
	(0.191)	(0.236)	(0.268)	(0.281)	(0.524)	(0.440)	(0.0138)
CHAIN_1	3.42***	3.04***	2.68***	2.94***	1.66**	1.63*	-0.0288
	(0.334)	(0.459)	(0.543)	(0.570)	(0.771)	(0.903)	(0.0182)
CHAIN_2	0.914***	0.395	-0.111	0.187	2.10**	-1.23	-0.0217)
	(0.341)	(0.473)	(0.553)	(0.577)	(0.870)	(0.923)	(0.0189)
LOG(POPDENSITY)	0.505***	0.679***	0.756***	0.448	-0.502	0.37	-0.00614
	(0.133)	(0.186)	(0.225)	(0.298)	(0.510)	(0.402)	(0.0118)
COUNTRYSIDE	2.25***	2.15***	1.87***	2.23***	1.81	5.02***	-0.00432
	(0.435)	(0.621)	(0.627)	(0.656)	(1.46)	(1.87)	(0.0331)
DISTANTREGION	2.47***	2.05***	2.66***	2.09**	3.01**	1.98	0.0190)
	(0.520)	(0.714)	(0.802)	(0.847)	(1.37)	(1.59)	(0.0320)
INCOME	3.22**	2.36	2.02	6.69**	1.07	5.99	0.0565
	(1.34)	(1.86)	(2.05)	(2.98)	(5.04)	(5.47)	(0.116)
STOCKHOLM	6.33***	6.08***	5.32***		5.49***	5.87***	-0.0334
	(0.642)	(0.907)	(1.04)		(1.30)	(2.01)	(0.0324)
GOTHENBURG	-3.73***	-4.49***	-4.41***				
	(0.907)	(1.23)	(1.48)				
WEST	-3.56***	-3.63***	-2.90***	-2.59***	-5.54***	-3.99***	-0.0299
	(0.517)	(0.773)	(0.848)	(0.815)	(1.09)	(1.43)	(0.0238)
SOUTH	2.03***	1.64**	2.52***	2.90***			
	(0.578)	(0.792)	(0.955)	(0.970)			
CONSTANT	92.3***	92.6***	92.7***	86.7***	110.1***	94.9***	1.04***
	(2.27)	(3.06)	(3.36)	(4.57)	(7.48)	(8.46)	(0.172)
SAMPLE	FULL	FULL	STORE<20	STORE<20 URBAN=0	FULL	SEE NOTE c)	FULL
R2 ADJ	0.362	0.362	0.332	0.338	0.420	0.428	0.125
NOBS	3705	3705	2672	2302	743	1105	327
GLS VAR(e)[b]		23.2	22.7	23.4	18.7	23.0	0.00421
GLS VAR(u)[b]		32.4	32.4	25.1	19.7	36.4	0.00364

a) Variables starred with *** are significant at the 1 percent level, with ** at the 5 percent level and with *at the 10 percent level.
b) Generalized least squares variance of error terms in random effects specification: $PRICE_{it}=b\mathbf{W}_{it}+u_i+e_{it}$.
c) PRICE observations from municipalities with at least one PRICE_BB observation.

[1] There is, however, a related literature that examines how markups vary across product groups/brands. Giuletti and Waterson (1997) use Italian price data and estimate markups for different product groups in different store types. Walsh and Whelan (1999), employ Irish price data for a number of product groups and a large number of brands to measure price dispersion. Gripsrud (1982) uses Norwegian data to examine how the relative price level of various products varies between retailers of different size. The key difference from our approach is that these studies do not attempt to measure impact of local and store specific factors on the price level in a given store. Indeed, these studies use price data that is aggregated over many stores.

[2] The motivation for choosing the spring survey for 1996 was to examine the pass-through of a large reduction in VAT (from 21 to 12.5 percent) in January 1996. We found that the pass-through, on average, was almost complete and mostly independent of market structure variables

[3] In Sweden the price tags of a good that is on sale typically state both the price before the sale (the "normal" price) and the sales price. Practices on normal prices are specified in a 1993 agreement between the retail food industry and a government agency. The normal price should not be misleading, and the sales price should be valid only for a limited time (up to 4 weeks) and be significantly lower (at least 10 percent) than the normal price.

[4] Talking to the chains, ICA claim that prices are set by the store manager whereas for KF prices are set centrally (but not necessarily equal across the country). We have examined the regional variation in prices across stores with the same chain affiliation. The hypothesis is that if the chain set prices centrally then there would be low variation in prices for stores that are in the same region and belong to the same chain. The data shows substantial price dispersion within all chains, but about 50 percent lower for KF stores than for ICA and DAGAB stores. The same conclusion holds when we, in addition, condition on the store type.

[5] Comparing the distributions of market structure variables corresponding to PRICE_BB (not shown) with Table 2 reveals that PRICE_BB are from larger localities: the median locality has 20 stores and only 10 percent of the observations are from localities with four or fewer firms.

[6] In some recent empirical papers (e.g. Nevo, 2001), structural models of demand and supply are estimated under the assumption that the observed prices correspond to the Nash equilibrium in a one-shot price setting game. The data set we have been able to assemble is not suited for such a study.

[7] In regressions (not reported) where HERF_STORE is excluded HERF_CHAIN is positive and weakly significant. This is explained in part by the multicollinearity between the two variables in small markets where, as shown in Table 3, most of the price effect lies.

[8] One might suspect a potential problem in using LOG(REVENUE) as a measure of store size since, by definition, revenue is partly a function of prices at the store. A better measure is store space but in our data it is only available from 1995 and has many missing observations. Regressions with data from 1995-1997 and REVENUE replaced by sales space, however, look very similar to those reported in Table 4 and Table 6.