Competition In the Swedish Food Retail Industry

An empirical pilot study estimating the mean price-cost markup

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Abstract
This thesis studies competition in the Swedish food retail industry by examining the presence of market power. Aggregated data for food retail firms on a national level for the years 1998-2009 is used to estimate the mean price-cost markup. The results give support to the presumption that Swedish food retail firms enjoy market power, which they use to set prices higher than the marginal cost. Combining the results of this study with previous studies, the author concludes that competition probably is imperfect on the average food retail market in Sweden. The results do not prove that the markup changed during the time period of 1998-2009. However, because of the aggregated nature of the data, the results are difficult to analyze further. Therefore, the thesis should be seen as a pilot-study for future studies with disaggregated data on a more local level.
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1. Introduction

The food retail industry manages the distribution of food and daily consumer goods to the everyday consumer. Since such goods represent a large part of the average consumer’s total expenses, even a slight price increase from the retailers can affect the consumer surplus considerably. Increases in prices may have several explanations, such as short-term or long-term shocks to the economy, but it is also a common presumption in economics that the price as well as consumer welfare depends on market structure. Intensified competition is thought to create lower prices and increase product range as well as increase the quality of the goods. In the Swedish food retail industry, the relatively high prices for food¹ combined with the dominance of a few large retailer chains have caused several economists to turn to imperfect competition as an explanatory theory².

Previous studies of the industry, such as Gullstrand and Jörgenssen (2011), generally agree that competition between individual food retail stores is geographically local, but that individual stores to a very high extent are incorporated in a few large firms or chains, with large market shares, which operate all over the country. If competition between these chains is on average imperfect in every geographical region in Sweden, you would expect there to be a positive mean price markup on national level.

The thesis will assess the competition of the Swedish food retailers on a national level. The purpose is to investigate if the food retail industry shows signs of imperfect competition on national level by analyzing the aggregated mean price-cost markup of all the local markets, i.e. how much higher, if higher at all, than marginal cost the average firm sets its price.

The method utilized to estimate mean industry markup is derived so that unobservable productivity shocks are canceled out to give unbiased results of the markup. The data used is on aggregated level, so the estimated markup will be a mean

¹ In Europe, the prices of food vary across countries considerably. In 2009, Sweden was among the countries with higher food prices, with a price level of 104 percent of the EU27 average. This can be compared to, for instance, Poland, whom had a price level at 64 percent of the EU27 average (Eurostat, 2010). However, it should be mentioned that income and price level differences could partly explain such variances.

² See for instance the literature overview made by Jörgenssen (2011).
markup for the entire industry in Sweden. Due to data limitations, the markup will only be estimated for different time periods from the late 90s to the 2000s respectively.

The reason for this study is to evaluate competition on the average local food retail market in Sweden with a method that has not been used for this particular industry before. Estimations of the mean markup have been done for the other stages of the food production process, but not for the food retail industry since competition is generally assumed to be local on such markets and thus not analyzable on national level. This study will function as a pilot study and thus clearing the grounds for a similar analysis on a more local level. Whatever the result, there are obvious policy implications as to whether competition in Sweden needs to be stimulated, and if so how.

The thesis is structured as follows: The next section presents the food retail industry in general and the Swedish markets in particular, as well as some previous studies of the industry. Economic theory for markets under imperfect competition is also introduced. The third section presents the empirical model as well as the data used. The fourth section displays the results of the empirical model. Last, the results are analyzed and the conclusions presented.

2. Background

2.1 The Food Retail Industry

Food retailing is a part of the food production process, which can be divided into three stages before the products reach the consumer, as shown in Figure (2.1).

Figure (2.1) The stages of food production

Presumably the consumer price of food is affected by the market structure of each of these markets as well as the interaction between them. This thesis will focus on the
situation on the retail market, leaving the other stages as well as the interaction between the stages to other studies.

The modern food retail industry is characterized by substantial economics of scale and transport costs, which create local markets. Such local markets are defined according to where distribution centrals and head offices of the retailer chains are situated. Economic theory states that vertically differentiated markets with high entry costs and economics of scale lead to natural oligopolies. The food retail market does not entirely pass for a natural oligopoly since it also is characterized by horizontal differentiation and different consumer preferences with regards to distance and prices (Ellickson, 2007). Therefore, it can be divided into two categories of stores, namely large supermarkets outside city centers and small stores closer to the customers. These two groupings only compete on a low level, as claimed by Ellickson (2007). Ellickson (2006) argues that while sunk entry costs cause larger markets to have more firms than smaller markets, the difference lies in smaller stores. The number of larger stores, or supermarkets, tends to be the same regardless of market size, but on larger markets the supermarkets have even larger stores with wider product range. So, the modern food retail market generally consists of a few large dominant chains, but because of the nature of the products, they have a regional dimension. This universal description of the food retail market can, according to Jörgenssen (2011), be applied to the Swedish retail market, but with a few alterations which are presented in the next section.

The Swedish food retail market is affected by low population density and characterized with high entry costs. Because of Sweden’s geography, transport costs are high and vary between different parts of the country. In the north, the sparse population and large distances and thus the large transport costs and required investments cause some of the smaller chains not to establish there at all. Because of these regional differences, when analyzed, the retail market is typically divided into regional parts. Market concentration is often used as an indicator of market structure. On national level the market concentration for Swedish retailers in 2009, calculated

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3 A study that focus on the other stages is for instance Olofsdotter et al (2011)
4 First put forth by Sutton (1991)
by the Herfindahl-index (HHI)$^5$, was 0.33, and respectively 0.31 for 2010$^6$, which
denotes a highly concentrated market. Cities in Sweden display even higher
concentration, with HHI on average of 0.55 (Lundvall and Hansen, 2009). As
expected, the concentration differs remarkably between different regions in Sweden.
In 2009, The HHI for the north of Sweden was 0.46 compared to 0.28 in the
Stockholm area. The reason for the large difference in concentration in this case is the
absence of certain retailer chains in the north$^7$.

However, a highly concentrated market may have several different
explanations, such as high entry costs or economies of scale. So comparing
concentration with price level over time, which, as we will see in the next section, has
been done in previous studies for the Swedish food retail industry, is of interest. As
mentioned, Swedish markets are characterized by the dominance of a few large
retailer chains. The three largest chains, ICA, Coop and Axfood, together claimed
over 85 percent of the national market in 2010$^8$. Among these three, ICA is
undisputedly largest with a market share of almost 50 percent in Sweden as well as
substantial market shares in Norway and the Baltic countries. ICA and Axfood
organize their stores according to franchising models, thus each store is considered an
individual firm and is therefore, according to competition laws, prohibited from
coordinating prices except under temporary offers or sale promotions. The second
largest retailer, Coop, is a consumer cooperative and is thus allowed to set prices on
central level$^9$. ICA and Coop have been the dominant chains on the Swedish markets
in the 2000s. Defining the national retail market as only made up by Coop and ICA,
the development of the market shares between the chains has changed from 2000 to
2010 as shown in Table (2.2).

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$^5$ HHI is calculated $\sum_{i=1}^{n} S_i^2$, where $S_i$ is the market share for firm $i$. HHI varies between 0 and 1, where
0 signifies perfect competition and 1 monopoly. Values above 0.25 generally indicate a highly
concentrated market (U.S. Department of Justice and Federal Trade Commission, 2010).
$^6$ Own calculations on data from Dagligvarukartan 2010 (2012)
$^7$ The retailer chains Netto, Lidl, and Bergendahl are either completely absent or have very few stores in
the northern regions of Sweden.
$^8$ Market share data from Dagligvarukartan 2010 (2012).
$^9$ More on cooperative ownership and its impact on competition, see Nilsson (2011).
**Table (2.2)** Swedish national market shares of ICA and Coop 2000-2010, defining the market as only made up by ICA and Coop.

<table>
<thead>
<tr>
<th>Year</th>
<th>ICA</th>
<th>Coop</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>2002</td>
<td>43</td>
<td>57</td>
</tr>
<tr>
<td>2004</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>2006</td>
<td>42</td>
<td>58</td>
</tr>
<tr>
<td>2008</td>
<td>35</td>
<td>65</td>
</tr>
<tr>
<td>2010</td>
<td>33</td>
<td>67</td>
</tr>
</tbody>
</table>

Source: *Dagligvarukartan 2010* (2012)

ICA has not only gained market shares towards Coop, but also in total throughout markets across the nation (Jörgenssen, 2011). The reason for the massive expansion of ICA can be explained by, as in Ellickson, (2006), increased internationalization. In the case of ICA, that happened when the large Dutch retailer Royal Ahold became a major owner in 2002. The new ownership might have increased ICA’s competitiveness through larger investment possibilities and greater economics of scale and scope. Looking back, the Swedish food retail industry has changed with the societal transformations. For instance, food today constitutes a lower share of the consumer’s total expenses than in the 1980s. This on the other hand has been compensated by increased demand for restaurant food (Lööv and Sköld, 2010). In the 1990s, competition rose and prices decreased on the food retail market due to Sweden’s entrance to the EU and various policies such as lowered consumption taxes on food. Jörgenssen (2011) mentions two main changes in the food retail industry in more recent years. Those changes are the entrance of low-price stores and the

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10 Ahold now owns 60 percent of the ICA-group (*Ahold N.V.*, 2012)

11 Though still a relatively large share, in 2010 the income share of food in the average household was 12 percent compared to 20 percent in the 1980s (Lööv and Sköld, 2010). The income share did not notably change in the 2000s.
introduction of private brands. Low-price chains offer lower prices by reducing the range of products and in-store service. The largest low-price chains in Sweden are the Danish Netto (2.2 percent market share 2010) and German Lidl (3.1 percent market share 2010) (Dagligvarukartan 2010, 2012). The other recent change, private brands, tends to increase negotiation power of the retailers towards the production industry, resulting in lower input prices for the retailers. It is also a price discrimination strategy as it allows chains to increase the price of traditional brands without decreased sales, since less price-sensitive consumers will continue to buy the traditional good out of preference. Private brands tend to lower competition, as there is no way to compare prices of different chains’ private brands.\(^\text{12}\)

There is a large amount of literature on the subject of competition and market structure in the food retail industry. Most studies focus on the relationship of market concentration and price setting. Such studies generally conclude that high concentration is related to high prices in food retailing.\(^\text{13}\) Also, because of the massive expansion of Wal-Mart, a field of literature fittingly called the “Wal-Mart”-literature study price competition and how the expansion of Wal-Mart reduced price level of other retailer chains.\(^\text{14}\) The following section presents some studies of the Swedish food retail industry.

### 2.2. Previous Studies of the Swedish Food Retail Market

Jörgenssen (2011) conducts a literature overview in the field of competition in the Swedish food retail market. He concludes that high concentration on the retail market originates in large economics of scale. However, high concentration might not always be a welfare loss for the consumers if it brings efficiency, wider range of products and lower prices to consumers. The establishment of international low-price chains, Jörgenssen finds, has reduced prices in Sweden, so to promote entry of more such chains would probably further increase competition without reducing efficiency.

Asplund and Friberg (2002) examine how the price of individual stores is affected by store specific variables and market structure variables. They use a wide

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\(^\text{12}\) For more on private brands, see Meza and Sudhir (2010).

\(^\text{13}\) See for instance Cotterhill and Putsis (2000).

\(^\text{14}\) Hausman and Leibtag (2007) found that the increased competition with the entrance of Wal-Mart on U.S. markets reduced the price level so that the compensated variance for the average consumer was 25 percent of total food expenditures.
dataset on prices in specific stores all over Sweden from 1993-1998 and find that store specific variables such as larger store size and certain chain affiliation positively affect prices significantly. Also, higher regional concentration between chains and local store concentration both significantly relate to higher prices but the effect is very small. The authors state however, that as food represents such a large part of consumer’s total expenses, even a small price increase can have a large effect on welfare.

Gullstrand and Jörgenssen (2011) evaluate the geographical boundaries of price competition among Swedish retailers. With the same kind of store-level data as Asplund and Friberg (2002), but for 2007, and with information on the geographical coordinates of each store, they evaluate which geographical variables that determine an individual store’s prices. Their results indicate that competition is very local, that is, only firms within close geographical distance significantly affect each other’s prices. They also find that the entrance of a low-price chain, such as Lidl or Netto, significantly lowers price level on the local market, although the effect is very small.

Another study on how market-structural variables affect retailers’ price setting is Lundvall and Hansen (2009). They use data from a large number of retail stores in 20 European countries to examine how the concentration on the local market affects the markup on that market. Their results show that local markets with higher concentration have significantly higher markups, ergo higher consumer prices. They also conclude that larger local markets lead to higher markups and higher prices. Lastly, they observe that Swedish markets have relatively high regulatory barriers for foreign retail firms to enter compared to European standards, and their results demonstrate that this leads to remarkably higher concentration on the market.

2.3 Oligopoly Theory
The model used to estimate mean markup is presented in the next section. In this section, some economic theory behind imperfect competitive markets and price markup is introduced.

A commonly used model for the firm’s behavior under imperfect competition, or more precisely, under oligopoly, is the Cournot oligopoly model. There are other more adequate methods on modeling oligopoly behavior, such as repeated Cournot
game theory\textsuperscript{15} or game theory models that take entry-costs and vertical differentiation into account\textsuperscript{16}, but because of the empirical, rather than theoretical, nature of this paper, these will not be assessed. As we are only interested in the basic idea of price setting under imperfect competition, any possible deviations from the theoretical assumptions in the case of the retailing industry in the models in this section does not affect the empirical analysis later on.

In the Cournot oligopoly model, \( n \) firms produce a total of \( Q \) homogenous goods. Each firm \( i \) produces \( q_i \), so \( Q = \sum_{i=1}^{n} q_i \). The market price, \( p(Q) \), depends on \( Q \) since firms are considered to have some degree of market power. The profit \( \pi_i \) for firm \( i \), given by a certain cost function \( C_i(q_i) \), is denoted by Condition (2.1).

\[
\pi_i = p(Q)q_i - C_i(q_i) \quad (2.1)
\]

As the \( n \) firms profit maximize, i.e. \( \frac{\partial \pi_i}{\partial q_i} = 0 \), we get a Cournot equilibrium output vector with all profit maximizing quantities, \( q^*=(q_1^*, q_2^*, \ldots, q_n^*) \). Profit maximization for firm \( i \) gives us the following first-order condition (2.2)\textsuperscript{17}:

\[
\frac{\partial \pi_i}{\partial q_i} = p(Q) + q_i \frac{\partial p(Q)}{\partial Q} - \frac{\partial C_i}{\partial q_i} = 0 \quad (2.2)
\]

We can rewrite (2.2) by defining \( \frac{\partial C_i}{\partial q_i} \) as marginal cost \( (MC_i(q_i)) \). We then divide both sides by \( p(Q) \) and extend the right-hand side by \( \frac{Q}{Q} \) to get Equation (2.3).

\[
\frac{p(Q) - MC_i(q_i)}{p(Q)} = -q_i \frac{\partial p(Q)}{\partial Q} \frac{Q}{p(Q)} \quad (2.3)
\]

\textsuperscript{15} For other imperfect competition models, see Gibbons (1992) or Arrow and Intriligator (1982, p. 491).

\textsuperscript{16} Ellickson (2006) used such a model for the retailing industry.

\textsuperscript{17} Second-order condition is presumed to be less than zero, that is \( 2 \frac{\partial p(Q)}{\partial q_i} + q_i \frac{\partial^2 p(Q)}{\partial q_i^2} - \frac{\partial^2 C_i}{\partial q_i^2} < 0 \)
Now, using the definition of price elasticity of demand, \( \varepsilon = \frac{\partial Q}{\partial p(Q)} \frac{p(Q)}{Q} \) and defining the market share for firm \( i \) as \( s_i = \frac{q_i}{Q} \), we get an expression for the price markup, namely Condition (2.4).

\[
\frac{p(Q) - MC_i(q_i)}{p(Q)} = \frac{s_i}{\varepsilon} \quad (2.4)
\]

Condition (2.4) is called the Cournot oligopoly pricing formula, which tells us that the markup, i.e. how much higher than marginal cost the firm sets its price, is determined by the absolute value price elasticity of demand and the market share of the individual firm. Greater price elasticity gives smaller markup. The markup is positively related to the market share, which in turn is positively related to the productivity of the firm.

In the specific case of and constant and identical marginal costs, \( \bar{MC} \), the markup becomes related only to the number of firms on the market, as shown in Condition (2.5).\(^{18}\)

\[
\frac{p(Q) - \bar{MC}}{p(Q)} = \frac{1}{ne} \quad (2.5)
\]

(2.5) is the famous Lerner Index, created by economist Abba P. Lerner (Lerner, 1934). The index implies that an increased number of firms on the market decreases markup. Hence, \( n=1 \) gives us the monopoly case, and larger \( n \) gets us closer to the perfect competition case where \( p=MC \).\(^{19}\)

Focusing on the markup, the Lerner index can be rewritten to a condition for the price markup, as shown in Condition (2.6).

\[
\frac{p(Q) - \bar{MC}}{p(Q)} = 1 - \frac{1}{\mu} \quad (2.6)
\]

---

\(^{18}\)If marginal costs differ between firms, we can, by summing the pricing formulas of the \( n \) firms, create a similar condition, with the difference that markup depends on \( n \) and the sum of the firm’s marginal costs (Cournot, 1897, p. 86).

\(^{19}\)Note that one have to be careful to take the limit of \( n \) goes to infinity, since if average cost is even just slightly decreasing, it is impossible for firms to have positive profits if \( n \) is very large (Schmalensee and Willig, 1989, p. 336).
Where the price markup is defined as \( \mu = \frac{p(Q)}{MC} \). A value of one denotes perfect competition. Values above one signifies positive price markup, which means that firms possess some extent of market power and therefore competition is imperfect on the market.

Using markup as an indicator of imperfect competition generates certain complications. Some economists argue that most firms have markups, even if the market in question is characterized by a high degree of competition (Elzinga and Mills, 2011). Also, high markup could exist to compensate for high fixed costs. Or, like Hall (1988) argued, high markups for the firm could be a sign of high competition, because high competition may result in high skill or superior products for individual firms. Specifically, if increased competition causes less productive firms to exit the market and thus causes more productive firms with relatively high markups to gain market shares, average markup may increase (Boone, 2008). As a result, although estimated markup is less informative about the distinct manifestations of market power, it is effective for estimating extent, gravity, and time variations of the markup, which in combination with other measurements of market structure and prices can become an indicator of imperfect competition. Another important measurement problem with estimating markups is defining the analyzed market. An economic market should include all firms and their products that interact to decide prices. This means that the products need to be demand-side substitutes and produced under the same geographical boundaries (Church and Ware, 2000, p. 437). Does this apply to the Swedish food retail market on a national level? There should not be a problem as far as product homogeneity go. Even though product range may vary in different regions of Sweden, overall the same products are sold. This is further proven by the frequent use of national promotions, commercials, and private brands by the large retailer chains. The geographical dimension is a significant problem as most previous studies point to the local nature of the Swedish retail industry. Since several markets imply several market markups, estimations of the markup on national level in Sweden should be interpreted as a mean of the local markets markups, and not a national market markup per se.

Using the Lerner index in empirical situations to estimate markup is difficult since the marginal cost is complicated to measure. Instead, the price-cost markup is typically estimated, which is defined similarly to price markup, with the exception...
that marginal cost is replaced with average variable cost (AVC). AVC is used since it is often observable and should not differ substantially from marginal cost if measurement errors from variables such as rate of return and amount of economic depreciation are small (Church and Ware, 2000, p. 436). The Lerner index for price-cost markup is displayed in equation (2.7).

\[
\frac{p(Q) - AVC}{p(Q)} = 1 - \frac{1}{\mu} \quad (2.7)
\]

The price-cost markup is defined as \( \mu = \frac{p(Q)}{AVC} \). The price-cost markup is what will be estimated in the next section with an appropriate empirical model.

3. Model and Data

3.1 The Empirical Model

In the previous section, it was shown how markup could be derived from the oligopoly market firm’s pricing formula. However, using that definition in empirical situations to get unbiased estimates of the markup is difficult because of unobservable productivity changes in the economy through, for instance, new technology. Instead we will use another model first used by Roeger (1995), who based his work on Hall (1988). Roeger’s model was further adjusted to fit the food production industry by Wilhelmsson (2006), whose model is the one used in this thesis with a few changes in the assumed production function. The main idea of the model is to use the difference between the primal, production based, Solow residual and the dual, price based, Solow residual to cancel out the unobservable hicks-neutral productivity term in the firm’s production function, to get an unbiased estimate of price-cost markup\(^{20}\).

The firm’s production is assumed to depend on three input factors. Wilhelmsson (2006) analyzes the Swedish food production industry, so his input factors are capital, labor, and raw materials. In this study, I will replace raw materials with commodities and raw materials to avoid unbiased results, since commodities and raw materials, rather than just raw materials, is assumed to be a more central input.

\(^{20}\) For derivation of the model, see Wilhelmsson (2006).
factor in the food retail industry\textsuperscript{21}. To simplify, commodities and raw material will be referred to as “materials” for the remaining part of the thesis.

Another necessary assumption for the model is constant returns to scale. At first glance, this comes off as problematic for the analysis, since the food retail industry is characterized with substantial economics of scale. However, if the analysis is conducted on a single industry over different time periods, and if the extent of economics of scale is assumed to remain constant during the analyzed time period, the estimates will still be unbiased (Wilhelmsson, 2006).

The problem with interpreting the results however remains. A high average markup can in fact be an indicator of a high degree of competition if it means that less productive firms with lower markups are forced to exit while more productive firms with higher markups stay on the market. Wilhelmsson (2006) solves this particular problem by using disaggregated data, since the markup of the individual firm should not be affected by the exit of less productive firms. In this study, disaggregated data for the food retail industry in Sweden was unobtainable and so the empirical results can be complicated to interpret. Yet, by contrasting the results of this study to other studies that measure competition in the Swedish food retail market, the results are still assumed to be interpretable.

The model is measuring the change between nominal sales and costs of input factors compared to the nominal value of capital. It is for firm $i$ calculated by Equation (3.1), as in Wilhelmsson (2006).

\textsuperscript{21} In the data, raw materials by itself have a cost share around less than 1 percent, while commodities and raw materials have around 75 percent.
\[ \Delta Y_{it} = \mu \Delta X_{it} \quad (3.1) \]

where the variables for firm \( i \) at time \( t \) are defined as:

\[ \Delta Y_{it} = \Delta \ln (sales) - \Delta \ln (cost \ of \ capital) \]

\[ \Delta X_{it} = \alpha_{Lt} (\Delta \ln(wage \ costs) - \Delta \ln(cost \ of \ capital)) + \alpha_{Mt} (\Delta \ln(material \ costs) - \Delta \ln(cost \ of \ capital)) \]

\[ \alpha_{Lt} = \frac{wage \ costs}{sales} = \text{labour cost share of output} \]

\[ \alpha_{Mt} = \frac{material \ costs}{Sales} = \text{material cost share of output} \]

\( \Delta Y_{it} \) is the growth in sales per capital unit. \( \Delta X_{it} \) is the growth in input factors weighted by input cost shares per capital unit. \( \mu \) is the estimated price-cost markup defined as in the previous section, \( \mu = \frac{p(C)}{AVC} \). A value of one signifies perfect competition. Estimates above one signify positive price markup, indicating that firms are using some extent of market power to set prices above marginal cost. Incorporating the model into regression, we get the regression function (3.2).

\[ Y_t = \beta X_t + \varepsilon_t \quad (3.2) \]

where,

\[ Y_t = \sum_{i=1}^{n} \Delta Y_{it} \]

\[ X_t = \sum_{i=1}^{n} \Delta X_{it} \]

\( \beta \) is the Estimated mean markup for the \( n \) firms on the food retail industry over the observed time periods, \( t \). A value of one signifies that, on average, there was perfect competition on the retail market during the observed time periods. Estimates above one signify positive average markup, thus indicating that firms experienced some
extent of market power during the observed time periods. \( \varepsilon_t \) is the random error term\(^{22}\).

Hence, the data needed to estimate the markup are nominal values of sales, wage costs, material costs, and cost of capital for the food retailers over a set of time periods. Cost of capital will be defined the same as Wilhelmsson (2006), i.e. the cost of capital is estimated to 7 percent of the capital stock. This percentage comes from Gullstrand and Johanssons (2005) estimation of a Cobb-Douglas function for the Swedish food production industry. The cost of capital could vary between firms and over time, but robustness checks made by Wilhelmsson (2006) indicate that such variations do not affect the results significantly.

### 3.2 Data

The dataset consists of aggregated data on the Swedish food retailer firms on a yearly basis, collected by Statistics Sweden. The data is collected through a combination of a total survey for the larger firms, and a sample survey for smaller firms, taken from company records of the Swedish Tax Enforcement Administration\(^ {23}\). The data is divided according to three different versions of the Swedish Industrial Classification (denoted “SNI” in Swedish), which is based on European Classification of Economic Activities (NACE)\(^ {24}\) but adapted to fit the Swedish market. Since the different versions differ in terms of, for instance, sample size and classifications, caution has been taken about mixing data from different versions. The used versions will be as follows:

- **SNI92**, based on NACE Rev. 1 for the years 1997-2002.

The classification in SNI92 is based on registered business of the firm, while in SNI2002 and SNI2007 it is based on meant business. Meant business means that if a firm mainly contributes to another firm’s production process, it is granted that firm’s classification. These definitions may cause measurement differences between the SNI

\(^{22}\) The random error term is assumed to be independent identically normally distributed and have expected value equal to zero \( (E(\varepsilon_t) = 0) \).

\(^{23}\) For information on procedure, quality and the different SNI-versions, see Statistics Sweden (2009) Företagens ekonomi (FEK) 2009

\(^{24}\) For information on NACE, see Eurostat (2008) *NACE Rev. 2 Introductory Guidelines*.
versions, but in the food retail industry such differences should be small since retailing is not part of some other major industry. Due to data limitations, the analysis will predominantly be on 3-digit level, analyzing the firms that fall under the category “Retail trade, except of motor vehicles and motorcycles” and more specifically “Non-specialized stores”. Data will also be combined from versions SNI2002 and SNI2007 to create a model for 4-digit level data, that is “Non-specialized stores with food, beverages or tobacco predominating”\(^{25}\). Although Standard Industrial Classifications (SIC), such as SNI or NACE, generally do not correspond to actual markets, several updates in SNI and NACE, have been made to make the data less biased and more like the real markets (Eurostat, 2008 *NACE Rev. 2 - Statistical classification of economic activities*).

Descriptive statistics of the variables, as well as number of firms included in the aggregated data, for each different version of SNI and time period follow in Table (3.3).

\(^{25}\) Note however that there is no large difference between the 3-digit and 4-digit level categories, indicating that most non-specialized stores are food retail stores. In the data, for instance, the sales of the 4-digit level non-specialized stores with food, beverages or tobacco predominating constitute over 90 percent of the sales of non-specialized stores on 3-digit level.
Table (3.3) Descriptive statistics

<table>
<thead>
<tr>
<th>SNI92 - 52.1 Non-specialized stores</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997-2002 Wage costs</td>
<td>6</td>
<td>12449</td>
<td>939</td>
</tr>
<tr>
<td>Material costs</td>
<td>6</td>
<td>112481</td>
<td>7507</td>
</tr>
<tr>
<td>Sales</td>
<td>6</td>
<td>146983</td>
<td>10541</td>
</tr>
<tr>
<td>Cost of capital</td>
<td>6</td>
<td>945</td>
<td>133</td>
</tr>
<tr>
<td>Firms</td>
<td>6</td>
<td>6711</td>
<td>356</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SN12002 - 52.1 Non-specialized stores</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-2008 Wage costs</td>
<td>6</td>
<td>15826</td>
<td>1026</td>
</tr>
<tr>
<td>Material costs</td>
<td>6</td>
<td>138744</td>
<td>9948</td>
</tr>
<tr>
<td>Sales</td>
<td>6</td>
<td>184817</td>
<td>12596</td>
</tr>
<tr>
<td>Cost of capital</td>
<td>6</td>
<td>3341</td>
<td>763</td>
</tr>
<tr>
<td>Firms</td>
<td>6</td>
<td>6113</td>
<td>258</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SN12007 - 47.1 Non-specialized stores</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2009 Wage costs</td>
<td>10</td>
<td>15342</td>
<td>1744</td>
</tr>
<tr>
<td>Material costs</td>
<td>10</td>
<td>136156</td>
<td>14263</td>
</tr>
<tr>
<td>Sales</td>
<td>10</td>
<td>136093</td>
<td>14310</td>
</tr>
<tr>
<td>Cost of capital</td>
<td>10</td>
<td>2481</td>
<td>426</td>
</tr>
<tr>
<td>Firms</td>
<td>4</td>
<td>5910</td>
<td>148</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SN12002 &amp; 2007 - 52.11 &amp; 47.11 Non-specialized stores with food, beverages or tobacco predominating</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-2009 Wage costs</td>
<td>7</td>
<td>14329</td>
<td>1031</td>
</tr>
<tr>
<td>Material costs</td>
<td>7</td>
<td>130750</td>
<td>10199</td>
</tr>
<tr>
<td>Sales</td>
<td>7</td>
<td>171525</td>
<td>13120</td>
</tr>
<tr>
<td>Cost of capital</td>
<td>7</td>
<td>2639</td>
<td>566</td>
</tr>
<tr>
<td>Firms</td>
<td>7</td>
<td>5760</td>
<td>279</td>
</tr>
</tbody>
</table>

Note: for SN12007, the variable for number of firms has missing observations for the years before 2005.

The different costs, sales, and number of firms represent national industry averages during the observed time period. Monetary variables are shown in millions of Swedish crowns (SEK). Cost of capital is defined as 7 percent times the capital stock,
which in the data is fixed assets, thus 0.07*fixed assets. The descriptive statistics show that there are large differences in, for instance, cost of capital and sales between the SNI versions, which partly is annual variations since the data is nominal (non-inflation adjusted), but that also might be differences caused by different definitions and conduct of the data collection for the different versions.

4. Results
The results of the empirical analysis are divided into two sections. The first section presents the estimated mean markup for the different time periods and SNI-versions. The second section evaluates the development of the mean markup over time.

4.1 Estimated Mean Markup
The results in this section are presented as follows. First, we look at the estimated mean markups for the different 3-digit level SNI-version and time periods respectively. Second, the result for a combined model on 3-digit level for longer time series is displayed, with data from SNI2002 and 2007. Third, we look at the 4-digit level estimated markup, with combined data from SNI2002 and 2007.

The estimated mean markup for the 3-digit level data, “Non-specialized stores”, is displayed in Table (4.1).

Table (4.1) Estimated mean markup for each SNI-version respectively, on 3-digit level.

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std error</th>
<th>P-value</th>
<th>N</th>
<th>GoF p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNI92-52.1 1998-2002</td>
<td>1.173</td>
<td>0.031</td>
<td>&lt;0.01</td>
<td>5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>SNI2002-52.1 2004-2008</td>
<td>1.205</td>
<td>0.005</td>
<td>&lt;0.01</td>
<td>5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>SNI2002-47.1 2001-2009</td>
<td>1.152</td>
<td>0.032</td>
<td>&lt;0.01</td>
<td>9</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Estimate is the estimated markup, $\beta$, for the concerned model. To the right of the estimate follow standard error, p-value for the estimates, number of observations, and the p-value of the goodness of fit F-test for each model. The p-value is the result of a t-test with the null hypothesis of perfect competition, which means the estimated
markup equals one. The goodness of fit F-test has the null hypotheses that there is no linear relationship between the dependent and independent variable, i.e. the estimate equals zero.

All versions show estimates significantly departed from one, and estimates that indicate positive markups for their corresponding time period. The positive markup implies that there, on average, was imperfect competition on the Swedish food retail markets during the observed time periods. The size of the markup varies slightly. However, since different SNI-versions are analyzed, these variations do not necessarily imply that the actual markup has changed in the different time periods.

Table (4.2) shows estimated mean markup for a model with combined SNI-versions for longer time series. The data for SNI92 & 2007 overlap so that data from both versions exist for the years 2001 and 2002. To make sure that the overlap does not affect the result, two models were made, where the first one takes data for the years 2001 and 2002 from SNI2007, and the second one takes the data from SNI92.

Table (4.2) Estimated mean markup for longer time series, with combined SNI on 3-digit level.

<table>
<thead>
<tr>
<th>SNI92 &amp; 2007, predominantly SN12007</th>
<th>Estimate</th>
<th>Std error</th>
<th>P-value</th>
<th>N</th>
<th>GoF p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>52.1 &amp; 47.1 1998-2009</td>
<td>1,157</td>
<td>0.024</td>
<td>&lt;0.01</td>
<td>12</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>SNI92 &amp; 2007, predominantly SN12007-52.1 &amp; 47.1 1998-2009</td>
<td>1,171</td>
<td>0.028</td>
<td>&lt;0.01</td>
<td>12</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Both models show estimates significantly departed from one as well as positive markups for the observed time periods. The difference in estimated markup between the models is assumed to origin from the different SNI-versions for the years 2001 and 2002.

Next, a model on 4-digit level, “Non-specialized stores with food, beverages or tobacco predominating”, with combined data from SNI2002 and 2007 is displayed in Table (4.3).
Table (4.3) Estimated mean markup for 4-digit level data with combined SNI.

<table>
<thead>
<tr>
<th>SNI2002 &amp; 2007 - 52.11 &amp; 47.11</th>
<th>Estimate</th>
<th>Std error</th>
<th>P-value</th>
<th>N</th>
<th>GoF p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2009</td>
<td>1.191</td>
<td>0.009</td>
<td>&lt;0.01</td>
<td>6</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

The estimated markup is also significantly different from zero and positive, thus further supporting the hypothesis that on average, the food retailers in Sweden experience some extent of market power with which they set price over marginal cost to make profits.

4.2 Development of the Estimated Mean Markup

To examine time variations in the markup, the model with the longest time series for the 3-digit level data is extended with indicator variables. The indicator variables are defined as dummy variables interacted with the markup variable. The time period is divided into three time segments: 1998-2001, 2002-2005, and 2006-2009. This way, each indicator variable has more observations than, say, if each year was a time segment. The time segments also reflect events that theoretically could have affected the markup. The massive expansion of ICA after Royal Ahold became a major owner in 2002 could have decreased competition, and thus affected mean markup positively. This effect would probably be visible a few years after 2002, henceforth the effect should be manifested in the variable for 2002-2005. Other events that could have affected competition, and in turn the markup, is the introduction of private brands and the establishment of low-price chains. However, since private brands theoretically lower competition and low-price chains tend to increase it, the net effect on markup is hard to predict. The regression used is displayed in Equation (4.4).

---

It can be argued that the expansion initially leads to increased price competition, so that markup is lowered until less productive firms are forced to exit the market. Markup could for the same reason also initially increase from decreased costs with increased economics of scale and scope. Whatever the initial effect on the markup is, the final result of the expansion of one chain is regarded lower competition and hence increase markup. The time frame of the process is however unknown.
\[ Y_t = \beta X_t + \beta_{D_1} D_{t1} X_t + \beta_{D_2} D_{t2} X_t + \epsilon_t \quad (4.4) \]

\( D_j \) is a time dummy variable and \( \beta_{D_j} \), where \( j = 1,2 \), is the derivation of the markup from the first time period. The indicator variables will signify departure from the first time period markup, thus the first time segment is excluded as an indicator variable. Markup models for 3-digit level SNI-data, with three time indicator-variables, are displayed Table (4.5) and (4.6).

**Table 4.5** SNI92 & 2007, predominantly SNI92 - 52.1 & 47.1 1998-2009

<table>
<thead>
<tr>
<th></th>
<th>Estimates</th>
<th>Std error</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markup (1998-2001)</td>
<td>1,175</td>
<td>0,037</td>
<td>&lt;0,01</td>
</tr>
<tr>
<td>2002-2005</td>
<td>-0,01</td>
<td>0,001</td>
<td>0,182</td>
</tr>
<tr>
<td>2006-2009</td>
<td>0,01</td>
<td>0,001</td>
<td>0,285</td>
</tr>
<tr>
<td>GoF p-value</td>
<td>&lt;0,01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 4.6** SNI92 & 2007, predominantly SNI2007 - 52.1 & 47.1 1998-2009

<table>
<thead>
<tr>
<th></th>
<th>Estimates</th>
<th>Std error</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markup (1998-2001)</td>
<td>1,173</td>
<td>0,033</td>
<td>&lt;0,01</td>
</tr>
<tr>
<td>2002-2005</td>
<td>-0,046</td>
<td>0,048</td>
<td>0,357</td>
</tr>
<tr>
<td>2006-2009</td>
<td>0,027</td>
<td>0,052</td>
<td>0,619</td>
</tr>
<tr>
<td>GoF p-value</td>
<td>&lt;0,01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The p-value for estimated markup is the result of a t-test with the null hypothesis of perfect competition, i.e. markup equal to one. The p-value for the indicator variables is the result of a test with the null hypothesis that the indicator variable equals zero. The Goodness of fit F-test tests the null hypothesis that non-linear relationship characterizes the regression, i.e. all estimates equals zero.

The estimates of the indicator variables indicate that the markup decreased in 2002-2005 and increased in 2006-2009 compared to 1998-2001, but the effect is very small. Also, none of the models showed significant departure from zero for the estimated indicator variables. Other formations of time segments, larger and smaller, that were tested resulted in larger insignificance and no notable change in the estimates. The conclusion is that for the time period 1998-2009, it cannot be proven that the mean
markup on the Swedish retail markets changed. A markup model for 4-digit level SNI data with time indicator-variables is displayed in Table (4.7). The model displayed also has three time segments, but other formations were also tested with no notable difference in the results.

**Table (4.7) SNI2002 & 2007 - 52.11 & 47.11 2004-2009**

<table>
<thead>
<tr>
<th></th>
<th>Estimates</th>
<th>Std error</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markup (2004-2005)</td>
<td>1,203</td>
<td>0,009</td>
<td>&lt;0,01</td>
</tr>
<tr>
<td>2006-2007</td>
<td>-0,01</td>
<td>0,00038</td>
<td>0,100</td>
</tr>
<tr>
<td>2008-2009</td>
<td>0,0003</td>
<td>0,00028</td>
<td>0,359</td>
</tr>
<tr>
<td>GoF p-value</td>
<td>&lt;0,01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

The estimates of this model indicate that the markup decreased slightly in 2006-2007 and increased slightly in 2008-2009 compared to 2004-2005. However, the estimates are very low and also not significantly departed from zero\(^{27}\). Therefore, it cannot be proven that the markup changed for the time period 2004-2009.

**5. Conclusions**

This thesis studies competition on the Swedish food retail market in the late 90s and 2000s by estimating the mean price-cost markup for the retailer firms on national level. The results of the empirical analysis should be contrasted to other studies of the competition on the Swedish food retail market before any conclusions are made.

The results show that on average there is a strongly significant positive markup for all the studied time periods. Although the results could signify high markup in some parts of the country and no markup in other parts, when the results of this paper are combined with other studies and data on regional market concentration, such a conclusion becomes unlikely. The markup is doubtlessly higher in some parts of the country, but competitive pricing is not probable anywhere.

The question if the positive markup indicates imperfect competition on the Swedish food retail market on average is best answered by comparing the results of this study with the results of earlier studies. Since several earlier studies have pointed

\(^{27}\) The estimate for the period 2006-2007 is in fact barely significant at 10 percent, but since the value of the estimate is very low, my conclusion is that the markup still cannot be proven to have changed from the first time period.
out relations between concentration and price setting, as well as lowered prices with entries of new retailer chains and high sunk entry costs in the retail industry, the results of this study support the argument that the average Swedish food retail firm uses its market power to set prices higher than competitive price levels. Further support to the hypothesis of imperfect competition is given by the generally low price- and income elasticities of food and consumers (Gillespie, 2007, p. 48). The concept that food generally is regarded to be a very price- and income inelastic good is in the Swedish case is confirmed by Lööv and Widell (2009). This enables firms to set higher prices without loosing customers and makes profit losses in periods of lower consumer income very low. Thus, the high markup is very likely an indication of imperfect competition on the average food retail market. The extent of imperfect competition is likely to vary across the country, but since only competition on national level was analyzed, no conclusions from this study can be drawn on regional or local competition.

The results give no support to the presumption that the average markup changed over the observed time periods. Still, too short time series as well as national, instead of local, level data could explain the non-significant results. The non-significant markup change also implies that there is no proof that the entrance of low-price chains, such as Lidl’s and Netto’s entrance on the Swedish market in the early 2000s, enhances competition on average in the country. However, since Lidl and Netto are not active in every region of the country, effects on national level should not be visible. Also, the results cannot prove that ICA’s increased market share, as well as the introduction of private brands, increased the industry mean markup in the 2000s. The insignificant effect on markup from ICA’s expansion could origin in the uncertainty of how markup varieties in the initial state of the expansion of one chain, and thus not be visible in such a short time span.

It should be mentioned that since the study was done on aggregated level, it is difficult to draw conclusions about the market power of the individual firm as well as the degree of competition on the market from the estimated markup. Therefore, this thesis should in first hand be viewed upon as a pilot-study on the subject of market power and imperfect competition on the Swedish food retail market. It is to be used as an introduction for a larger study with disaggregated data on local level.
Future studies could, as just mentioned, use disaggregated data on a local level, for instance municipality level, to get more precise and analyzable results of the markup in different regions. This would further show where competition-enhancing policies would be most effective. Also, in ten years or so, it would be interesting to see if the markup decreased during the years of, say, 2009-2010, because of the large economic crisis. This would show how sensitive the consumers are to price changes, which in turn could demonstrate retail firm’s possibility to set higher prices without loosing customers, and thus be an indicator of market power.
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