GOTHENBURG SCHOOL OF BUSINESS ECONOMICS AND LAW

The Strength of Competition in the Swedish Grocery Retailing Market

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A Comparison to Germany

Paper within Industrial Economics

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Ulrika Lööf
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Abstract

I have many times heard that the Swedish grocery retail market has low competition, high concentration and high food prices, whereas in Germany the prices are considered lower and the competition more intense[1]. I decided to investigate if this claim is true and if the market structure in Sweden is likely to be a problem. The study shows that Sweden and Germany have the same strength of competition and entry barriers in the grocery retailing market. I also discovered that the competition in both Sweden and in Germany get more intense when new chains enter the market. To reach these results the relationship between store density and population density was estimated, showing there is no difference between the countries in the number of costumers per chain a grocery retailer needs to retain the same profit when the number of chains is increasing. This is referred to as the strength of competition in the market. The idea is that if more costumers per chain are required to reach the intended profit level, it indicates an intensified competition due to increased price pressure and smaller profit margins.

Furthermore, I found that Sweden has a higher degree of concentration in the grocery retailing market. Although, the fact is that Sweden has a large surface relative Germany but a much smaller population. Therefore the high concentration in Sweden is most likely a result of economies of scale coming from natural market conditions, rather than a result of high entry barriers and an inefficient market.

I have distinguished between the level of competition and the strength of competition. The strength of competition is the increase in competition one additional chain in the market creates and the level of competition shows the accumulated competition all chains in the market have contributed to. When studying concentration I conclude that the level of competition in Germany must be higher than in Sweden. There are more stores and more different chains competing with each other in Germany. Each new chain established in both Sweden and in Germany creates equally much additional competition, yet there are more chains in Germany contributing to the accumulated level of competition.

Finally, the outcome shows that the competition intensifies in both countries when a new chain is established in the market. When population density increases by one per cent, chain density increases by 0.86 per cent, indicating that each chain needs more customers per chain to retain the same profit when the number of chains increases. This in turn implies increased price pressure and then also increased competition.

[1] Lundvall, Karl (2004), "Konsumenterna, matpriserna och konkurrensen", The Swedish Competition Authority Report 2004:2

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Introduction

To increase the understanding of the study, this section provides information about the meaning of efficient competition and the structure of the Swedish and the German grocery retail markets. Purpose, questions and limitations are outlined as well.

Background

The Significance of Competition

Competition is essential for a market to work efficiently. Poor competition can lead to allocative inefficiency in the market in the form of prices set above marginal costs and output below the optimal level. Low competition can also result in lower quality and a more narrow range of products, due to weak incentives for the firms to improve. Moreover, it can be the case that chains provide poorer service such as shorter opening hours as a result of an uncompetitive situation, not to mention that in highly concentrated markets there is a risk the firms will engage in collusive behavior such as price cartels or tacit agreements disadvantaging the customers. There can be many aspects creating a situation of low competition in a market, for instance high entry barriers such as high startup costs or regulations, poor price transparency or a high degree of differentiation among firms. Competition gives firms incentives to be innovative and cost efficient, which in the end benefits consumers (Cabral, 2000). Because grocery consumption is a large part of people's expenditures and it is something we cannot cut back on when we face financial difficulties, this market should preferably work efficiently.

In this study I will talk about both the *strength* of competition and the *level* of competition and I therefore want to describe the difference between these two expressions. The strength of competition is demonstrated by the additional competiveness one new chain contributes when establishing in a market. The level of competition is simply the accumulated competition that all chains in the market have created together. This means that in a market with many stores – if the competition works efficiently – the level of competition must be higher.

Measuring competition can be complex. Different industries are structured differently, for example due to the nature of the industry firms are of varying size. Some industries are very capital intensive and require huge startup costs, whereas others involve hardly any startup costs. Naturally, capital-intensive industries with large sunk costs are likely to be highly concentrated. However, high concentration is not always associated with the mentioned negative aspects. When economies of scale are predominant in an industry – which often means that the fixed costs are high – the cost structure can be such that the costs are minimized with few large firms operating in the market. Grocery retailing is a sector characterized by a small number of large chains and it is therefore interesting to study whether the competition between them still works efficiently, and what market conditions affect both the strength and level of competition (Cabral 2000).

The Swedish and the German grocery retailing markets

In Sweden the dominating retailing chains ICA, Coop, Axfood, Bergendahls, Lidl and Netto stand for about 96 per cent of the total sales in the market. ICA is the largest retailer with a market share of 50 per cent. The chain is organized through franchising so that each store is privately owned. However, the group has joint wholesale activities, market communication and an integrated logistic network[2]. In the beginning of the 2000s the two discount chains Netto from Denmark and Lidl from Germany opened stores in Sweden, bringing the budget alternative to the market.[3]

The German grocery retail market is dominated by the REWE Group and Edeka, and the dominating discount retailers are Aldi and Lidl. Edeka is organized similar to the Swedish chain ICA, where the different stores to some extent operate independently. The grocery retailing industry in Germany has for the past years been characterized by a reduction of smaller stores and an increase in the number of hypermarkets. Moreover, a strong trend in Germany is the increase of discount markets, which have gained market shares from ordinary supermarkets and smaller grocery stores. The main characteristics of the discount markets are low prices and a relatively low variety of products. Even though many mergers have taken place and reduced the amount of medium-sized firms, the strength of competition has not significantly been affected due to the increasing numbers of discount firms. It is claimed that because of the large number of discount chains, the competition in Germany is more intense than in other European countries with a similar concentration situation.[4]

Purpose and Questions

The purpose of this study is to discover whether it can be claimed that Sweden has weaker competition in the grocery retailing market than Germany and to investigate whether there are any substantial differences between the two markets when it comes to entry barriers and concentration. The following questions are answered:

- Is the strength of competition in the Swedish grocery retailing market weaker than in Germany?

[2] Jörgensen C., (2011), "Lokalisering och konkurrens i dagligvaruhandeln", AgriFood Economics Centre
[3] Hazapi C., Tomas M(2005).,"Lågprislivsmedelsbutikernas existens i svensk varudaglighandel", Södertörns Högskola
[4] The German Competition Authority,(2011), "Tätigkeitsbericht 2009/2010", Report 1766/40, 20 July

- Are there any differences in entry barriers and concentration between the markets in the two countries?
- Does the competition in Sweden and in Germany work efficiently?

Limitations

Due to difficulties finding data, this study is limited to 50 different municipalities in each country. Smaller retailers, convenience stores, kiosks and gas stations have not been considered in the analysis since they do not offer a full range of products and are therefore not considered to directly compete with larger grocery chains, supermarkets and hypermarkets.

Theoretical Framework

This section will explain the model measuring the strength of competition and entry barriers in the market. The model is illustrated with graphics to clarify.

Modeling Competition in Concentrated Markets

Bresnahn and Reiss (1991) showed that it is possible to draw inferences about the effect of entry in an oligopolistic market without observing prices or costs. They present a method to model market structure with the underlying intuition that when the number of people required to support a given number of firms is increasing, the competition must be getting stronger. If this is the situation, profit margins shrink due to price pressure and the firm needs a larger population to cover entry costs. Bresnahn and Reiss develop the idea of a demand entry threshold, showing the demand required for a certain number of firms to be profitable.[5] Estimating this relationship between number of chains and population indirectly provides a picture of the competition situation, since it is reasonable to assume that chains want to attain a certain level of profit even though new chains are established, and the change in number of customers per chain gives an idea of how the competition altered after the new establishments. With this underlying intuition, the model outlined by Bresnahn and Reiss has by Bergman and Stennek (2011) been simplified to be applicable to the following analysis.[6]

[5] Bresnahan, T. and Reiss, P. (1991), "Entry and competition in concentrated markets". Journal of Political Economy, 99:977-1009

[6] Bergman, Mats and Stennek, Johan (2011), "Bra konkurrens trots hög koncentration". Mimeo

Chain density and population density are regressed in logarithmic terms to even out large differences in population size and km². The relationship is reflected by the straight line

$$\ln(cd) = \beta ln(Pd) + \alpha,$$

where $\ln(cd)$ equals the logarithm of chain density, $ln(Pd)$ is the logarithm of population density and α equals the intercept. The intercept of the regression is interpreted as barriers to entry and determines the line's position in the diagram. The intercept determines how many customers a monopoly firm needs in order to be profitable. The slope is interpreted as the strength of competition in the market and shows how much chain density increases with population density. Figure 1 explains the intercept of the lines:

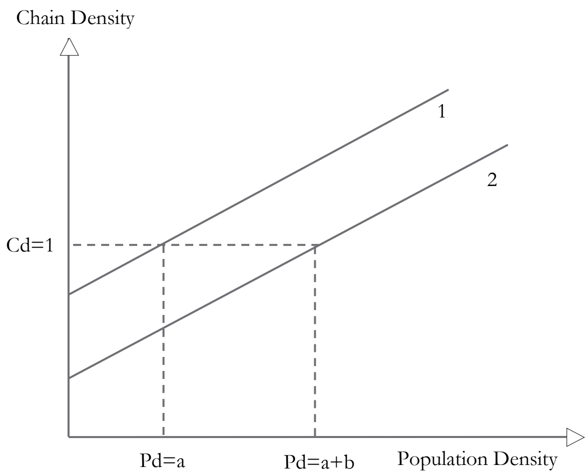

Figure 1: The intercept showing barriers to entry in the market The two lines are based on the function *ln(cd)=ln(pd)+a*, where *cd* equals Chain density, *pd* equals Population density and *a* is the intercept. In market 1 it takes a Population density of *a* in order for one store to be established and in market 2 it takes a Population density of *a+b* for one store to be established. Therefore the barriers to entry in market 1 are lower than in market 2.

Assume that the slopes of the two lines are equal and, for simplicity, that km² equals 1 so that chain density is the same as number of chains and population density is the same as population size. To illustrate the entry barriers in the two markets, let us start by observing market 1. In market 1, in order for the first chain to be established, a population of *a* is required. However, in market 2, a population of *a+b* is required for one chain to be established. This means that in market 2, a larger population is needed for the first chain to be profitable, and the interpretation is that the barriers to entry are larger in this market. Another interpretation of the intercept is how many stores a monopoly firm needs in order to cover entry costs when establishing in a market. Barriers to entry can for instance be high establishing costs, regulations set by the city government or economies of scale.

Figure 2 illustrates the relationship between the variables reflected by the slope parameter and how to interpret the competition from this relationship.

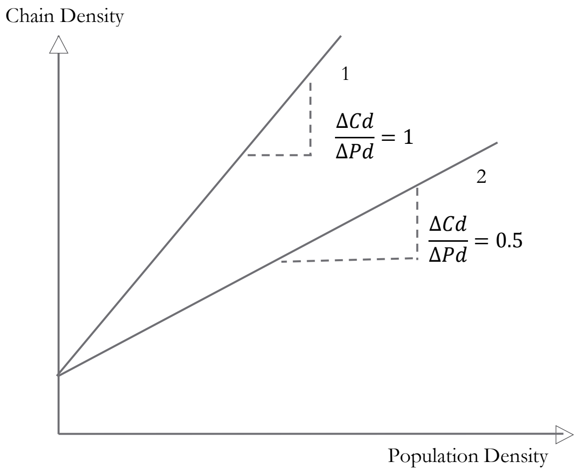

Figure 2: The relationship between Chain density and Population density showing the strength of competition. Based on the function *ln(cd)=ln(pd)+a*, where *cd* equals Chain density, *pd* equals Population density and *a* is the intercept. In market 1 Chain density increases equally much as Population density, meaning the competition is not increasing. In market 2 Chain density increase less than Population density, indicating the competition is increasing (own working).

Let us assume that both countries have the same intercept – meaning they have the same level of entry barriers. In market 1, chain density increases equally much as population density because the slope is equal to 1. This implies that the competition is not intensifying in this market because there is no change in how many customers a chain needs in order to be profitable after new chains are established. In market 2 on the other hand, chain density increases less than population density and here chains need more customers per chain in order to retain the same profit level. This indicates that the competition became higher. The bottom line is that when the slope parameter is less than 1, competition becomes more intense when the number of chains increases.

Many studies of competition in comparison between different countries are considering prices or profit margins, but it is important to remember when performing such studies that exchange rates and inflation can bias the outcome. This study is an indirect way of looking at the competition and is therefore free from such biases.

The theory outlined above will be applied, when making the comparison between Sweden and Germany, and if a significant difference in the relationship between chain density and population density and different intercepts can be found, it shows that the two countries differ substantially in strength of competition and barriers to entry.

Data

This section describes the variables and data with definitions of the competing firms, the relevant economic market and concentration.

The Definition of a Firm

The competing firms are primarily defined by chains, but the interpretation of the firm as stores is also taken into consideration in order to detect whether the outcome is sensitive to such definition. There is a problem with the interpretation of the co-operatively organized chains ICA and Edeka. It can be discussed whether their chains individually compete with each other due to their independence, or if they face lower competition between each other because they operate under the same umbrella organization. However, to account for the potential bias that the different interpretations can give, the analysis is also carried out both with ICA and Edeka integrated as chains and separated as independent market participants.

The decision to mainly define the competing firms as chains is based on the idea that stores within the same chain do not compete with each other and considering the competition between individual stores could overestimate the degree of competitiveness in the market. However, it can be argued that in markets where each chain has a large number of stores, the competition intensifies compared to if they have few stores (comparing with the same number of chains participating in the market). Therefore, the alternative definition of the firm as an independent store has been taken into consideration. Another factor supporting stores as the definition of a firm is that in Sweden prices can vary between stores belonging to the same chain depending on the location; thus, prices are determined by the local competition rather than nationally.[7]

For simplicity, all competing chains are assumed to be of the same size and are also assumed to compete equally much with each other. However, these assumptions can create a bias in the competition analysis. When considering the competition between different stores, it can be questioned whether small grocery stores compete with hypermarkets. For a small grocery retailer it is important to be centrally located but for a hypermarket it is the opposite – they are often located in the outskirts of the city so people conveniently can go there by car and find a parking space. For a hypermarket it is also crucial to offer a broad product range, whereas small chains usually only have the most basic products. It could also be discussed whether discount chains compete with supermarkets. They do operate in the same sector but have differentiated themselves by focusing on different aspects such as low prices versus a wide products range.

The Definition of the Relevant Economic Market

Each chosen municipality represents one relevant economic market and the different grocery stores are defined by zip codes. This method was chosen because of its simplicity and due to limited time and resources. However, it may have been more desirable to run a "hypothetical monopolist" test. The US Department of Justice issued the Horizontal Merger Guidelines in 1992, which states that the relevant economic market is the minimum geographical area in which a hypothetical profit-maximizing firm could slightly increase its prices to make a larger profit.[8] Therefore, the relevant economic market would be the area in which a hypothetical monopolist could operate. The accuracy of the empirical outcome could potentially be increased by carrying out a "hypothetical monopolist" test. However, the data has been gathered with consistent criteria for all considered municipalities and should therefore give a satisfying picture of the circumstances.

A properly defined market is such that it defines one isolated area in which the citizens mainly do all their grocery shopping, and the stores generally only attract residents from within the defined area. If one municipality is close to another municipality of similar size or larger, the citizens may go grocery shopping in a city where they are not registered as residents. This means that the chains do not compete only with other chains within in the defined market but also with chains

[7] Lundin, Douglas (2011), "Mat och Marknad – Från Bonde till Bord", The Swedish Competition Authority Report 2011:3
[8] U.S. Department of Justice and the Federal Trade Commission (1992), Horizontal merger guidelines, 2 April

in nearby areas, which implies that the competition really is more intense than the analysis shows. Municipalities close to larger cities have not been selected since it is assumed to be more likely that people commute in larger citites. The municipalities were chosen based on a population size of 30 000-150 000 and cannot be closer than 50 km to a city with more than 400 000 inhabitants.

There is also a risk that the relevant market is too widely defined and that all chains within the defined market do not compete with each other due to distance, which can result in the estimated degrees of competition ending up higher than they actually are. These two potential biases imply an offsetting effect since one results in higher competition and the other one results in weaker competition. With Germany being more densely populated and cities being located relatively close to each other, there is a more predominant risk for the first bias – that residents in one city do there grocery shopping in another city. However, in Sweden the risk is rather that the market is too widely defined due to large distances. Consumers are not very likely to travel long distances to do their grocery shopping – yet if a chain can offer a wider range of products to a lower price it gives incentives to travel farther than one normally would. This indicates that the relevant market for a hypermarket is larger than for a small grocery chain.

Data and Variables

Different municipalities were selected with regard to population size and their closeness to other large cities. Data on number of stores, number of chains and number of square kilometers based on the definition of the firm and the relevant economic market was collected. Data was collected by attaining information from each municipality's local governments and from each grocery retail chain's website by searching for grocery stores using zip codes. The variables used in the regression are presented in Table 1.

Measuring number of chains and population in absolute numbers can be misleading since some markets have a large surface while others are smaller. Two markets can have the same number of chains and the same population but be of significantly different sizes. To take this into account, both number of chains and population were divided by square kilometers to get chain density and population density before regressing the data. When comparing Swedish and German municipalities, the comparison between chain density and population density will give a more accurate picture since the municipalities are of different sizes. Furthermore, the variables were transformed into logarithmic terms in order to even out differences between population size and square kilometer. This simplifies the comparison between the different markets.

Table 1: Mean, Standard deviation, Minimum value and Maximum value of the regression variables Km², Population, Chains 1 (ICA and Edeka respectively considered as integrated as one chain), Chains 2 (ICA and Edeka respectively considered as separate market participants) and Stores.

Variable	Observations	Mean	Std.Dev	Min	Max
Km²	100	772.17	1146.84	31	6859
Population	100	64615.18	30952.27	30918	194800
Chains 1	100	5.7	1.47	2	9
Chains 2	100	11.12	4.09	4	24
Stores	100	20.47	8.57	5	44

Measuring Concentration

Concentration will be measured by the ratio C_4 and then compared to the Herfindal index. C4 is the sum of the market shares of the four largest firms. C_4 is a traditional measure of market concentration and has the advantage of being relatively easy to use while still giving a satisfying picture of the market condition. C_4 is determined by:

$$C_4 \equiv \sum_{i=1}^{4} s_i$$

The result is expressed in percentage terms, and an outcome in the range of 50 per cent to 80 per cent is regarded as medium concentration, whereas 80 per cent to 100 per cent indicates high concentration. The critique against C_4 is that the distribution of firm size is not taken into consideration; therefore we compare it to the Herfindal index, which accounts for firm size (Cabral, 2000). The Herfindal index is given by:

$$H \equiv \sum_{i=1}^{n} s_i^2$$

The Herfindal index is the sum of all firms' market shares raised to the power of two, and the interpretation of the outcome is as follows:

Table 2: Interpretation of Herfindal Index (source: US Merger Guidelines 2010, §5.3)

Outcome	Definition
H< 0.01	Highly competitive market
0.01<H<0.15	Unconcentrated market
0.15<H< 0.25	Moderately concentrated market.
H> 0.25	Highly concentrated market

Concentration Measures for Germany and Sweden

To measure C_4, each chain's total amount of stores in all observed municipalities was aggregated. Next, the market share of each chain was calculated by dividing the chains' number of stores by the total numbers of stores in all 50 municipalities. The four chains with the largest market shares were finally added together to estimate C_4; see Table 3.

The analysis shows that the concentration in Sweden is higher than in Germany. Sweden has an estimated C_4 of 0.92 while Germany has a C_4 of 0.72. Sweden falls within the region of high concentration whereas Germany is in the percentage range of medium concentration.

Table 3: Concentration in Germany and Sweden

Chain:	Edeka	Rewe	Aldi Nord/Süd	Netto marken discount
Market share	0.22	0.19	0.17	0.14

$$C_4(Germany) \equiv \sum_{i=1}^{4} s_i = 0.72$$

Chain:	ICA	Coop	Axfood	Lidl
Market share	0.41	0.21	0.24	0.05

$$C_4(Sweden) \equiv \sum_{i=1}^{4} s_i = 0.92$$

Table 3 shows that the market shares of the four largest chains in Sweden are skewed, meaning that there is a notable difference between the chain with the largest market share and the chain with the smallest market share among the four chains considered. This indicates that the market is even more concentrated than the measure C_4 illustrates. To see if the C_4 ratio gives a satisfying picture of the conditions, the Herfindal index is calculated. The Herfindal index gives more weight to larger firms since the market shares are squared and the index ranges from 1 to n, where n is the number of firms in the market. The calculated Herfindal indices are shown in Table 4.

Table 4: Herfindahl indices for Germany and Sweden

Chain(Germany)	Edeka	Rewe	Lidl	Kaufland	Aldi Nord/Süd	Real	Netto	Netto MD	Norma
Share²	0.047222	0.036388	0.01634	0.002136	0.029949	0.000813	0.000349	0.01868	0.003717

$$H(Germany) \equiv \sum_{i=1}^{n} s_i^2 = 0.16$$

Chain (Sweden)	ICA	Coop	Bergendahl	Axfood	Netto	Lidl
Share²	0.166274	0.045622	0.001508	0.058912	0.002082	0.002648

$$H(Sweden) \equiv \sum_{i=1}^{n} s_i^2 = 0.28$$

Sweden has a Herfindal index of 0.28 and hence falls in the range of high concentration, and Germany has a Herfindal index of 0.16, which is concidered moderate concentration but close to having an unconcentrated market. Consequently, after taking firm size into consideration, Sweden is again found to have a higher concentration than Germany. The calculated Herfindal index is in line with the previously calculated C_4 ratio.

Econometric Analysis and Empirical Results

This section explains the econometric model and presents the empirical results.

Econometric Analysis

To investigate how population density affects chain density, an econometric analysis has been performed. The estimated regression is

$$ln(cd) = \beta_0 + \beta_1 \ln(pd) + \beta_2\theta + \beta_3[\ln(pd) \times \theta]$$

where $ln(cd)$ equals the logarithm of chain density, β_0 is the intercept of the regression, $\ln(pd)$ is the logarithm of population density, θ is a dummy variable for country, where Sweden equals 0 and Germany equals 1, and finally $(lnpd \times \theta)$ is the logarithm of population density times the dummy variable country. The dummy variable has the function of creating an intercept and a slope parameter specific for Germany. If Germany has different entry barriers, the dummy variable θ will show the specific intercept for the German observations, and if Germany has strength of competition $(lnpd \times \theta)$ will show the specific slope for the German observations. To make this clearer we can set the dummy variable equal to zero, which will be the case for all the Swedish observations.

The estimated regression for Sweden (θ=0) is

$$ln(\mathrm{cd}) = \beta_0 + \beta_1 \ln(pd)$$

and the estimated regression for Germany (θ=1) is

$$ln(\mathrm{cd}) = [\beta_0 + \beta_2\theta] + [\beta_1 \ln(pd) + \beta_3(\ln(pd) \times \theta)]$$

What we want to find out is whether these two regressions are the same or if the German observations have a specific intercept and slope parameter. The data is regressed – primarily with chain density as the dependent variable and population density as the independent variable. The same regression will also be performed when considering the stores of the co-operatively organized retailers ICA and Edeka as separate competing entities. Finally, the regression will be estimated with store density as the dependent variable. A significance level of 5 per cent will primarily be used when performing hypothesis tests on the result.

Empirical Results

Chain Density and Population Density with ICA and Edeka Integrated

The plotted data of chain density and population density in Sweden and in Germany is displayed in Figure 3. The Y-axis shows chain density and the X-axis shows population density, both are in logarithmic terms. The green dots are Swedish municipalities and the blue dots are German municipalities. We can see that the German municipalities have higher chain density and higher population density, which tells us that the German markets are less concentrated but also have larger populations. Both sets of data have an estimated fitted line, and when observing this line we see that the Swedish observations seem to be in line with the German observations. We can potentially see a larger intercept for the German municipalities, and to deeper analyze the relationship between store density and population density, the following regression is generated:

$$ln(cd1) = 0.86\, ln(pd) + 0.73\theta + 0.01[\ln(pd) \times \theta] - 8.94 \qquad Adj\ R^2 = 0.93$$

based on the data from Table 5.

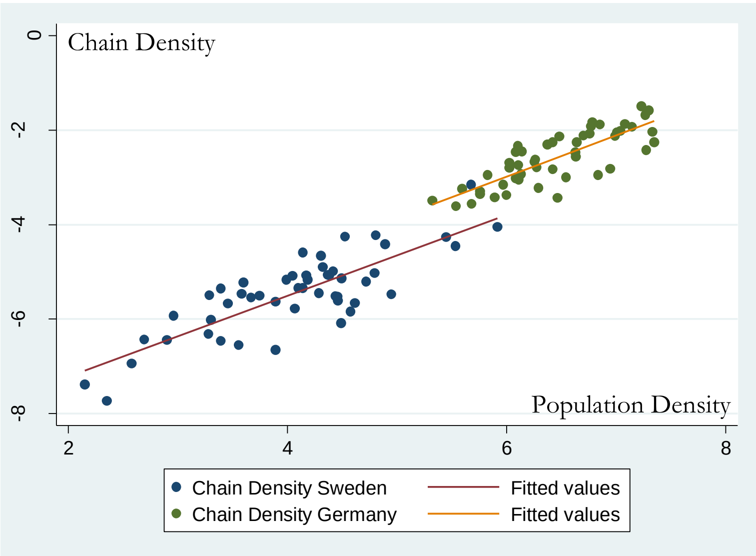

Figure 3: The relationship between Chain density and Population density in Sweden and in Germany - ICA and Edeka stores are interpreted as integrated chains.

Table 5: Regression Chain density and Population density - ICA and Edeka integrated.

Chain Density (cd1 - ICA and Edeka integrated)	β	Std. Err.	t	P>t
Population density ln(pd)	0.86	0.07	11.60	0.000
Country (θ)	0.73	0.79	0.92	0.358
Population density × Country [ln(pd)× θ)]	0.01	0.14	0.09	0.927
Intercept (a)	-8.94	0.31	-29.14	0.000

From the estimated regression we can see that the intercept is equal to -8.94 and the slope of the line when considering all the observations is 0.86. Further, we can calculate the specific intercept for the German observations by adding the β for the dummy variable θ to the intercept, giving - $-8.94 + 0.73 = -8.21$. This means that the specific intercept for the German observations is equal to -8.21, yet the parameter θ is not significant at the chosen significance level of 5 per cent and can therefore not be statistically proven to be different from zero.

The specific slope parameter for Germany is obtained by adding the parameter $[\ln(pd) \times \theta]$ to the slope parameter $ln(pd)$, giving 0.86 + 0.01 = 0.87. Again, the parameter $[\ln(pd) \times \theta]$ is not significant at the 5 per cent level and cannot be statistically proven to be different from zero.

If θ and $[\ln(pd) \times \theta]$ were significant, the chain density in Germany would have a different slope parameter and a different intercept relative to Sweden. However, since they are shown to be insignificant we can conclude that barriers to entry and the strength of competition are the same in the two countries. The adjusted R^2 of the regression equals 0.93, meaning that 93 per cent of the variation in chain density can be explained by the variation in population density.

Chain Density and Population Density with ICA and Edeka Separated

Moreover, to take into consideration the problem with interpreting ICA and Edeka stores respectively as one integrated firm, the same regression as above is estimated with the difference that the ICA and Edeka chains are considered individual entities competing with each other. The outcome is shown in Figure 4.

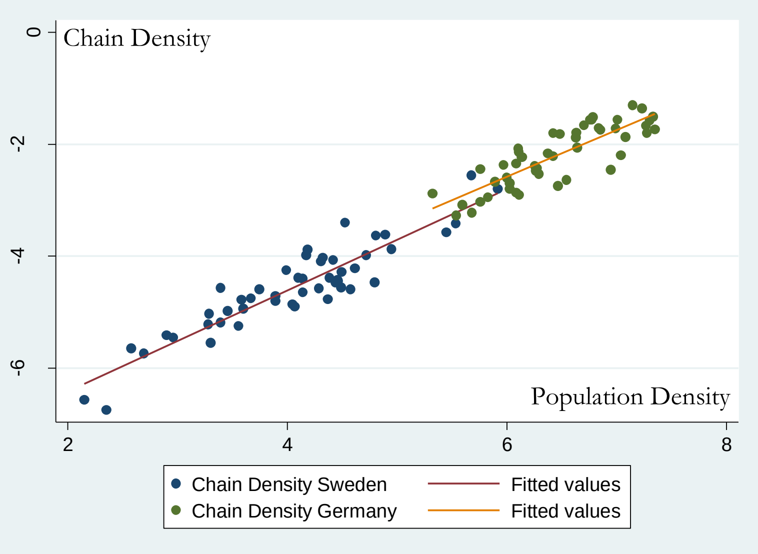

Figure 4: Chain density and Population density in Sweden and Germany – ICA and Edeka separated.

In this Figure the German observations seem to be even more in line with the Swedish observations. Still, the intercept for the German municipalities seems to be slightly above the intercept for the Sweden municipalities. Based on data from Table 6, the econometric analysis gives the following outcome:

$$ln(cd2) = 0.90\ln(pd) + 0.62\theta - 0.07[\ln(pd) \times \theta] - 8.23 \qquad Adjusted\ R^2 = 0.95$$

Here $ln(cd2)$ equals chain density in logarithmic terms when ICA and Edeka are considered separated. The estimated β is 0.90 and the adjusted R^2 equals 0.95, and also here the parameters θ and $[\ln(pd) \times \theta]$ are insignificant at the five per cent significance level.

Table 6: Regression Chain density and Population density - ICA and Edeka separated

Chain Density (cd2 - ICA and Edeka separated)	β	Std. Err.	t	P>t
Population density ln(pd)	0.90	0.05	16.94	0.000
Country (θ)	0.62	0.57	1.08	0.283
Population density × Country [ln(pd)× θ)]	-0.07	0.10	-0.68	0.497
Intercept (a)	-8.23	0.22	-37.17	0.000

Store Density and Population Density

To investigate whether using the other definition of competing firms affects the outcome, the same regression was performed considering the competition between stores instead of chains. Figure 5 presents the outcome.

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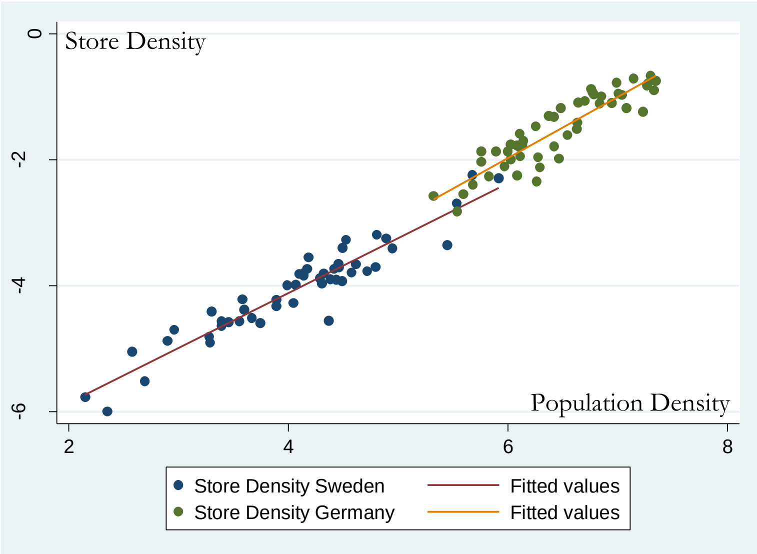

Figure 5: The relationship between Store density and Population density in Sweden and Germany.

The outcome does not seem to differ from the above estimations. The Swedish observations are still almost in line with the German observations. Based on the data from Table 7 the econometric analysis shows:

$$ln(sd) = 0.87\ln(pd) - 0.18\theta + 0.10[\ln(pd) \times \theta] - 7.60 \qquad Adjusted\ R^2 = 0.97$$

Table 7: Regression of Store density and Population density.

Store density ln(sd)	β	Std. Err.	t	P>t
Population density ln(pd)	0.87	0.04	20.40	0.000
Country (θ)	-0.18	0.46	-0.39	0.701
Population density × Country [ln(pd)× θ)]	0.10	0.08	1.23	0.223
Intercept (a)	-7.60	0.18	-42.87	0.000

Here $\ln(sd)$ equals store density in logarithmic terms, the estimated β is 0.87 and the adjusted R^2 equals 0.97.

As we can see from the above results, the outcomes of the three different estimations are relatively similar, and neither θ nor $[\ln(pd) \times \theta]$ are significant in any of the cases. Thus, the conclusion does not change when interpreting ICA and Edeka as separated instead of integrated, or when estimating store density instead of chain density.

Measure of the Degree of Competition

The analysis of the degree of competition in Sweden and in Germany shows that both countries face increased competition when the number of chains increases. The result is based on the regressions presented in Table 8. The regressions have a positive parameter for population density of 0.86, which means that when the population density increases one per cent, the chain density increases by only 0.86 per cent. Table 8 further illustates this relationship.

Table 8: Customers per chain in a market with a Population density parameter of 0.86

	Monopoly	Duopoly	3 Chain Oligopoly
Population Density	1000	2163	4678
Customers per Chain	1000	1081.5	1559

Assume for simplicity that km² equals one. A population of 1000 is required for a monopoly to be profitable. When another chain is established and the market becomes a duopoly, the population has to increase 1/0.86=1.16 times in order for the chains to make the same profit. The relationship here is the inverse because we have a starting point in the percentage increase of chain density and not population density. Consequently, the required profit requires more customers per firm.

The regression with ICA and Edeka separated has a parameter of 0.90 and the last regressions with store density as the dependent variable shows a parameter for popuation density of 0.87, meaning that in both cases the dependent variable increases less than population density. However, by running a hypothesis test it could not be proven that the β for any of the above regressions is significantly different from 1 at a 5 per cent significance level. At a 10 per cent significance level the β for chain density both with ICA and Edeka separated and intergrated is significant.[9] It is important that β is below 1 because when β equals 1, chain density inceases equally much as populations density, which means that the chains do not need more customers per chain to retain normal profit and the competition is not increasing.

Discussion of the Outcome

In this section the results presented previousy are discussed and potential biases and alternative interpretations are presented.

The results show no significant difference between Sweden and Germany in the degreee of competition, which goes hand in hand with the Swedish competition authority's report "Mat och Marknad – från bonde till bord", where Sweden is claimed to not have lower competition than other comparable countries.[10] However, it is often stated that Sweden has weak competition and a high concentration in food retailing relative to other countries. This is, as mentioned, commonly used as an explaination to high food prices.[11] We therefore might have expected the competition in Sweden to be weaker than in Germany and it is interesting to investigate why this is not the case.

To better understand the outcome, we take a closer look at the characteristics of the two considered markets. Some features differ between the markets in Sweden and in Germany. In Sweden the concentration of retailers is higher than in Germany. Both the German and Swedish grocery retailing industry has been characterized by a reduction of smaller stores and an increase in the number of hypermarkets. However, a very strong trend in Germany is the increase of discount markets, which have gained market shares from ordinary supermarkets and smaller grocery stores. Even regular grocery retailers in Germany are opening up their own discount stores.

However, we can ask ourselves the question why we cannot see a difference in competition between chains in Sweden and Germany even though there seem to be differences in the market conditions. Clearly the German market is to a greater extent characterized by discount chains, which should put a downward preassure on prices and increase competition. Nonetheless,

[9] For further details see Appendix 1

[10] Lundin, Douglas (2011), "Mat och Marknad – Från Bonde till Bord", The Swedish Competition Authority Report 2011:3

[11] Lundvall, Karl (2004), "Konsumenterna, matpriserna och konkurrensen", The Swedish Competition Authority Report 2004:2

discount markets do not nessecarily compete directly with traditional chains. They offer a smaller range of products, and the service and display of the products are probably at a lower level of quality. They have therefore differentiated themselves from other chains and many customers value quality above price level. It is arguable that discount chains are not perfect substitutes to other chains and due to this, the difference in number of discount chains between the countries do not significantly affect the strength of competition.

When studying the relationship between chain density and population density to measue the strength of competition, it could hypothetically be the case that the chains respond to the increased competition by becoming more cost efficient. This would mean that they would need fewer customers per chain than if there were no cost reduction in order to retain the same level of profit after new establishments. This implies that the competition is potentially stronger than the model suggests. However, if we make the assumption that the firms have maximized their cost efficiency, the increased number of customers per chain will straightly reflect the increase in competition. Although chains can respond to increased competition by lowering costs, it will come to a point when this is no longer possible.

Furthermore, we must also consider alternative explanations to chain density in addition to population density. Other potential factors that can effect the number of chains in a market are the level of income, people's preferences and people's willingness to pay for food. Taking these variables into account when estimating the relationship could alter the outcome – however, the level of income was taken into consideration and shown not to have a significant effect on the number of chains.[12] A reason explaining this outcome can be that groceries are essential no matter what level of income you have. Income level is likely to not have the same affect in the grocery retailig market as for example in the clothing market. Two other factors that can have an impact on the number of chains are the cost of floor space and transportation costs.[13] Cost of floor space can be interpreted as a barrier to entry and is therefore covered by the intercept. If the cost of floor space is very high, more customers per chain will be required to open the first chain. However, transportation costs are arguably more significant in Sweden than in Germany and can be seen as included in the concentration measures. If transportation costs are high, the chains have large economies of scale and the market will therefore be more concentrated. This affects the level but not the strength of competition.

[12] For further details see Appendix 1.
[13] Asplund, Marcus & Friberg, Richard (2003), "Food prices and market structure in Sweden"

Equivalent in the two countries is that the market is characterized by large retailing chains. Germany has a larger number of chains operating in the market, although we have to keep in mind that Germany has a population of about eight times the population in Sweden. However, the market concentration is proven to be higher in Sweden than in Germany, and, theoretically, a high concentration leads to poor competition. The rate of concentration does not seem to have a large effect on the strength of competition.. However, it does affect the overall strength of competition in the country. Arguably, Sweden faces a higher concentration simply because of low population density and great distances between urban communities. Such conditions give the retailers in Sweden large economies of scale compared to German retailers, as they have to invest a lot of money in the distribution network, among other factors. When economies of scale are predominant, the average cost decreases with output, and the size is smaller and number of chains present in the market are fewer (Cabral, 2000). Arguably, the high concentration detected in Sweden is the most efficient market structure for cost efficiency. This results in the absolute competiton in Sweden being lower than in Germany, but the concentration has not affected the marginal competiton one additional chain adds to the market. Taking a stand in this analysis, the high concentration detected in Sweden is not a problem. Today there is a great deal of focus on the power of large firms dominating the market and how their dominant positions can hurt the customers. However, there are many positive economies of scale benefits of having large firms and in particular in the food retailing industry, for instance due to quantity discounts given to firms ordering large volymes from wholesalers. With the benefits of scale economies in mind, it can be in society's interest to focus more on reaching efficient competition than worrying about firms growing too large. The real concern is whether certain conditions in the market have negative affects on the customers. Low competition can never benefit consumers or the society as a whole.

Another noticable result when analyzing the concentration in the two countries is the barriers to entry. High entry barriers can be an explanation to high concentration – although the outcome showed no difference between Sweden and Germany in entry barriers even if the countries have different degrees of concentration. This result therefore supports the idea that the degree of concentration in Sweden is the naturally most efficient market structure and is not due to obstacles to establishing new chains. It is equally easy or hard to establish a new chain in Sweden as in Germany. Nevertheless, we have to keep in mind that just because the result showed no differences in entry barriers, it does not mean they are low. In Sweden for instance, when a retail chain wants to establish a new chain, the city government has to give permission, and they also decide how many chains can be established and where they will be located. When making the decision, the city will consider how the profitability of other chains will be affected. Another potential entry barrier in the two countries is the integrated food supply chain. The dominating retailers have a highly integrated supply chain that is closed to other participants in the market.[14] The city governments should not set up barriers to entry when new chains are to be established. However, we cannot determine whether the barriers to entry are high or low, and to analyze this issue more deeply is outside the frame of this study. What we suggest is that the high concentration in Sweden is not a result of entry barriers, since they are at the same level in Germany, yet Germany faces a lower concentration.

Finally, we now know that Sweden and Germany have the same strength of competition, but to take it one step further we questioned whether the competition works efficiently in the two countries. It could be shown that both chain density and store density increase less than population density in the two countries. We reached a point estimate less than one for all three regressions, and this tells us that the competition in Sweden and in Germany intensifies when a new chain is established. However there are potential biases in this analysis such as the relevant economic market being too widely defined, meaning that the area within which chains actually compete with each other is much more narrow than assumed. Another bias is the risk that different chains such as discount markets do not directly compete with larger supermarkets and hypermarkets, implying that they are not good substitutes for each other. These biases can result in an overestimation of the competition.

[14] Lundin, Douglas (2011), "Mat och Marknad – Från Bonde till Bord", The Swedish Competition Authority Report 2011:3

Conclusion

This section will sum up the analysis of the study.

Although it is commonly argued that Sweden faces lower competition than Germany and that the competition in Germany works more efficiently than in many other European countries, this study indicates that the Swedish grocery retailing market has the same strength of competition as the German grocery retailing market. The notion that the competition in Sweden is less efficient must therefore be questioned. What similarities in the markets cause the competition to be equal cannot be completely sorted out by this study, but we did discover that the entry barriers are similar, and it can be assumed that factors such as the cost of establishing a new store and the ability to receive permisson from the local governments are equal between the countries. Another idea is that chains in both countries differentiate themselves and equally much when establishing in a new market.

A significant difference found is the degree of concentration in the two markets – Sweden has a remarkably higher concentration than Germany. However, the high concentration in Sweden is simply due to the "natural" characteristics, with Sweden being a large country with a small population, resulting in substaintial economies of scale for example due to transportation costs. This idea is supported by the fact that the difference in concentration is not reflected by a difference in the strength of competition. Moreover, it is backed up by the discovery that entry barriers are similar in the two countries. A high concentration in a country can be a result of significant barriers to entry; however, in this case entry barriers cannot fully explain the degree of concentration because of differences between the the countries in concentration but similarities in entry barriers. Therfore, it is more likely that factors such as economies of scale are behind the level of concentration in Sweden. With this in mind it is more crucial to focus on enhancing competition rather than on preventing firms from merging and becoming large and investigating whether the firms with high market shares use their dominant position in a negative way or not, although our results indicate that this is not the case. However, the concentration has an effect on the overall competition in the country. In both Sweden and Germany, each new chain established contributes to additional competition in the market. There are several more chains established in Germany than in Sweden, indicating that the level of competition is higher. This tells us that the claim that Sweden faces weaker competition is true when considering the aggreated level of competition in the country, and it can explain why Sweden is claimed to have high food prices. However, the bottom line is that Sweden cannot reach Germany's level of competition by new regulations or through competition policy, since the diference is only due to natural factor that Sweden has a low popuation density.

Finally, both the Swedish and the German market are characterized by increased competition both between stores individually and between chains in more densely populated areas. However, we cannot state whether the degree of competition is high or low, and there is a risk that the outcome is biased. It can be that the relevant economic market is too widely defined, telling us that chain competition in the grocery retailing market is more local than expected. It can also be that different types of chains, such as discount markets and large supermarkets, do not directly compete with each other, because they differentiate themselves by focusing on different characteristics. To analyze whether such differentiation benefits or hurts the consumers, information about price levels or profits is required. For further analysis, it would be interesting to investigate whether the outcome differs when defining the relevant economic market more narrowly, because it is important to know at which level chains compete in order to detect weaknesses in the competition.

Appendix 1

Calculations and Hypothesis Testing of the Result

Comparison Between Sweden and Germany

The regression is estimated from the following function:

$$ln(cd) = \beta_0 + \beta_1 \ln(pd) + \beta_2 \theta + \beta_3 [\ln(pd) \times \theta]$$

where $ln(cd)$ is the logarithm of chains divided by square kilometers, $\ln(pd)$ is the logarithm of population divided by square kilometers, θ is the dummy variable for country with Sweden equal to zero and Germany equal to one, and $[\ln(pd) \times \theta]$ is country multiplied with the logarithm of population density.

The estimated regression for Sweden (θ=0) is

$$ln(cd) = \beta_0 + \beta_1 \ln(pd)$$

and the estimated regression for Germany (θ=1) is

$$ln(cd) = [\beta_0 + \beta_2 \theta] + [\beta_1 \ln(pd) + \beta_3 (\ln(pd) \times \theta)]$$

In order to discover if Sweden and Germany have the same slope parameter and intercept, we perform the following hypothesis test:

$$H_0: \beta_0 = \beta_3 = 0$$

$$H_1: H_0 \ is\ not\ true$$

Table A1: Regression Chain density and Population density - ICA and Edeka integrated.

Chain Density (cd - ICA and Edeka integrated)	β	Std. Err.	t	P>t
Population density ln(pd)	0.86	0.07	11.60	0.000
Country (θ)	0.73	0.79	0.92	0.358
population density × country [ln(pd)×θ)]	0.01	0.14	0.09	0.927
Intercept (a)	-8.94	0.31	-29.14	0.000

By observing the paramters P-values, we can state that both β_2 and β_3 have a P-value larger than the significance level of both 5 per cent and 1 per cent, and we can therefore not reject the null hypothesis that the parameters are equal to zero. The same is true for the estimations of chain density with ICA and Edeka separated and with store density as the dependent variable, analyzed from the following tables:

Table A2: Regression Chain density and Population density – ICA and Edeka separated.

Chain Density (cd2 - ICA and Edeka separated)	β	Std. Err.	t	P>t
Population density ln(pd)	0.90	0.05	16.94	0.000
Country (θ)	0.62	0.57	1.08	0.283
Population density × Country [ln(pd)×θ)]	-0.07	0.10	-0.68	0.497
Intercept (a)	-8.23	0.22	-37.17	0.000

Table A3: Regression of Store density and Population density

Store density ln(sd)	β	Std. Err.	t	P>t
Population density ln(pd)	0.87	0.04	20.40	0.000
Country (θ)	-0.18	0.46	-0.39	0.701
Population density × Country [ln(pd)×θ)]	0.10	0.08	1.23	0.223
Intercept (a)	-7.60	0.18	-42.87	0.000

Measuring Strength of Competition

The parameter for population density is 0.86, which implies that when population density increases by one unit, the chain density increases by only 0.86 units. As mentioned earlier, when the chain density increases less than the population density, we can assume that each chain needs a larger number of customers to attain normal profit and therefore the compition has intensified. To statistically prove this, the following hypothesis test has been performed:

$$H_0: \beta_1 < 1$$

$$H_1: \beta_1 \geq 1$$

The test was performed by using a t-test with the calculated t-values:

Chain level – ICA and Edeka integrated:

$$t = \frac{0{,}86-1}{0.07} = -2$$

Chain level – ICA and Edeka separated:

$$t = \frac{0{,}90-1}{0.05} = -2$$

Store level:

$$t = \frac{b_2-\beta_2}{se(b_2)} = \frac{0{,}87-1}{0.04} = -3.25$$

Critical t-value at a 5 per cent significance level: $\mathrm{t}_{\alpha,\mathrm{N-K}} = \pm 1.676$

Acceptance region: [-1.676;1.676]

Rejection region is: is [-∞; -1.676] U [1,676;∞]

Critical t-value on a 1 per cent significance level: $\mathrm{t}_{\alpha,\mathrm{N-K}} = \pm\ 2.403$

Acceptance region: [-2.403;2.403]

Rejection region is: is [-∞; -2.403] U [2.403;∞]

At a 5 per cent significance level, for all observations the calculated t-values are smaller than the critical t-value and we can therefore reject the null hypothesis that β_1 is smaller than one. However, at a 1 per cent significance level the calculations for chain density have a t-value within the acceptance region. We can therefore accept the null hypothesis that beta is smaller than one.

Calculation with additional independent variables

TableA4: Regression Chain Density, Population Density and Income

Chain density	β	Std. Err.	t	P>t
Population density	0.92	0.08	11.21	0.000
Population density × Country	-0.05	0.14	-0.37	0.721
Country	-20.2	13.13	-1.54	0.127
Income	-1.69	0.98	-1.92	0.088
Income × Country	1.73	1.09	1.59	0.114
Intercept	-7.60	0.18	-42.87	0.000

The parameters *Population density* × *Country* , *Country, Income, Income* × *Country* and the intercept are all insignificant at the 5 per cent and at the 1 percent significance level.

List of References

Asplund, Marcus & Friberg, Richard (2003), "Food prices and market structure in Sweden"

Bergman, Mats and Stennek, Johan (2011), "Bra konkurrens trots hög koncentration". Mimeo

Bresnahan, T. and Reiss, P. (1991), "Entry and competition in concentrated markets". *Journal of Political Economy*, 99:977-1009

Cabral, Luis M.B. (2000), *Introduction to industrial organization*, The MIT press, Massachusetts.

Hazapi C., Tomas M.,"Lågprislivsmedelsbutikernas existens i svensk varudaglighandel", Södertörns Högskola 2005

Jörgensen C., (2011), "Lokalisering och konkurrens i dagligvaruhandeln", AgriFood Economics Centre

Lundin, Douglas (2011), "Mat och Marknad – Från Bonde till Bord", The Swedish Competition Authority Report 2011:3

Lundvall, Karl (2004), "Konsumenterna, matpriserna och konkurrensen", The Swedish Competition Authority Report 2004:2

The Swedish Government Resolution 14, Jo2010/1629, 20 May 2010, p 2

The German Competition Authority, "Tätigkeitsbericht 2009/2010", Reporte 1766/40, 20 July 2011

U.S. Department of Justice and the Federal Trade Commission, Horizontal merger guidelines, 2 April 1992