Food prices and market structure in Sweden *

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Abstract

This paper examines retail grocery price levels with a large panel of stores that operate in Swedish local markets. We explain price variation across grocery stores by market structure variables to capture differences in competition intensity and a number of store and region specific factors. Higher local concentration of stores, higher regional wholesaler concentration and a lower market share of large stores all lead to higher prices in a market. No significant price effect is found of chain concentration at the local market level. Overall, the impact of market structure variables on food prices in Sweden is small in percentage terms.

Keywords: Food prices, firm concentration, market structure, price competition, grocery retail, grocery wholesale.
JEL codes: D43, L13, L81.

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1. 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 stores in local Swedish grocery markets.

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, degree of product differentiation) but also on the potential for long-run implicit collusion. See Fisher (1989) and Sutton (1990) for critical views on the ability of oligopoly theory to generate testable hypotheses, in particular ones that are robust across industries.

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), Bresnahan and Reiss (1991), Claycombe (2000), Cotterill (1986), and Kwoka (1984); Weiss (1989) surveys early studies. In agreement with the basic prediction, most find a 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.

Food is a principal component of household expenditures, which implies that even if market power only results in only a few percent higher prices the welfare effects can be very large. Our data allows a study which in most respects is different from previous studies of competition in food retailing. First, our price information contains prices of individual 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 Sweden, as well as most other European countries, is dominated by a few chains. Internationally, there is also a widespread belief of further consolidation in the sector which may result in yet higher concentration.[1] We are also able to evaluate the claim that large stores exert a downward pressure on prices in the area.

To our knowledge this study is the first econometric analysis of price levels and competition in European food retail markets.[2] Cotterill (1993) provides a survey of studies on US data. Most closely related to ours are studies that make use of variation in prices across regional markets. In almost every case the number of observations is severely 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 US 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.

Overall, our results point to a statistically significant effect from market structure on price levels. 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 a significant presence of large stores in an area tend to depress price levels.

2. Data

We study prices across grocery stores in Sweden over the period 1993-1997. Table 1 details the variable definitions and the data sources.

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[1] See for instance Financial Times, 22 May 2000, "Blood on the supermarket floors".

[2] Gripsrud (1982) and Giuletti and Waterson (1997) examine differences in pricing policy for different types of food products on Norwegian and Italian data respectively.

Table 1 about here

Prices

We use store level prices of individual products. The Pensioners' National Organization gave us access to their price survey forms. 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 participating members (several hundred in 1996) check the prices on roughly thirty items in the store where they regularly shop and, if possible, in some nearby stores. 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). 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 products with different characteristics (washing-up detergent: multinational producer, sugar: high transport costs, bread: agricultural product, fish roe spread: uniquely Swedish, cocoa: fluctuating world market price) with a unique brand (except sugar) that were included in each survey.[3] [4]

The recorded price of a product is its normal price (national regulation requires that any product which is on sale also has its normal price stated) which 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. From these a yearly price index for each store is constructed, denoted PRICE (see Table 1 for the exact definition) which is neutral to inflation. For comparison we also report regressions with price indexes of the individual products, PRICE_X.

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 years; 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, given that no control is made for factors that might affect prices such as changes in

[3] Several of the other products were less well defined (e.g., pork chops-quality differences, soap-different producers). Others were available in different sizes (potatoes, toilet paper).

[4] 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

chain affiliation or market structure. For individual products the corresponding price correlations are between 0.5 and 0.7. The second check is to compare our index to the price of a more comprehensive basket from a relatively limited number of stores, collected by the Swedish government consumer agency. This basket gives the price in a given store of monthly food consumption for a representative family and includes 157 items. It includes occasional sales prices and store brands but does not correct for the fact that not all products are available in each store. The correlation between the price of that basket (for 1997) and our index was 0.59 for the 85 stores where we had price information from both sources. Bearing in mind the differences in data sources a correlation of 0.59 must be considered very high. The conclusion from the two checks is that PRICE can be used to approximate the general price level at the store.

Firms

The store specific data contains yearly (1993-97) 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, hypermarket, supermarket, grocery, convenience store), primary wholesaler, and the exact location. The identity of a store is based on its address; a change in name or chain affiliation does not alter the identity.

The Swedish food retailing sector is highly concentrated and dominated by three groupings; ICA, KF and DAGAB.[5] Each of these groups has a particular structure. The largest group is ICA (in 1996 there were 3155 affiliated stores with a 45 percent national market share) which is a cooperation of independent stores who presently are allowed to cooperate on buying, transport and marketing.[6] 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 advertised special offers. KF is a centrally coordinated group of regional consumer cooperatives (1253 stores, 25 percent market share). In contrast to ICA, the regional cooperatives can, in principle, decide on prices at the individual store. Some 2150 stores, most

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complete. There was only weak evidence that the price change in an individual store could be explained by market structure variables. Results are available upon request.

[5] In a European perspective the high concentration is not unique. To exemplify, the three firm concentration ratios for Denmark, Norway, Finland, Netherlands, Switzerland, Great Britain and Germany are 66, 75, 67, 67, 40 and 50 percent, respectively (source: The Swedish Ministry of Trade and Industry, 1998, Ds 1998:72, Appendix, p.37).

[6] Following the new competition laws in Sweden, effective from 1993, the cooperation of independent ICA stores was given a temporary exemption. Proposed changes to the competition laws (Näringsdepartementet, 2000) will eliminate this exemption.

of them independent convenience stores, are affiliated with DAGAB, which has a 24 percent market share. In addition to these groups there are a number of independent chains that in some regions (primarily in the southern and western parts of the country) make up a significant share of sales but at a national level have a joint market share of only 6 percent. Somewhat loosely, we will refer to ICA, KF, and DAGAB as "chains" although "wholesaler" might be more appropriate.[7]

Market structure and the intensity of competition

As mentioned in the introduction, in empirical studies of competition in regional markets within the same industry, market structure variables (firm concentration, number of firms, etc) are often significant determinants of price levels (Schmalensee, 1989 p.988, Weiss, 1989).

Most theories of oligopolistic competition suggest that, *ceteris paribus*, firms with few competitors, or firms that operate in more concentrated markets, have more market power and thereby set higher prices. However, outside such general predictions 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.[8] 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.

In theoretical models of oligopolistic competition, a "market" contains only firms that compete for the same set of consumers. This implies that, strictly speaking, even broad predictions on how price is related to market structure are valid only insofar as the market is correctly defined. A major practical problem is therefore to delineate market boundaries.

In our data, a narrowly defined market is the location (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 and given that its consumers are roughly within the location, market structure should be measured at the store level. To explain

[7] The term "chain" is misleading in the sense that although a store takes deliveries from ICA, KF, or DAGAB, some of them are operated independently and others under a common name (e.g., there are many stores operating under the brand names Hemköp and Vivo that are all supplied by DAGAB).

[8] In some recent empirical papers on competition (e.g., Berry et al., 1995, and Nevo, 2000), structural models of demand and supply are estimated under the assumption that the observed prices correspond to the Nash equilibrium prices in a one-shot Bertrand competition in differentiated products. To do so on grocery stores one would need far more detailed data on the characteristics of each store, the geographical and income distribution of consumers, as well as measures of the geographical distance between stores in the same market.

variation in PRICE by competition across stores in the location we use the Herfindahl index based on store revenue, HERF_STORE.

Since each store is associated with a chain it is plausible that prices also reflect the composition of chains in the location. Under the assumption that all stores that belong to a given chain have the same owner, PRICE would be explained by the concentration at the chain level. Again we use the Herfindahl index, HERF_CHAIN. In grocery retailing, where stores within several chains have separate owners endowed with some degree of discretion in their pricing decision, the effect on PRICE will be less clear-cut. The reason is that stores belonging to the same chain are less differentiated (compared to stores belonging to different chains) which tends to intensify short-run price competition between them. Finding that prices are higher in markets with high concentration, measured at the chain level, therefore suggests that stores within the same chain compete less fiercely.

Although chains may be unable to directly control prices at the store level it is possible that they can let wholesale prices vary across regions in the country.[9] 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 is attractive in some other dimension (e.g., offer a wide product range). This implies that the market boundaries for large stores are wider than for other grocery stores. For this reason we define MSBIGSTORE_A and MSBIGSTORE_B to be the market share of hypermarkets and large supermarkets, respectively, in the municipality.

Other factors

Variation in prices will, in addition to the market structure variables, be explained by cost- and demand factors as well as store-specific factors such as store type, store size, and chain affiliation. In our study, as in most previous works on prices and market structure, we partly have to resort to aggregate measures.

[9] We believe that chains are (explicitly or implicitly) restricted in the amount they can let wholesale prices vary across stores in the same region. Of course, wholesale prices may differ across stores due to quantity discounts and transport costs, but unlikely due to the local competitive conditions.

The municipal is the standard area classification in Sweden, and the most disaggregated 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. We let the average income proxy for both differences in demand 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. Our best measure of these costs is the population density in the municipal. Differences in transport costs can to a large extent be captured by dummy variables for the most remote areas. In the 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 corresponding to the sample of stores for which we have information on prices.

Table 2 about here

From the table 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.[10,11] The distribution of prices is approximately symmetric; the Pearsonian coefficient of skewness is 0.17.

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[10] In the basket (from 156 stores) collected by the Swedish Government Consumer Agency the corresponding numbers indicate that the stores in 10^{th} and 90^{th} percentile have 10 percent lower and 9 percent higher prices than the mean, respectively.

[11] We have also examined the regional variation in prices across stores with the same chain affiliation. The hypothesis is that if prices are centrally set by the chain then there would be low variation in prices for stores that are in the same region and belong to the same chain. This is of particular interest since stores affiliated with the largest chain, ICA, by competition laws are prohibited from price cooperation. By comparing variation in both prices of individual products and PRICE, we find that there is fairly substantial price dispersion. Overall, the lowest price dispersion is for KF stores, which are allowed to set prices centrally; the dispersion among ICA and DAGAB stores is about 50 percent greater. The same conclusion holds when one, in addition, condition on the store type. We take this as evidence that pricing decisions at ICA stores are, to a first approximation, made at the store level. Further results are available upon request.

Most price observations are from markets with only a few stores where it is reasonable to assume that market structure is measured at level where 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.[12] Competition is most likely localized with several overlapping submarkets in some of the larger markets. At the chain level the markets are obviously far more concentrated. Here roughly 50 percent of the observations are from markets with HERF_CHAIN above 0.4. This is an immediate reflection of the limited number of chains that dominate the sector. This is also evidenced by the corresponding chain concentration at the regional level level, HERF_REGION, which ranges between 0.25 and 0.56. However, about 80 percent of price observations are from A-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 postal area with fewer than twenty stores.

Table 3 about here

Overall, there is a clear 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.

4. Results

We employ random effects estimators to explain the variation in PRICE and prices of individual products since there is little or no variation in the explanatory variables over time.

Store price level

Table 4 presents the estimated coefficients from price regressions. We begin by discussing the regressions on the full sample (the first two columns) where the point estimates

[12] In an interview survey Gripsrud and Gronhaug (1985) found that in a Norwegian town with 51 grocery stores the average store had three perceived competitors, and only about 25 percent felt they had more than five.

are similar but as Lagrange multiplier tests strongly favor the random effects specification we focus on the second column. The results in the last two columns 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.[13] This pattern 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.[14] 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.

Taking point estimates of HERF_STORE and HERF_REGION in the second column suggests that monopoly at the store and 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. With this as reference we get an increase in price of 1.0 percent. From this simple experiment we conclude that, in percentage terms, the price effects of regional chain concentration are small over most of the range covered in the sample. Performing 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.

[13] 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. We also experimented with a cross product of HERF_STORE and HERF_CHAIN, but the coefficient was not significant.

[14] The results do not change when HERF_REGION is defined at the more aggregate county (in total 25) level rather than the A-region level. However, the concentration at the more disaggregate municipal level does not help to explain variation in PRICE which would indicate that chains are unable price discriminate in such narrow areas.

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).[15] 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.[16]

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

Finally, there is a marked difference between the two largest urban areas in Sweden. Prices in the Gothenburg region are almost 10 percent lower than in Stockholm, and 5 percent lower than in the rest of the country. In particular, the difference in prices in Gothenburg and Stockholm is very substantial, as one would expect the costs of sales space to be similar.[17] Furthermore, prices are also lower 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 (or threat to buy) from alternative suppliers and thereby undermine the market power of the Swedish chains. As with the presence of large stores in general, this tends to have a downward pressure on prices in other stores as well. However, the same effect is not found for the area nearest to Denmark (including the third largest town, Malmoe), SOUTH, where prices are slightly higher than the rest of the country. This finding goes

[15] 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 onward, and in the years 1995-1997 there is 10 percent missing observations on this variable. 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.

[16] It is also conceivable that this is due to geographical differences not captured by the included regional variables (ICA being most dominant in the most sparsely populated areas). However, even in regressions on regional subsamples CHAIN_1 remains positive and significant.

[17] The very significant difference between Gothenburg and Stockholm is evident also from simple descriptive statistics on PRICE disaggregated by year and store type. The mean PRICE in a given year and store type is about 8-12 percent lower in Gothenburg (in hypermarkets the difference is smaller).

against our prior that the region closest to Denmark would be the one where large stores would have it easiest to take deliveries 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 regression with both store specific and regional variables is only 0.02. Our difficulties in explaining the regional dummies are also a testament to the limits of the analysis.

In the two last columns 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 20 stores, it fails to be significant when one also excludes the urban markets. HERF_REGION remains highly significant in both subsamples.

Store prices of individual products

In Table 5 we use prices of individual products, PRICE_X, as the dependent variables.[18] The signs and magnitudes of most coefficients corresponds closely to those established in Table 4

Table 5 about here

HERF_STORE has a positive coefficient, except for sugar, but is only significant for one product. As in Table 4, HERF_CHAIN tend to be negative but is never significant. The concentration at the regional level is positive and significant for four products. However, it is

[18] In Asplund and Friberg (1999) we estimated nominal prices for individual products on a year-to year basis and the results were qualitatively similar to those reported in Table 6. The problem in a panel data framework is not general inflation (the growth in CPI between adjacent surveys were 4.7, 0.2 and 0.8 percent) but the fact that the price of an individual product may show a development quite distinct from general inflation. For instance, the nominal retail price of cocoa is largely determined by the world market price of cocoa beans, whose price series is very different from the Swedish CPI.

insignificant for cocoa.[19] 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 therefore are lower than in the rest of the country, for imported goods. 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.

5. 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).

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’ compared to 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

[19] This is not an artifact of the panel estimator: the same is found in year-by-year regressions. We have no other explanation to the negative sign than it is driven by low price of the product at the largest chain (it is the only regression where CHAIN_1 shows up without a positive coefficient). The argument is that ICA, whose market share is highly important in calculation of HERF_REGION, holds a low price on the product and that it forces the other chains to respond.

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.

The pattern can be explained by ease of entry at the store level and significant entry barriers at the chain level. It is easy for an individual (or chain) to set up a new store. In their pricing decisions most store managers have substantial discretion such that there is price competition even between stores within the same chain. The price effects at the market level could then be attributed to the integer nature of the number of stores in a market. The regional variation in prices would thereby be caused by differences in wholesale prices; higher wholesale prices in regions where the chain concentration is relatively high. As opposed to the market level where entry of new stores tend to equalize prices, establishing a new chain in a region is associated with significant costs of building a distribution network and brand recognition.

A final finding related to market structure 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 reasoning behind is that the large stores take their sales from other stores that must respond, either by meeting price competition or exit the market. The results point to the latter response, which is also supported by the long downward trend in the number of grocery stores.

Throughout the paper we have stressed that in percentage terms the price effects seems small. Partly this is due to that all regions are highly concentrated, the within sample magnitude of the price effect is therefore small. Nevertheless, given that food is a highly important part of most households' expenditures it is necessary to look at the aggregate effect. Assume that there are two million households in Sweden, which on average spend SEK 5000 (roughly USD 600) on food per month. One percent higher prices then corresponds to SEK 600 per annum per household or an aggregate SEK 1200 million. Thus even though the price effects of concentration are small in food retailing they may have substantial welfare implications.

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Table 1. Definitions and data sources.

Variable	MEAN (ST.DEV)[a] where applicable	Definition and source
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.
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.
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)
LOCATION		Name of the location ("ort") where the store is located. In total there are 1396 locations in the data. (The location 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 prices are recorded.

Table 2. Descriptive statistics corresponding to the stores for which PRICE is recorded.

	PRICE	STORES	HERF_STORE	HERF_CHAIN	HERF_REGION	REVENUE
MEAN	100.0	23.87	0.3050	0.4772	0.3649	4.37
ST.DEV	9.075	41.37	0.2372	0.2371	0.0541	4.19
NOBS	3714	3714	3714	3714	3714	3705
MIN	77.24	1	0.01457	0.2209	0.2523	0.075
10^{th}	87.43	2	0.05193	0.3244	0.3070	0.90
20^{th}	92.26	4	0.1024	0.3448	0.3142	1.25
25^{th}	94.03	4	0.1245	0.3556	0.3204	1.75
30^{th}	95.80	5	0.1422	0.3630	0.3283	1.75
40^{th}	97.62	6	0.1954	0.3831	0.3386	2.25
MEDIAN	100.2	8	0.2656	0.4131	0.3552	3.50
60^{th}	102.6	13	0.3241	0.4589	0.3733	3.50
70^{th}	104.5	18	0.3774	0.5034	0.3923	4.50
75^{th}	105.4	23	0.4115	0.5247	0.3942	5.50
80^{th}	107.4	33	0.4608	0.5600	0.4017	6.75
90^{th}	111.4	56	0.5807	0.7225	0.4491	8.75
MAX	148.9	234	1.000	1.000	0.5622	48.00

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 with store price index, PRICE, as dependent variable.
(Standard errors in parenthesis.)

ESTIMATOR	LS POOLED	RANDOM EFFECTS	RANDOM EFFECTS	RANDOM EFFECTS
SAMPLE	FULL	FULL	STORE<20	STORE<20 URBAN=0
HERF_STORE	2.136**	3.106**	3.012*	2.000
	(1.074)	(1.382)	(1.548)	(1.605)
HERF_CHAIN	-1.331	-1.260	-1.248	0.187
	(1.353)	(1.702)	(1.745)	(1.841)
HERF_REGION	9.257***	10.761***	12.297***	10.891***
	(2.861)	(3.539)	(3.856)	(3.799)
MSBIGSTORE_A	-1.651	-2.806*	-2.562	0.042
	(1.268)	(1.640)	(1.929)	(2.432)
MSBIGSTORE_B	-1.342*	-2.578***	-2.721***	-2.351**
	(0.728)	(0.937)	(0.986)	(1.036)
BIGSTORE_A	-4.670***	-4.036***	-4.187**	-4.410**
	(0.798)	(1.055)	(1.632)	(1.747)
BIGSTORE_B	-1.919***	-1.655***	-1.845***	-1.818***
	(0.358)	(0.452)	(0.537)	(0.575)
LOG(REVENUE)	-3.709***	-3.532***	-3.404***	-3.478***
	(0.191)	(0.236)	(0.268)	(0.281)
CHAIN_1	3.418***	3.047***	2.684***	2.938***
	(0.3349	(0.459)	(0.543)	(0.570)
CHAIN_2	0.914***	0.395	-0.111	0.187
	(0.341)	(0.473)	(0.553)	(0.577)
LOG(POPDENSITY)	0.505***	0.679***	0.756***	0.448
	(0.133)	(0.186)	(0.225)	(0.298)
COUNTRYSIDE	2.253***	2.149***	1.873***	2.233***
	(0.435)	(0.621)	(0.627)	(0.656)
DISTANTREGION	2.473***	2.048***	2.665***	2.092**
	(0.520)	(0.714)	(0.802)	(0.847)
INCOME	3.223**	2.363	2.018	6.692**
	(1.339)	(1.859)	(2.054)	(2.978)
STOCKHOLM	6.328***	6.078***	5.318***	
	(0.642)	(0.907)	(1.044)	
GOTHENBURG	-3.732***	-4.487***	-4.413***	
	(0.907)	(1.235)	(1.482)	
WEST	-3.565***	-3.634***	-2.898***	-2.587***
	(0.517)	(0.773)	(0.848)	(0.815)
SOUTH	2.031***	1.645**	2.518***	2.902***
	(0.578)	(0.792)	(0.955)	(0.970)
CONSTANT	92.272***	92.656***	92.717***	86.738***
	(2.274)	(3.067)	(3.364)	(4.573)
R2 ADJ	0.362	0.362	0.332	0.338
NOBS	3705	3705	2672	2302
GLS VAR(e)[a]		23.2	22.7	23.4
GLS VAR(u)[a]		32.4	32.4	25.1

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: $PRICE_{it}=\beta \mathbf{W}_{it}+u_i+e_{it}$.

Table 5. Results from random effects-regressions (full sample) with prices of individual products, PRICE_X, as dependent variables. (Standard errors in parenthesis.)[a]

	SUGAR	BREAD	SPREAD	COCOA	DETERG
HERF_STORE	-0.365	6.877**	2.567	1.093	1.835
	(1.358)	(2.940)	(2.129)	(1.997)	(2.117)
HERF_CHAIN	1.482	-4.937	-3.610	-0.741	2.910
	(1.703)	(3.672)	(2.660)	(2.464)	(2.635)
HERF_REGION	10.254***	13.998*	10.404**	-4.295	18.153***
	(3.555)	(7.618)	(5.568)	(5.141)	(5.490)
MSBIGSTORE_A	-2.101	-5.476	-1.502	-2.715	-0.277
	(1.592)	(3.473)	(2.512)	(2.377)	(2.490)
MSBIGSTORE_B	-1.218	-4.347**	-2.652*	-1.638	-1.687
	(0.920)	(1.991)	(1.443)	(1.362)	(1.435)
BIGSTORE_A	-1.976*	-5.652**	-3.223**	-5.272***	-3.632**
	(1.020)	(2.232)	(1.648)	(1.541)	(1.596)
BIGSTORE_B	-1.068**	-2.864***	-1.107	-1.435**	-1.690**
	(0.451)	(0.971)	(0.709)	(0.654)	(0.697)
LOG(REVENUE)	-2.912***	-4.969***	-3.856***	-1.325***	-5.439***
	(0.236)	(0.511)	(0.370)	(0.349)	(0.366)
CHAIN_1	3.473***	4.278***	1.883**	-0.176	6.523***
	(0.429)	(0.942)	(0.683)	(0.660)	(0.687)
CHAIN_2	0.888**	-3.641***	-0.442	5.957***	0.277
	(0.439)	(0.965)	(0.700)	(0.676)	(0.705)
LOG(POPDENSITY)	-0.183	1.367***	0.702**	0.548**	0.700**
	(0.172)	(0.378)	(0.274)	(0.269)	(0.275)
COUNTRYSIDE	0.861	4.038***	2.574***	1.102	2.115**
	(0.570)	(1.260)	(0.906)	(0.889)	(0.920)
DISTANTREGION	5.299***	0.322	0.717	-2.363**	5.709***
	(0.664)	(1.450)	(1.0519	(1.042)	(1.064)
INCOME	5.432***	4.831	1.347	0.556	1.582
	(1.718)	(3.761)	(2.730)	(2.693)	(2.740)
STOCKHOLM	2.037**	8.533***	6.805***	6.126***	7.607***
	(0.834)	(1.832)	(1.325)	(1.308)	(1.337)
GOTHENBURG	-4.801***	-6.572***	-3.348*	-7.330***	0.312
	(1.149)	(2.525)	(1.822)	(1.747)	(1.820)
WEST	-4.179***	-6.588***	-2.733**	-3.513***	-1.021
	(0.694)	(1.547)	(1.117)	(1.095)	(1.127)
SOUTH	-1.266*	-0.163	2.650**	3.290***	3.779***
	(0.735)	(1.612)	(1.160)	(1.119)	(1.173)
CONSTANT	90.178***	89.597***	96.204***	98.808***	88.608***
	(2.897)	(6.301)	(4.576)	(4.440)	(4.573)
R2 ADJ	0.294	0.235	0.181	0.214	0.336
NOBS	3682	3630	3569	3412	3613
GLS VAR(e)[b]	38.7	149.7	75.8	63.0	65.8
GLS VAR(u)[b]	18.8	97.9	52.8	50.4	58.9

c) Variables starred with *** are significant at the 1 percent level, with ** at the 5 percent level and with *at the 10 percent level.

d) Generalized least squares variance of error terms in random effects specification: $PRICE\_X_{it}=\beta \mathbf{W}_{it}+u_i+e_{it}$.

Table 6. Results from random effects-regressions (full sample) with prices of individual products, PRICE_X, as dependent variables. (Standard errors in parenthesis.)[a]

	SUGAR	BREAD	SPREAD	COCOA	DETERG
HERF_STORE	-0.365	6.877**	2.567	1.093	1.835
	(1.358)	(2.940)	(2.129)	(1.997)	(2.117)
HERF_CHAIN	1.482	-4.937	-3.610	-0.741	2.910
	(1.703)	(3.672)	(2.660)	(2.464)	(2.635)
HERF_REGION	10.254***	13.998*	10.404**	-4.295	18.153***
	(3.555)	(7.618)	(5.568)	(5.141)	(5.490)
MSBIGSTORE_A	-2.101	-5.476	-1.502	-2.715	-0.277
	(1.592)	(3.473)	(2.512)	(2.377)	(2.490)
MSBIGSTORE_B	-1.218	-4.347**	-2.652*	-1.638	-1.687
	(0.920)	(1.991)	(1.443)	(1.362)	(1.435)
BIGSTORE_A	-1.976*	-5.652**	-3.223**	-5.272***	-3.632**
	(1.020)	(2.232)	(1.648)	(1.541)	(1.596)
BIGSTORE_B	-1.068**	-2.864***	-1.107	-1.435**	-1.690**
	(0.451)	(0.971)	(0.709)	(0.654)	(0.697)
LOG(REVENUE)	-2.912***	-4.969***	-3.856***	-1.325***	-5.439***
	(0.236)	(0.511)	(0.370)	(0.349)	(0.366)
CHAIN_1	3.473***	4.278***	1.883**	-0.176	6.523***
	(0.429)	(0.942)	(0.683)	(0.660)	(0.687)
CHAIN_2	0.888**	-3.641***	-0.442	5.957***	0.277
	(0.439)	(0.965)	(0.700)	(0.676)	(0.705)
LOG(POPDENSITY)	-0.183	1.367***	0.702**	0.548**	0.700**
	(0.172)	(0.378)	(0.274)	(0.269)	(0.275)
COUNTRYSIDE	0.861	4.038***	2.574***	1.102	2.115**
	(0.570)	(1.260)	(0.906)	(0.889)	(0.920)
DISTANTREGION	5.299***	0.322	0.717	-2.363**	5.709***
	(0.664)	(1.450)	(1.0519	(1.042)	(1.064)
INCOME	5.432***	4.831	1.347	0.556	1.582
	(1.718)	(3.761)	(2.730)	(2.693)	(2.740)
STOCKHOLM	2.037**	8.533***	6.805***	6.126***	7.607***
	(0.834)	(1.832)	(1.325)	(1.308)	(1.337)
GOTHENBURG	-4.801***	-6.572***	-3.348*	-7.330***	0.312
	(1.149)	(2.525)	(1.822)	(1.747)	(1.820)
WEST	-4.179***	-6.588***	-2.733**	-3.513***	-1.021
	(0.694)	(1.547)	(1.117)	(1.095)	(1.127)
SOUTH	-1.266*	-0.163	2.650**	3.290***	3.779***
	(0.735)	(1.612)	(1.160)	(1.119)	(1.173)
CONSTANT	90.178***	89.597***	96.204***	98.808***	88.608***
	(2.897)	(6.301)	(4.576)	(4.440)	(4.573)
R2 ADJ	0.294	0.235	0.181	0.214	0.336
NOBS	3682	3630	3569	3412	3613
GLS VAR(e)[b]	38.7	149.7	75.8	63.0	65.8
GLS VAR(u)[b]	18.8	97.9	52.8	50.4	58.9

e) Variables starred with *** are significant at the 1 percent level, with ** at the 5 percent level and with *at the 10 percent level.

f) Generalized least squares variance of error terms in random effects specification: $PRICE\_X_{it}=\beta \mathbf{W}_{it}+u_i+e_{it}$.