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Master Degree Project in Economics

Competition in the Swedish Pharmacy Market

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Master Degree Project No. 2015:62
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Acknowledgments

I would like to express gratitude towards my supervisor Professor Johan Stennek at the Department of Economics for his support and advice in the writing of this thesis. Thanks also go to Yonas Alem and Florin Maican at the Department of Economics who have contributed with practical guidance and answered many of my questions. Finally, a great thank you to my family and friends who have supported me throughout the process.

Mia Hackelsjö

Gothenburg 2 June 2015

Abstract

Since the deregulation of the state monopoly of Apoteket AB, several private agents have entered the Swedish pharmacy market which has resulted in a new competitive environment. For analysing competition in the market, this study uses six years of data for 2009, 2011, 2012, 2013, 2014 and 2015. Panel data estimation allows for comparisons both over time and between municipalities. The major results indicate that competition is weak among the pharmacies and that the number of pharmacies increases in markets with more chains. Overall, the reform has resulted in higher availability for the consumers and longer opening hours, with the largest impact in urban areas where the majority of the new pharmacies have established.

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1. Introduction

In July 2009, the state owned monopoly of Apoteket AB was deregulated as one of three major reforms that restructured the Swedish pharmacy market. Expectations of higher efficiency, increased diversity, lower prices and higher availability for the population were some of the objectives with these reforms (Swedish Agency for Public Management 2013). After the market opened up for competition, private firms have entered and larger chains have established and acquired smaller ones. In combination with changed regulations, this has resulted in a new competitive environment for the incumbents.

Since 2009, the number of pharmacies has increased by 44 percent and the majority of these have established in densely populated areas. The number of pharmacies has increased over time for all regions in the country, however with a large variation between different regions. For instance, Stockholm has 114 more pharmacies in 2015 compared to 2009, an increase of 73.5 percent. For Jämtland the number of pharmacies has increased by only 2 or equivalently 8.7 percent (Apoteksinfo.nu 2015).

The aim of this thesis is to investigate the competition in the market and examine the development during the years after the deregulation. This is possible by analysing market panel data and applying a model that is based upon the ideas of Bresnahan and Reiss (1991) for explaining how the pharmacies establish in the market. Using the concept of minimum population sizes that firms need in order to enter the market, it is feasible to obtain indications about the firms' margins and thereby draw conclusions about competition. The model is explained in details in chapter 4 below.

Earlier studies have evaluated the market after the deregulation. Competitive aspects in the market were investigated in late 2010, shortly after the market had been restructured. The major concerns from that investigation considered mainly the differences between smaller and larger agents in the market and this was highlighted as an area for improvement (Swedish Competition Authority 2010). The Swedish pharmacy market has also been evaluated with focus on the achievement of the objectives with the reform in terms of availability and costs (Swedish Agency for Health and Care Services Analysis 2014; Swedish Agency for Public Management 2013; Swedish Agency for Growth Policy Analysis 2012). Other studies have analysed the availability and costs as well as competition in several European pharmaceutical markets (Anell 2005; Rudholm 2008).

This thesis can serve as a complement to the previous studies by providing a quantitative methodology for estimating the competition in the market. Using current data at a time when the market has adjusted more to its new structure is also an important contribution. It can also give an understanding for the determinants of establishment among pharmacies and potential differences from the monopoly market. The empirical results show that despite the large increase in pharmacies, the competition is weak among the pharmacy chains. Further, patterns of more pharmacies where there are more chains imply that business stealing is common in the market. This together with the social responsibility of the former monopolist can partly explain the high establishment in urban areas.

Chapter 2 gives a background to the major changes in the market after the deregulation and chapter 3 provides a brief overview of previous studies in the field. Chapter 4 continues with the theoretical framework. Information about the data and the empirical methodology are given in chapter 5 and the econometric specification is presented in chapter 6 together with the major hypotheses which are going to be investigated. The results together with the analysis are presented in chapter 7 and chapter 8 summarizes the main conclusions of the study. Finally, references and appendix are given in chapter 9 and 10, respectively.

2. Background

2.1 The Components of the Deregulation

The end of the state owned monopoly of Apoteket AB in 2009 was one of three major changes included in a reform which is usually referred to as the reregulation of the Swedish pharmacy market. The two additional parts of the reform were the introduction of rights to sell prescription free drugs for other agents than pharmacies and increased possibilities for care givers to organize provision of drugs to hospitals. The government wanted to achieve five main objectives with this reregulation, namely increased availability of drugs, enhanced quality of and higher supply of services, lower costs of drugs, sustained competency and safety in provision of drugs and to address the role of pharmacies in improving the use of drugs. One of the most important focuses was to increase the availability of drugs for consumers, which could be realized through more pharmacies entering the market and introducing longer opening hours (Swedish Agency for Public Management 2013).

As part of the deregulation process, Apoteket AB went through a reconstruction in 2009 and approximately 50 percent of all pharmacies were sold to new owners. The new owners were obliged to keep running stores in sparsely populated areas during the three following years (Swedish Competition Authority 2010). In addition, the infrastructure of Apoteket AB was separated for purpose of enhancing the possibilities for new pharmacy chains to enter. There was also an introduction of permissions required for running pharmacies, which can be obtained from the Medical Products Agency. Free price setting was also introduced for prescription free drugs, which now are allowed to be sold by other agents than pharmacies after registration at the Medical Products Agency. There are, in addition to the pharmacy market, other markets affected by the deregulation. One example is the market for manufacturing of extempore medicines. However, the focus in this thesis is on the community pharmacy market[1]. Community pharmacies are here defined as pharmacies which are mainly focusing on providing drugs to the public (Swedish Agency for Public Management 2013).

[1] If no other specification is given in the text, the term pharmacy in this thesis refers to community pharmacies.

2.2 Regulations in the New Market

The new deregulated market still contains several regulations and laws determining the roles and missions of the pharmacies. This legal framework includes certain requirements mainly to ensure that the safety and the quality of the services provided by the pharmacies are preserved. For instance, the law of patient safety states that pharmacies are care givers and that the employees are health care professionals. Also, the law about trade in drugs states that permission to run a pharmacy is issued only for those who are suitable for the mission and that also have good prospects of achieving the requirements for doing so. Manufacturers, holders of drug sales permissions or prescribers of medicines are not allowed to run a pharmacy (Dental and Pharmaceutical Benefits Agency 2015).

The authorities that supervise and review the pharmacies are the Dental and Pharmaceutical Benefits Agency (Tandvårds- och Läkemedelsförmånsverket, TLV) the Health and Social Care Inspectorate (Inspektionen för Vård och Omsorg, IVO) and the Medical Products Agency (Läkemedelsverket). The Swedish eHealth Agency (eHälsomyndigheten) is another authority who supports the pharmacies with information and access to information on receipts and database issues. TLV are mainly responsible for the pharmaceutical benefits and to decide whether a medicine or product should be included in the benefit or not. In addition, they also handle purchase and sales prices for the medicines and determine substitution possibilities and obligations between different drugs. Since 2013, TLV also provide and handle subsidies to pharmacies operating in thinly populated areas. The main responsibility of the Medical Products Agency is to issue permissions for operating pharmacies. Further, they provide regulations regarding trade with medicines and technical alcohol. IVO are supervising and controlling that the pharmacy staff are following the regulations stated in the patient safety law. Also, they are handling complaints regarding Lex Maria, messages from the public or from pharmacies about situations that have resulted in or could have resulted in damage concerning the care of patients (Dental and Pharmaceutical Benefits Agency 2015).

2.3 Prices and Other Competitive Tools

Price setting is restricted in the pharmacy market and the pharmacies cannot freely set prices on all their products. Many of the prescription medicines are included in the drug benefit, which subsidies the drugs and thereby secures that the consumers do not have to pay more than a maximum price for the medicines that it covers. The prices of prescription drugs included in the drug benefit are indirectly determined through the trade margin which is set by TLV. The trade margin is the compensation given to pharmacies for providing medicines included in the drug benefit, and is determined from the difference between the buying price and the selling price. In connection to the deregulation, the trade margin was increased for generic drugs, i.e. drugs with the same contents as those whose name was earlier protected by patents. Also, the requirements are now higher for substitution of generic drugs in comparison to the monopoly market, which can be expected to decrease the prices of medicines in general. Another difference regarding prices is that the pharmacies are allowed to negotiate prices with manufacturers of medicines with patents (Swedish Agency for Health and Care Services Analysis 2014).

Due to the regulated trade margin, the possibility to affect prices for the pharmacies is restricted to prescription drugs that are not included in the drug benefit, prescription free drugs and other commodities provided, most often beauty or care products. However, since the majority of total turnover is coming from prescription drugs, around 75 percent in 2013, price setting does not have such a large role for the pharmacies in comparison to the case with a market with free price setting for all products. The share of total turnover coming from prescription free drugs during the same year was 11 percent and for other commodities 13 percent (Swedish Competition Authority 2015).

Except for setting prices, there are other ways in which pharmacies can compete. Examples are holding longer opening hours, keeping larger stocks of medicines and providing higher quality of products and services (Swedish Agency for Health and Care Services Analysis 2014). For instance, if a pharmacy is closed, the customers can choose to visit another store with longer opening hours. Similarly, if the medicine demanded is not available at a pharmacy the customer can switch to another store to collect it. The average weekly opening hours have increased since the deregulation by approximately 6 hours, which is an indication of that pharmacies use opening hours as a competitive tool (Apoteksinfo.nu 2015). Additionally, if the customer does not have a pleasant experience from the pharmacy personnel or the information regarding the use of medicine or other products, this can also result in switching to another store. The possibility to go to another store in general is larger in urban areas, which have more pharmacies and where pharmacies are situated closer to each other. Therefore the competition can be potentially higher in urban areas regarding opening hours, stocks of medicines and quality in comparison to rural areas where the possibility for the consumers to visit another pharmacy is more restricted.

2.4 Differences in Firm Incentives

There are several aspects that differ regarding the incentives for establishment between pharmacies in the monopoly market and the pharmacies in the current market. For instance, Apoteket AB was not a purely profit maximizing monopoly but had also a social responsibility. This social responsibility can be interpreted as an obligation to focus mainly on securing availability for the consumers. For instance, the social responsibility required Apoteket AB to hold a network of stores with a higher density than what would be the outcome with a purely profit maximizing monopolist. A purely profit maximizing firm do not have as high incentives for keeping stores evenly spread all over the country because the cost in time for consumers is not likely to be regarded in the establishment of stores. The customers' demand for drugs is relatively inelastic to price changes and hence they would switch to another store operated by the same monopolist if two stores were situated close to each other. Hence, the net revenues would only increase if more stores and decreased transportation costs made the customers shop at the pharmacies more often. Therefore, the outcome is likely to be more stores for a monopolist that has a social responsibility compared to a monopolist who does not have that objective (Swedish Agency for Health and Care Services Analysis 2014). By the same reasoning, firms in the current market which are only maximizing profit will not consider to provide an evenly distributed network of stores to such a large extent as the monopolist who also had a social responsibility.

Another important difference in firm objectives in the decision of opening a new store is the possibility to take over the other stores' customers. For the monopolist, opening an additional store can result in taking over customers from the other stores which are also operated by the same firm, a so called cannibalization effect. The monopolist is therefore not likely to open as many stores as compared to the firms in the competitive market, when it is possible to take over the other incumbents' customers and thereby increase revenues, so called business stealing. Taking over customers from the own stores can also be observed with several competitors in the market, but in that case it is possible to gain customers from the other incumbents. As proposed by Feenstra and Ma (2007), firms under monopolistic competition are considering the possible gains in profit as well as the probability of taking over sales from other varieties when introducing a new product in a market. This can also be applied to the pharmacy market, when thinking in terms of new stores instead of new product varieties. When opening one additional store, there is a probability to take over the competitors' customers, but there is also a risk of taking over customers from already existing stores of the same firm. The cannibalization effect is larger in the monopoly market since there is only one firm operating. The firms in the current market have to bear both the cannibalization effect and the business stealing effect in mind in the decision to establish additional stores. These differences in incentives between the monopolist and the pharmacies in the current market can result in more stores in the competitive outcome as compared to the monopoly market.

3. Literature Review

There are several studies analysing the situation in the Swedish pharmacy market after the deregulation. The Swedish Competition Authority received a mission from the government in 2008 to follow the development in the deregulated market and report the findings in late 2010. The major aim with this work was to identify potential competitive problems in the market and inform the government about these, in order to secure that the market is functioning. Information is gathered through meetings, interviews and survey questionnaires with agents and stakeholders. According to the report, one potential area for improvement is to increase the possibilities for smaller agents to operate at equal conditions as the larger ones. For instance, the report states that the price setting for IT-systems have been favourable for the larger agents and has not taken the smaller agents into consideration. Also, problems are reported concerning Apoteket AB to have opposed other agents to use the term "apotek" in their trademark, which means "pharmacy" in Swedish. However, this term is currently used by many of the chains and hence this problem seems to have been only temporary. Some of the major conclusions in the report about what is needed for enhancing the competitive environment are to develop a clear and more transparent picture of the ownership of Apoteket AB, as well as to increase possibilities for smaller agents to operate under similar conditions as the larger agents in the future. One other finding is that Apoteket AB in 2010 still had a major role in the market due to the well-established trademark and the number of existing stores (Swedish Competition Authority 2010).

Moreover, the situation in the deregulated Swedish pharmacy market has been evaluated with perspective on the objectives of the reform, such as availability for the inhabitants. The Swedish Agency for Health and Care Services Analysis (2014) and the Swedish Agency for Growth Policy Analysis (2012) conclude that the availability to pharmacies mainly has improved in urban areas and find that the average weekly opening hours have increased. The Swedish Agency for Public Management (2013) has also evaluated the deregulation and the accomplishment of the major objectives with the reform. Overall, the goals of lower costs and higher availability have succeeded, whereas the competency and safety in provision of medicines have only been partly accomplished. One conclusion is that the major challenge in the current market is to assure that smaller and larger agents operate at equal conditions in the long term.

In addition, other studies analyse the impact of different reforms in pharmaceutical markets. The majority of these suggest that deregulation has resulted in increased availability but not necessary to lower costs or higher quality of services. Rudholm (2008) examines the Norwegian pharmacy market and the effects from additional entering firms on costs and availability. A comparison to the situation prior to the deregulation is performed by estimation of a cost function and by using linear regression methods. Data collection is made from annual reports for a sample of the pharmacies before and after the deregulation. The results of the paper show that costs have not decreased among the Norwegian pharmacists after the deregulation but availability to pharmaceutical services has increased extensively. Another study by Vogler, Habimana and Arts (2014) evaluates how access to medicines, quality of services and costs differ between deregulated and regulated pharmacy markets in nine different European countries. One of the main conclusions is that availability has not increased in the deregulated markets, since establishment of new pharmacies most often take place in urban areas where many pharmacies already exist. Oligopolistic structure is observed in the Norwegian market and a higher economic pressure with the increased competition might force the incumbents to focus more on profitability rather than public health concerns.

Anell (2005) examines the outcomes from the deregulations in the pharmacy markets in Iceland and Norway. The deregulated markets in both Iceland and Norway have resulted in higher concentration and approximately two to three chains owning around 80 to 97 percent of the whole market. Also the entry requirements are still similar to the previous markets, and therefore one conclusion is that these deregulated markets might need interventions from the state in order to encourage more competition. Further, Heinsohn and Flessa (2013) investigate the competition at the German pharmacy market. In Germany, pharmaceutical products constitute a large part of the expenditures of public health insurance and several reforms have been implemented in order to keep down the costs of pharmaceuticals. One of the findings is that German pharmacy owners do not perceive a high competitive pressure. Also, one of the most important determinants for increased profit margins and net revenue for the pharmacies is the ability of the owner to be inventive and dynamic.

In conclusion, earlier studies have evaluated the situation in the Swedish pharmacy market as well as the effects of reforms in other European pharmaceutical markets. The common results from almost all of these studies are that availability most often has increased for the consumers, mainly in the urban areas, and that the the competitive environment has not changed remarkably after the reforms. This study can contribute to the existing literature by providing a more quantitative methodology to investigate the strength of competition in the market. It also uses current data and therefore adds to the previous research through analysing the market in a time when it has adjusted more to its new structure.

4. Theoretical Framework

4.1 Entry and Competition in Concentrated Markets

For being able to measure competition in a market, it is first necessary to define what is meant by that expression. One way of describing competitive equilibrium is when the price of a good is set at the marginal cost. Hence, there is higher competition in a market where the firms are setting prices close to marginal costs and lower competition if the firms can charge prices above marginal costs (Tirole 1988). However, it is not always possible to observe costs for the firms in a market, which makes it difficult to quantify competition in practice. Also, firms can compete in other ways than in prices, such as providing higher quality, keeping larger stocks for the possibility to offer good service to the customers and holding longer opening hours. This can force the firms to become more efficient for being able to cope with the higher costs that these aspects can bring.
Hence, there is a need for a measurement that can estimate competition regardless of the scale in which it is expressed. For this purpose, the model by Bresnahan and Reiss (1991) can be used, creating possibilities to infer margins from a certain amount of inhabitants that each firm needs for making profit in the market. This concept is referred to as entry thresholds.

In order to draw conclusions about how intense competition is in the market, the number of entrants N is analysed in relation to the size of the market. For each firm, there is a break-even price-cost margin $M_N = P_N - MC(q_N)$. When more firms enter the market, these margins change if competitive pressure is affected. The assumption is that if margins decrease with more firms entering, the firms will need more inhabitants for making the same profit. For observing how the margins change with more firms, it would be optimal to analyse how these break-even price-cost margins decline when N increases from one to two, from two to three and onwards. However, the number of inhabitants that each firm needs to be active in the market is used in order to draw conclusions about margins, simply because margins are most often not visible in the real world (Bresnahan & Reiss 1991).

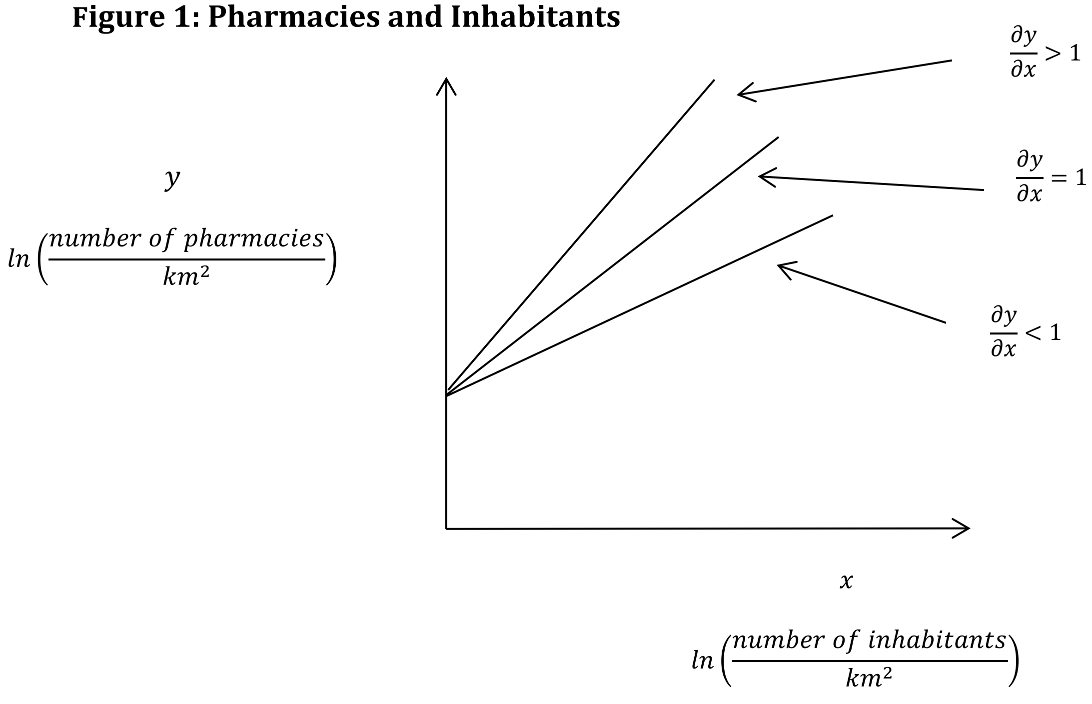
4.2 Theoretical Model

The following model is an interpretation of the theory above and has previously been used by Lööf (2011). The relationship between the number of pharmacies and the number of inhabitants in a market can be described by the following linear function

$$ln(number\ of\ pharmacies/km^2) = \alpha + \beta * ln(number\ of\ inhabitants/km^2).$$

The slope of the line, β, describes the coefficient of the variable for the number of inhabitants in a market. Hence, it describes the change in the number of pharmacies in a market coming from an increase in the number of inhabitants. The number of pharmacies in each market is divided by the geographical area in square kilometres, in order to control for varying geographical size. This is also referred to as pharmacy density in the following analysis. The variables are transformed into logarithmic terms in order to allow for interpretation in percentage changes. Illustrations of the relationship between the number of pharmacies and the number of inhabitants in a market are given in Figure 1 and Figure 2 below. The figures describe different components of competition that can be used for interpretation of the results of the model.

Figure 1: Pharmacies and Inhabitants

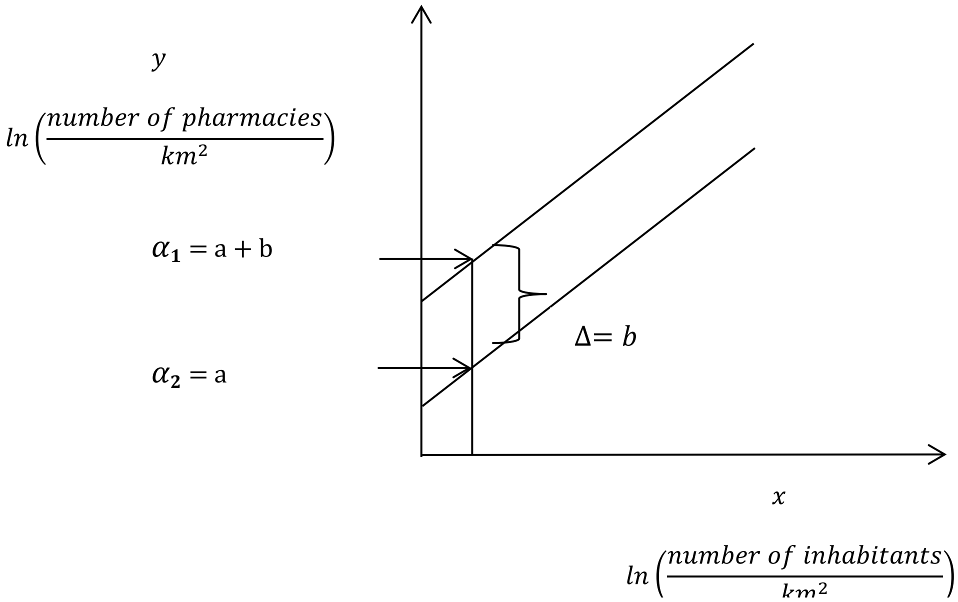


In Figure 1, the focus is on the interpretation of the slope of the line. Three different examples are given, which represent varying competitive outcomes. A slope of the line that is equal to one, as presented by the middle line in Figure 1, implies that there is no change in competition when one additional firm enters the market. This is because a one percent increase in inhabitants will result in a one percent increase in the number of firms. Further, a slope coefficient equal to one means that the number of inhabitants per firm needed for making a certain profit does not change when more firms enter. To explain this in terms of how the number of inhabitants per firm has to change for keeping a certain level of profit as more firms enter, we have to investigate the inverse of the slope of inhabitants. This means that when the slope is equal to one, the inverse of the slope is also equal to one. For instance, if a single firm needs 1000 customers to make a certain level of profit and one more firm enters, the two firms will need 1*1000 customers each to make the same profit. This suggests no change in competition with additional firms on the market, since they need the same number of inhabitants as the case with only one firm. Therefore, margins are unchanged.

In contrast, a slope coefficient that is smaller than one, as presented by the lower line in Figure 1, implies that the competition increases as more firms enter the market. As the number of inhabitants increases by one percent, the number of pharmacies will increase by less than one percent. From another perspective, it means that when more firms enter, it will result in a need of more inhabitants per firm for making the same level of profit as before. In this case, if a single firm needs 1000 customers for making a certain profit, more firms entering will result in more than 1000 customers each to keep the profit level constant. For instance, observing a slope of 0.8, the inverse is 1/0.8=1.25. Hence, the number of inhabitants per firm will have to increase to 1.25*1000=1250 for making the same profit as before. Therefore, this is a sign of lower margins when more firms enter and thereby increased competition.

Finally, if the slope coefficient is larger than one, as illustrated by the upper line in Figure 1, it is a sign of decreasing competition when more firms enter the market. For a one percent increase in inhabitants, there will be a more than one percent increase in pharmacies. Similarly, there will be a lower increase in the number of inhabitants needed to make the same profit when more firms enter. Assuming a slope equal to 1.25, the inverse is 1/1.25=0.8. For example, if a single firm needs 1000 customers to make a certain profit, as one more firm enters the number of inhabitants per firm needed to make the same profit will decrease to 0.8*1000=800. In other words, it implies making higher margins with additional firms and therefore competition decreases with more firms in the market.

Figure 2: Intercepts and Entry Barriers



Illustrated in Figure 2 are two lines representing two different market outcomes. The intercept of the estimated regression line can be interpreted to say something about the barriers to entry in the market. The higher intercept α_1= a + b of the line would suggest that the entry barriers are lower in that case compared to a lower intercept α_2 = a. The minimum number of firms in a market is determined by the intercept, meaning that the higher the intercept, the higher is the minimum amount of firms. Hence, more firms are in the market for the same number of inhabitants, which can be interpreted as lower entry barriers. In Figure 2, it means that at intercept α_1 there is *b* more firms for the same number of inhabitants as compared to intercept α_2**,** where there is only *a* firms.

5. Data and Methodology

5.1. Limitations

Pharmacies in the current market can face competitors in addition to other pharmacies, such as stores and gas stations with permission to sell prescription free drugs and beauty products. However, prescription free drugs and beauty products account for approximately 25 percent of the total turnover for the pharmacies, which decreases the incentives for including these potential competitors in the analysis. Also, in 2012, the pharmacies accounted for 82.2 percent of the total sales for prescription free drugs (Swedish Agency for Public Management 2013). A combination of these facts and a need of limiting the extent of this thesis have resulted in the decision to not include these competitors in the following analysis.

Further, even if competition can be beneficial to consumers and society through lower prices and higher efficiency, it is at the same time possible to observe potential shortcomings of a deregulated market. Examples can be the outcomes from a lessened social responsibility such as availability to stores as well as lower quality because of increased costs. Another negative side effect is seen in the increasingly common over usage of paracetamol that has been observed since the decision to allow other agents than pharmacies to sell painkillers and prescription free drugs. Because of the major consequences of these cases, paracetamol substances in pill formula will no longer be included in the sell permission for other than pharmacies from the 1st of November 2015 and onwards (Medical Products Agency 2015). These aspects of competition are not in focus of this study.

Regarding the data analysis, it would have been optimal to compare data for several years at the regulated market with data for several years after the deregulation. Due to difficulties with finding data originating from the period prior to the deregulation, this has not been possible. The data from 2009 are representing the outcome prior to the deregulation and therefore regarded as not being affected by the policy change. Data from 2010 is not included since the deregulation came into force in 2009 and hence the market was reconstructed during 2010. Consequently, 2011 is the first year in the dataset representing the outcome after the deregulation.

5.2 Relevant Economic Market

In order to analyse the competition in the market, it is necessary to start with defining the relevant economic market, which is divided into both geographical and product dimensions.

5.2.1 Product Market

Goods and services are considered to be on the same market if consumers regard them as close enough substitutes. If the products are seen as close substitutes, it implies that the producers of the products need to compete for the same consumers (Tirole 1988). Examples that can be taken into consideration are prices, characteristics and functions of the products. The different chains of pharmacies provide products and services that are mainly of homogeneous characteristics which do not vary much between pharmacies. Moreover, the largest chains on the market take decisions about products and prices at the national level and no large variation is observed at local level. Also, the main part of the products that pharmacies provide is prescription drugs and these are sold by every pharmacy. This would suggest that the product market is defined at the pharmacy level (Swedish Competition Authority 2015).

The other part of the product assortment constitutes of beauty and care products which might vary from pharmacy to pharmacy and potentially also between local markets. In larger markets there can be a higher share of the product assortment that constitutes of beauty and care products compared to in smaller markets. Hence, in larger markets there can be a higher degree of differentiation between the pharmacies as compared to in the smaller markets. This can decrease the strength of competition between pharmacies in the larger markets if the consumers choose a specific pharmacy based on its provision of certain products. Hence, pharmacies in smaller markets provide more similar products and might therefore experience higher competition compared to the larger markets. If this product variation between pharmacies is higher in larger municipalities, it can affect the estimation of competition so that the estimated competition becomes higher than it actually is. However, the majority of the product assortment and revenues for the pharmacies is derived from the prescription drugs, which all pharmacies provide. The product market in the analysis is therefore defined at pharmacy level.

5.2.2 Geographical Market

It is necessary to define the geographical market in order to identify which pharmacies that are competing with each other. The Swedish Competition Authority stated in the merger case between ICA Gruppen and Apotek Hjärtat that the geographical market for pharmacies are most probably considered to be at the local level (Swedish Competition Authority 2015). Some of the reasons for this distinction can be that the products and services are homogeneous and the customers are therefore expected to have a maximum amount of travel time and cost that they are willing to spend to shop at a pharmacy. However, the local level at which the geographical market should be defined is not clear.

It can be argued that the local level is defined as the municipality level, when municipalities are situated relatively far away from each other. For municipalities that are included in larger urban areas such as Stockholm, Gothenburg and Malmö it can be more likely to regard the whole regional area as one local market. This is because many of these municipalities are included in the urban areas of these larger cities and the travelling time between the municipalities is short. For these areas, it can be misleading to regard every municipality as one local geographical market because pharmacies in this whole area are likely to compete with each other. There are also more people commuting between municipalities in the larger urban areas and it is likely that pharmacies establishing in these areas also include these commuters in their customer base. Urban areas with more pharmacies can also experience higher competition which can increase quality and services among these pharmacies, compared to areas that do not have as many pharmacies. This can make individuals who commute to work in a larger urban area expected to do their pharmacy visits on their way to or from work. At the same time, it can be argued that individuals in urban areas where more pharmacies are situated are less likely to spend a long travel time to shop at a pharmacy. With more alternatives for which pharmacy to visit, customers in urban areas can be more sensitive to distance compared to customers in rural areas. This would imply that in urban areas it is more probable that the local geographical market is smaller compared to rural areas.

The main implications from this for the estimation of competition can be that if the local geographical market is determined at the municipality level, there is a risk of underestimating the actual competitive pressure. In other municipalities, pharmacies might not compete with each other even if they belong to the same municipality, because there is a long distance between them. This can cause the results to indicate higher competitive pressure than what is actually the case. One possible outcome can be to assume that these two opposing effects are evening out the bias in the analysis.

One alternative to the municipality market definition is to regard the local geographical markets as densely populated towns, since almost all pharmacies are established in the most densely populated areas in a municipality and hence it can give a more accurate structure of the actual local markets. In comparison to the case with municipalities, it can be more plausible to assume that pharmacies in densely populated towns are competing with each other. This is because distances are shorter and hence they compete for the same customers. One practical problem with this definition can be that many densely populated towns are situated close to other densely populated towns, meaning that the customers easily can switch to the pharmacy in the other town. This can be an implication of the municipality level to be more accurate for local market definition. In addition, it is more difficult to find data available at the densely populated town level. Due to the complications and arguments presented above, the municipality level is chosen as the local geographical market for the analysis of this thesis.

5.2.3 Store vs. Chain Competition

Another aspect that needs to be taken into consideration is whether to investigate competition at the pharmacy store level or the pharmacy chain level. For instance, competition at the chain level can be regarded mainly from a product market perspective, since pharmacies belonging to the same chain mostly provide similar products and their prices are determined at national level. Thereby, chains might have certain strategies that distinct them from other chains, such as what products that are included in their assortment and service aspects. Pharmacy stores can rather reflect the geographical importance and a tool for the chains to gain customers can be to establish more stores. The following analysis will focus both on pharmacy store level competition and chain level competition.

5.3 The Data

Data of location, name and opening hours for all pharmacies in the Swedish pharmacy market in 2009, 2011, 2012, 2013, 2014 and 2015 are collected from Apoteksinfo.nu. Apoteksinfo is a website that gathers information about the pharmacies in the Swedish market in one single database, by collecting information from the pharmacies' websites or directly from pharmacies providing them with data (Apoteksinfo.nu 2015).

The data of pharmacies is processed and analysed at municipality level. In order to distinguish between the local markets geographically, municipalities belonging to the larger city regions of Stockholm, Gothenburg and Malmö, where 100 percent of the population live in or live close to densely populated areas, are not included in the analysis. Also, municipalities with less than 5 inhabitants per square kilometre are not included in the analysis in order to reduce the oddest values in the data. This results in 210 municipalities representing different local markets. Information is added about the number of inhabitants and other demographic and geographic factors that are specific for the respective municipalities. The data that complement the pharmacy information are collected from Statistics Sweden (Statistics Sweden 2015).

5.3.1 Descriptive Statistics

Prior to the deregulation in 2009, there were in total 924 pharmacies in the market. In 2015, the same figure had grown to 1331 pharmacies, resulting in an increase of 44 percent since the deregulation (Apoteksinfo.nu 2015). The development in the number of pharmacies divided into the different regions of Sweden is presented in Table 1. As mentioned in the introduction, Stockholm has experienced the largest increase and Jämtland has experienced the lowest increase. However, the number of pharmacies has increased for all regions in the country.

Table 1: Pharmacies by Region 2009-2015

Region	2009	2011	2012	2013	2014	2015	Change
Blekinge	12	16	17	17	17	19	+7
Dalarna	35	40	40	38	40	41	+6
Gotland	7	8	9	10	11	11	+4
Gävleborg	34	42	42	42	44	44	+10
Halland	28	39	40	43	45	45	+17
Jämtland	23	24	24	24	25	25	+2
Jönköping	36	45	48	48	49	49	+13
Kalmar	28	32	36	36	38	38	+10
Kronoberg	23	30	30	30	31	31	+8
Norrbotten	37	41	41	42	42	42	+5
Skåne	103	148	154	158	160	161	+58
Stockholm	155	242	242	256	266	269	+114
Södermanland	24	32	33	34	33	34	+10
Uppsala	29	41	43	42	43	45	+16
Värmland	34	43	42	42	42	42	+8
Västerbotten	41	44	45	46	45	45	+4
Västernorrland	34	39	39	40	43	43	+9
Västmanland	24	36	36	37	38	38	+14
Västra Götaland	141	193	198	204	205	205	+64
Örebro	30	38	40	39	40	41	+11
Östergötland	46	61	62	64	62	63	+17
Total	**924**	**1234**	**1261**	**1292**	**1319**	**1331**	**+407**

The number of different agents in the market decreased from 13 to 10 between 2011 and 2015 (Apoteksinfo.nu 2015). As seen in Table 2, the four largest chains are Apoteket AB, Apotek Hjärtat, Kronans Apotek and Apoteksgruppen. The category "Independent" includes pharmacies that are independently operated by private agents. The development of the number of pharmacies per chain during the years 2011 and 2015 is shown in Table 2. The figures reflect that Apotek Hjärtat and Kronans Apotek are the chains who have experienced the largest increase in the number of pharmacies during this period of time. Vårdapoteket was acquired by Apotek Hjärtat and Medstop was acquired by Kronans Apotek in 2013 (Swedish Agency for Public Management 2013). Moreover, in January 2015 Apotek Hjärtat was acquired by Ica Gruppen, owner of Cura Apoteket (Swedish Competition Authority 2015). However, this is not accounted for in the analysis and hence Cura Apoteket and Apotek Hjärtat are considered as two different chains. The average weekly opening hours among the pharmacies have increased from 43.4 to 49.2 between 2009 and 2015 (Apoteksinfo.nu 2015).

Table 2: Pharmacies per Chain

Chain	2011	2012	2013	2014	2015
Apoteket AB	365	375	373	369	370
Apotek Hjärtat	270	274	303	306	310
Kronans Apotek	206	216	229	303	304
Apoteksgruppen	154	157	163	165	165
DocMorris/Lloyds Apotek	81	76	77	83	83
Medstop	64	65	67	0	0
Cura Apoteket	41	45	56	64	68
Vårdapoteket	24	27	0	0	0
Independent	12	14	15	20	22
Boots	7	2	2	2	2
VetAp	5	4	3	3	3
Foxfarmaci	4	4	4	4	4
Din Apotekare	0	2	0	0	0
Djurfarmacia	1	0	0	0	0
Total	**1234**	**1261**	**1292**	**1319**	**1331**

In Appendix Table 1, statistics for the variables at municipality level are presented. As seen in the table, the mean number of pharmacies is 3.7 and varies from one to 29. The standard deviation of the number of pharmacies between municipalities is 4.2 and for each municipality over time the standard deviation is 0.8. Hence, there is a larger variation from municipality to municipality than within the same municipality over time. There are on average 2.1 chains present in each municipality, with a minimum of one and a maximum of ten.

Further, there are on average 27 434 inhabitants in every municipality, with a range between different municipalities of 3646 to 203370 and for the same municipality it varies from 18815 to 34347. Hence, also the number of inhabitants varies more from municipality to municipality in comparison to over time. The share of inhabitants 65 years or older is on average 23 percent, varies between 15 and 31 percent from municipality to municipality and on average from 19 to 26 percent over time for a specific municipality. There is a large difference in geographical area of the municipalities and the mean size is 922.8 square kilometres with a minimum of 55.9 and a maximum of 6859. The average income per capita in the sample is 230581 SEK, varying between 198910 SEK and 306385 SEK between municipalities and from 193836 SEK to 260489 SEK over time for the same municipality.

5.4 Methodology

The empirical methodology for analysing the data is panel data estimation with Random Effects. Panel data consist of repeated observations at several points in time for the same specific unit. The major advantage is therefore that it allows for making comparisons both between different municipalities and within the same municipality over time. The Pooled OLS, Random Effects and Fixed Effects models are the most common and are valid under varying assumptions. The choice between them is dependent of the objective of analysis and the characteristics of the data (Cameron & Trivedi 2010). As stated above, the Random Effects model is chosen for estimation. Also the Pooled OLS and Fixed Effects models are applied to the data for purpose of testing the robustness of the results by comparing the outcomes from the three different models. Below follows a discussion of these three methods and why the Random Effects model is chosen.

5.4.1 Pooled OLS

The Pooled OLS model can be expressed as:

$$y_{it} = \alpha + x'_{it}\beta + u_{it}, \qquad (1.)$$

where y_{it} is the number of pharmacies in municipality i in time period t, α is the intercept of the regression line, x'_{it} is a vector of all the variables that can explain the number of pharmacies in municipality i, β describes the effect of the explanatory variables and u_{it} is a term that captures everything else that can affect the number of pharmacies in municipality i that is not included in the explanatory variables or that are unobservable (Verbeek 2012). Examples can be political factors in the municipality, cost of store area or number of hospitals. For instance, if political factors have impact on the quality of health care in a municipality, they can affect the number of pharmacies and thereby be included in the error term. If a municipality has spent less effort on the health care services due to political decisions, there might be a higher demand for pharmaceutical services in that municipality, since the pharmacies serve as complements to the health care system. One assumption can also be that there are more pharmacies in a municipality with many hospitals. With more hospitals there can also be a larger amount of patients that want to take out their prescribed drugs or that need complementary health care products. It can also be the other way around, namely that there is a larger demand for pharmacies when there is a lower amount of hospitals. This can be the result if individuals search for help regarding lighter symptoms such as colds at pharmacies to a higher degree when there are not that many hospitals for the public to turn to. One threat to consistent estimates is hence omitted variable bias, i.e. not being able to include all factors that are affecting the dependent variable in the regression.

Since the data consist of observations of the same municipalities over time, there is a problem with correlated error terms in the model. For example, assume that the number of pharmacies is affected by the number of hospitals that are not included as explanatory variables and thereby included in the error term. If the number of pharmacies in a municipality is affected by the number of hospitals in one period it will probably be affected by this in the next period as well, causing correlation between the two periods' error terms. The error terms are thereby no longer independent of each other. The OLS estimator, which is only valid under assumptions of independent error terms, can therefore yield unreliable results. It is possible to apply the OLS estimator when correcting for this problem by using standard errors that are clustered at the municipality level. This type of standard errors allows for correlation between the error terms at the municipality specific level which makes the estimators more reliable in comparison to the default standard errors (Verbeek 2012).

The major problem with Pooled OLS is that there can be biased estimated coefficients due to correlation between the error term and the explanatory variables. For instance, if the explanatory variable of inhabitants is correlated with the number of hospitals, this can cause biased estimators. There will be an overestimated coefficient if there is a positive correlation between hospitals and pharmacies. The actual effect from inhabitants on pharmacies is then smaller than proposed by the OLS estimation. If the number of hospitals had been included in the regression, that variable would have captured some part of the effect on the dependent variable. This problem can potentially be controlled for by using the Fixed Effects model. Another problem with the Pooled OLS model is that it does not account for the panel structure of the data. Therefore it can also be more efficient to apply the Fixed Effects model or the Random Effects model since they make a distinction between the municipality specific factors and the time varying factors of the error term (Verbeek 2012). However, for this model to be valid, several assumptions need to hold.

5.4.2 Fixed Effects

The Fixed Effects model is defined as

$$y_{it} = \alpha_i + x'_{it}\beta + \varepsilon_{it}, \qquad (2.)$$

with the difference from equation (1.) that it includes a specific intercept α_i for each municipality that does not vary over time, capturing unobservable municipality specific effects. Examples of factors that can be included in the α_i and differ between municipalities but not over time can be the above mentioned number of hospitals or political factors resulting in varying health care quality. These might affect the number of pharmacies and are varying mostly between municipalities and not so much over time. An example of an unobservable factor affecting the number of pharmacies that vary mostly over time and not between municipalities could potentially be the interest rate. If it has impact on the establishing of pharmacies through willingness to take loans for the pharmacy owners, there will be fewer pharmacies willing to open with a higher interest rate. If this is the case, this factor can be included in the error term of the model and since it does not differ much from municipality to municipality, but rather more over time, it is included in the ε_{it} and not in the α_i.

By including the municipality specific intercept and transform the model so that the factors in it are subtracted, the explanatory variables are allowed to be correlated with the α_i and not with the error term ε_{it}. This correlation would usually bias the estimators, but the Fixed Effects model eliminates the time invariant municipality effect by using the following transformation

$$(y_{it} - \bar{y}_i) = (x_{it} - \bar{x}_i)'\beta + (\varepsilon_{it} - \bar{\varepsilon}_i). \qquad (3.)$$

From this, it is possible to use OLS estimators because the possible correlation between the explanatory variables and the time invariant factors causing biased estimators are subtracted. For instance, if the number of hospitals is affecting the number of pharmacies and these are correlated with inhabitants, performing the transformation in

(3.) will reduce the effect on pharmacies from hospitals from the model and therefore no bias will be left in the estimators.

However, if there is little variation in the majority of the variables over time and more variation between municipalities, the Fixed Effects model can be inappropriate because it eliminates all the municipality specific time invariant effects. For instance, assume that the municipality specific unobservable factor includes the number of hospitals, the geographical size of the municipality and other important time invariant aspects that can have impact on the number of pharmacies. Performing the transformation in (3.) will then result in low variation in the model because the only variation that is left comes from changes over time. If the variation over time in the variables is not large, the estimated coefficients are no longer reliable with the Fixed Effects model. In that case, the Random Effects model can be more accurate (Cameron & Trivedi 2010).

5.4.3 Random Effects

The Random Effects model can be defined as

$$y_{it} = \alpha_i + x_{it}'\beta + \varepsilon_{\text{it.}} \qquad (4.)$$

This model is similar to (2.), but it does not eliminate the municipality specific factors included in the α_i as performed in the transformation in (3.). However, one assumption in the Random Effects model is that the α_i and the explanatory variables are uncorrelated. As stated above, this does not hold if the number of inhabitants is correlated with the number of hospitals or any of the other unobservable municipality specific factors. This restrictive assumption is therefore a drawback of the Random Effects model. However, since the number of inhabitants and the other variables vary more from municipality to municipality than over time, the Fixed Effects model that does not require such a strong assumption, is likely not appropriate. The Fixed Effects model will subtract the variation in pharmacies that comes from factors that do not vary over time. Hence, the choice is between Pooled OLS and Random Effects. Since the Random Effects model is taking the panel data variation into account, it is usually more efficient than the Pooled OLS model (Cameron & Trivedi 2010).

It is possible to perform tests for the validity of the respective models which can give some guidance for the choice of proper model. The first test is the Breusch-Pagan Lagrangian Multiplier test, which investigates if there are any municipality specific effects in the data of the estimated regression, hence any variation in the number of pharmacies that comes from the differences between municipalities. The null hypothesis in the Breusch-Pagan Lagrangian Multiplier test is that there are no municipality specific effects. If the null is not rejected, it means that there are no individual specific effects and hence it is possible to apply the Pooled OLS model. If the null hypothesis is rejected, it means that the Random Effects model or the Fixed Effects model should be used instead (Verbeek 2012; Baltagi 2001).

The other test which is called the Hausman test investigates whether the Fixed Effects model or the Random Effects model is more appropriate. The idea is to test for individual random effects and the test measures the differences between the estimators of the Fixed Effects and Random Effects models (Verbeek 2012). Under the null hypothesis, it is possible to use both models whereas under the alternative hypothesis it is only possible to use the Fixed Effects model. For purpose of the analysis in this thesis, a non-rejected null hypothesis would suggest using the Random Effects model in favour of the Fixed Effects model, because of the smaller variation in the variables over time as compared to the variation between the individual units.

6. Hypotheses and Econometric Model

6.1 Hypotheses

The two major hypotheses which are going to be investigated are the following:

1. There is competition between the pharmacies in the market. For this hypothesis to hold, the expectation is to observe a coefficient of inhabitants that is significantly lower than one.

2. Due to the large increase in pharmacies during the years after the deregulation, competition in the market is expected to have increased over time. For this hypothesis to hold, the expectation is that the slope of inhabitants is lower in 2015 as compared to 2011.

6.2 Econometric Model

The econometric specifications used for testing the hypotheses are defined below.

Regression 1

$$ln(pharmacy\ density_{it}) = \alpha_i + ln\left(\frac{inhabitants}{km2}_{it}\right)\beta_1 + \left[ln\left(\frac{inhabitants}{km2}_{it}\right) * dummy11\right]\beta_2 + ln(inhabitants\ 65\ or\ older)\beta_3 + \ln(income\ per\ capita)\,\beta_4 + \delta_1 dummy11 + \varepsilon_{it}$$

Regression 1 is used for measuring the competition at pharmacy store level. The dependent variable is hence the number of pharmacies in each municipality divided by the geographical area of the municipality. Data for 2011 and 2015 are included in the regression and year dummies are created to capture any difference between these years. Using 2015 as the reference year, it is possible to compare the situation in the market in 2011 with the outcome in 2015. An interaction variable is also created between the year dummy for 2011 and the number of inhabitants per square kilometre. This is in order to control for differences in the slope for inhabitants between 2011 and 2015, which reflects potential differences in strength of competition.

The number of inhabitants 65 years of age or older is included as control variable, since it is plausible that older individuals increase the demand for health care and therefore can potentially also increase the number of pharmacies. The average income per capita is also included as a control variable, expecting that the higher income, the more are people willing to spend in general and hence also on pharmaceutical products (Abraham, Gaynor & Vogt 2007; Bresnahan & Reiss 1991). Therefore a municipality where the inhabitants have a higher income can result in more pharmacies in that municipality. The variables are transformed into logarithmic terms in order to make comparisons in percentage changes.

Regression 2

Regression 2 is measuring the competition at chain level. Therefore, the difference from regression 1 is that the number of chains in each municipality is now used as the dependent variable.

$$\ln(chain\ density_{it}) = \alpha_i + ln\left(\frac{inhabitants}{km2}_{it}\right)\beta_1 + \left[ln\left(\frac{inhabitants}{km2}_{it}\right) * dummy11\right]\beta_2 + \ln(inhabitants\ 65\ or\ older)\beta_3 + \ln(income\ per\ capita)\beta_4 + \delta_1 dummy11 + \varepsilon_{it}$$

7. Results and Analysis

7.1 Tests of Model and Robustness of the Results

The results for regression 1 and 2 are presented in Table 3 and 4, respectively. For each of these regressions, tests have been performed regarding what model to choose. As seen from the output in Appendix Table 2-5, the Breusch and Pagan Lagrangian Multiplier test and Hausman Taylor tests both suggest that the Random Effects model is more appropriate. Overall, the results from the Pooled OLS and the Random Effects models are similar, whereas the Fixed Effects model behaves differently from the other two. Because of the small variation over time in the data, the Fixed Effects model is not selected because it does not give reliable estimates of the variation in the data that is not attributed to time. Further, the Pooled OLS model does not take the unobservable municipality specific variation in the data into account. These characteristics together with the test results give support to use the Random Effects model and its results are hence interpreted in the following analysis.

7.2.1 Regression 1

Table 3: Results Regression 1

VARIABLES	Pooled OLS ln (pharmacies /km2)	Fixed Effects ln (pharmacies /km2)	Random Effects ln (pharmacies /km2)
ln(inhabitants/km2)	0.913***	1.318	0.904***
	(0.0287)	(0.963)	(0.0309)
ln(inhabitants/km2) *dummy2011	-0.0345**	-0.0293	-0.0347**
	(0.0167)	(0.0229)	(0.0176)
ln(inhabitants65)	0.0665**	-0.0610	0.0635**
	(0.0286)	(0.497)	(0.0312)
ln(income per capita)	-1.024***	-0.0517	-0.729**
	(0.349)	(0.505)	(0.291)
dummy2011	-0.0260	0.0392	0.00106
	(0.0630)	(0.0913)	(0.0652)
constant	-8.242***	-9.373**	-8.451***
	(0.336)	(4.636)	(0.306)
Observations	420	420	420
R-squared	0.860	0.117	0.860
Number of Id	210	210	210

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

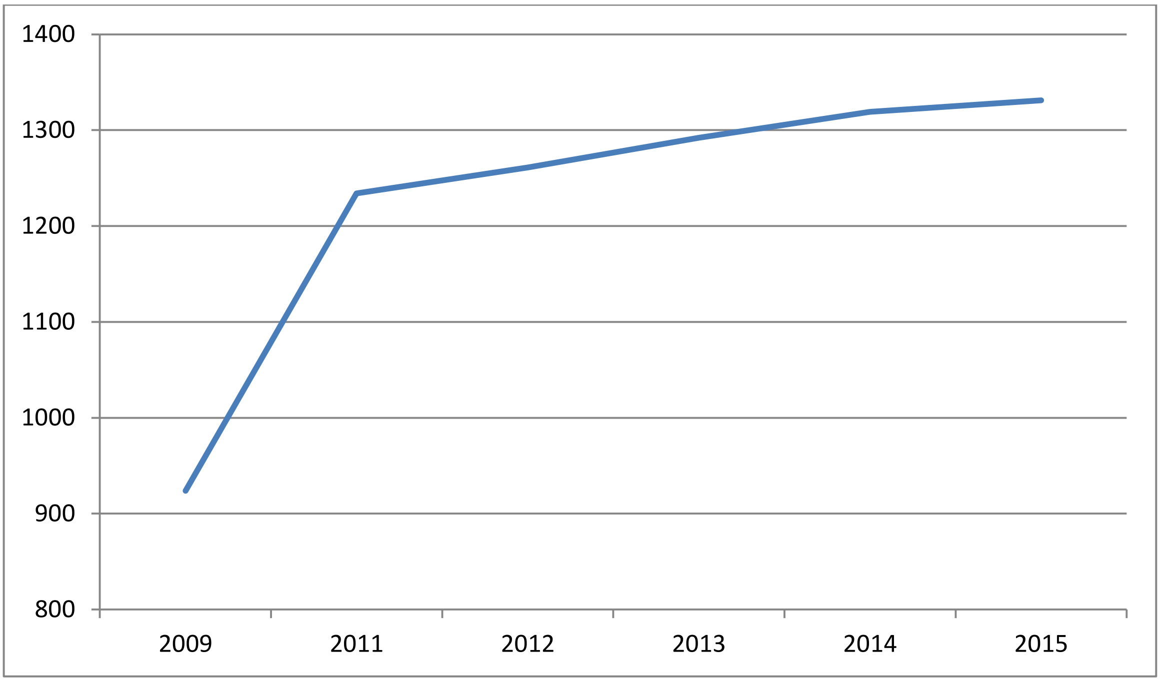
In regression 1, only data from 2011 and 2015 are included for analysis of competition in the market and to investigate whether the strength of competition is different in 2011 in comparison to 2015. As seen in the results in Table 3, the estimated coefficient for the number of inhabitants per square kilometre is statistically significant at the one percent level and equal to 0.904. If the estimated coefficient should be equal to one, it would imply no effect on competition when more firms enter the market. Therefore, a hypothesis test is performed to see if the estimated coefficient is significantly different from one. As seen in Appendix Table 6, the coefficient is significantly different from one at the one percent level. This result implies that the pharmacies experience a slightly increased competitive pressure as more stores are established in the market.

This indicates that with a one percent increase in the number of inhabitants, the number of pharmacies will increase by 0.904 percent. Thinking in terms of how the number of inhabitants has to increase for one more firm to enter instead of how the number of pharmacies increases with more inhabitants, it is necessary to take the inverse of the estimated coefficient for inhabitants. The inverse of the coefficient estimate is 1/0.904=1.106, suggesting that the number of inhabitants per pharmacy has to increase by 1.106 times for one more pharmacy to enter the market. Assuming that a single firm needs 1000 customers to make a profit would mean that for a second firm to enter, the number of inhabitants per firm has to increase by 1.106 times, resulting in 1106 inhabitants per pharmacy for making the same profit as before. This means that margins decline with more firms in the market and that competition therefore is slightly increased as additional firms enter, which was also expected from hypothesis 1.

Moreover, the estimated coefficient of the interaction term for 2011 is equal to -0.0347 and statistically significant at the five percent level. Since 2015 is the reference year, the estimated coefficient represents the difference in slopes for 2011 in comparison to 2015. This means that the total effect of inhabitants in 2011 is 0.0347 percentage points lower in comparison to 2015, hence 0.904-0.0347=0.87. The inverse is 1/0.87 = 1.15, and this implies that if one firm needs 1000 customers, as one additional firm enters, the number of inhabitants per firm needed to make the same profit is 1150. This is hence a larger impact on competition when more firms enter in 2011 compared to in 2015.

Hypothesis 2 states that the expectation is to find increased competition over time at the deregulated market, due to the large increase in pharmacies during this period. The expectation is hence a lower coefficient for 2015 in comparison to 2011. However, this is not the case and the regression results show a lower coefficient for 2011, which is the opposite of the expectation. One potential explanation to this result is that the market is still adjusting to the new competitive structure. If the market had been in equilibrium, a lower slope would imply higher competition. However, during the first years of the deregulation, when the market is not yet settled, a higher slope coefficient for inhabitants can be a result of that more pharmacies are willing to enter rather than a sign of less competition. In a market that has recently opened up for competition, there will probably be higher possibilities for making profit in the beginning than after some time, resulting in more stores entering in the beginning. Because of this adjustment process, it is not possible to interpret the lower coefficient as decreased competition. The graph in Figure 3 illustrates the number of pharmacies over time in the aggregated market. From the curvature it is clear that there has been a diminishing increase in pharmacies over time.

Figure 3: Number of Pharmacies 2009-2015



The pattern of the market experiencing a diminishing establishment of additional pharmacies is also seen in Appendix Table 8, where graphs are drawn for the development of the number of pharmacies in 12 randomly chosen municipalities in the sample. The similar pattern for these municipalities is that there is a higher increase during the first years which then declines for additional years. Another graph is given in

Appendix Table 9, showing the aggregated development at municipality level for the whole market. Again, the overall development seems to be a diminishing increase in the number of pharmacies for every additional year which supports the assumption that the market is adjusting to its new structure.

Moreover, as seen above in Table 3, the control variable for inhabitants older than 65 is significant at the five percent level and positive, suggesting that as the number of older inhabitants increases, the number of pharmacies in a municipality increases. The other control variable income per capita shows that an increase in the average per capita income in the municipality will have a negative effect on the number of pharmacies. One potential explanation to this can be that if individuals with a higher income are healthier, they do not need to visit pharmacies as often as individuals with lower income. Thereby there can be fewer pharmacies in areas with a higher average income per capita. The intercept in Table 3 is equal to -8.451 and the year dummy for 2011 is not statistically significant. This implies that it is not possible to say anything about the difference in intercepts between 2011 and 2015; hence it is not possible to conclude that there is a difference in entry barriers between these years.

7.2.2 Regression 2

The results from regression 2 are presented in Table 4. Again, only data from 2011 and 2015 are included in the analysis and the difference from regression 1 is that the dependent variable is now the number of different chains in a municipality. The estimated coefficient for the number of inhabitants is 0.957 and statistically significant at the one percent level. The hypothesis test of the coefficient being different from one is performed, and the outcome is seen in Appendix Table 7. According to the test, the null hypothesis is rejected and therefore it is not possible to say that the coefficient is different from one. Hence, it is not possible to say that the competition changes as more chains enter the market. The coefficient is higher in comparison to the store level analysis, suggesting that when taking the different chains into account, the competition in the market is even weaker. Hence, hypothesis 1 does not hold according to the analysis at chain level.

Moreover, the estimated coefficient of the interaction term for 2011 is not significant, and it is therefore not possible to confirm hypothesis 2 about increased competition over time. The estimated coefficient for older inhabitants is significant and negative, implying that when the number of older inhabitants increases, the number of different chains decreases. Income per capita is again significant and has a negative impact on the number of chains. The intercept is equal to -5.723 and the dummy for year 2011 is equal to -0.128 and significant at the five percent level. This suggests that the intercept for 2015 is higher in comparison to 2011 and hence this can be a sign of decreased entry barriers between these two years. However, it is necessary to keep in mind the adjustment process in the market during these years which can affect the results.

Table 4: Results Regression 2

VARIABLES	Pooled OLS ln(chains/km2)	Fixed Effects ln(chains/km2)	Random Effects ln(chains/km2)
ln(inhabitants/km2)	0.968***	0.296	0.957***
	(0.0279)	(1.030)	(0.0310)
ln(inhabitants/km2) *dummy2011	0.00612	0.00209	0.00626
	(0.0208)	(0.0245)	(0.0189)
ln(inhabitants65)	-0.335***	0.161	-0.336***
	(0.0313)	(0.531)	(0.0310)
ln(income per capita)	-0.828**	0.376	-0.516*
	(0.365)	(0.540)	(0.297)
dummy2011	-0.155**	0.00333	-0.128*
	(0.0701)	(0.0976)	(0.0693)
constant	-5.490***	-8.520*	-5.723***
	(0.331)	(4.959)	(0.308)
Observations	420	420	420
R-squared	0.836	0.037	0.836
Number of Id	210	210	210

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

7.2.3 Correlation between Pharmacies and Chains

One additional aspect that can be interesting to investigate is whether there are more pharmacies in markets where there are more chains. If this is the case, it can be a sign of the earlier discussed phenomenon of taking over competitors' customers, i.e. business stealing. When performing a correlation analysis and including data for 2015 only, the result is a correlation between pharmacy density and chain density of approximately 0.80. This is hence a positive and relatively high correlation. In order to also include the size of markets and the other factors earlier included as explanatory variables, a regression is performed with pharmacy density as the dependent variable. Chain density is included as explanatory variable together with the other variables in regression 1 and 2, except for the interaction terms and year dummies. This allows for holding all the other variables constant and observing what happens with the number of pharmacies if there is an increase in the number of chains, everything else equal. The results in Table 5 below show that the estimated coefficient of chain density is positive and significant at the one percent level. Hence, given that all the other variables are the same, a one percent increase in chains per square kilometre will result in a 0.641 percent increase in pharmacies. This suggests that there are more pharmacies when there are more chains, everything else equal. Since the variables chain density and pharmacy density are affecting each other, the estimated coefficient can be biased due to reversed causality. The number of pharmacies will affect the number of chains and also the number of chains will affect the number of pharmacies, hence there can be no chain without a pharmacy and there can be no pharmacy without a chain. Still, the coefficient of chain density can serve as an indication reflecting if there is a positive or negative correlation between the two.

Table 5: Results Regression 3

VARIABLES	ln (pharmacies /km2)
ln(inhabitants/km2)	0.267***
	(0.0652)
ln(chains/km2)	0.641***
	(0.0683)
ln(income per capita)	-0.268*
	(0.137)
ln(inhabitants65)	0.313***
	(0.0270)
Constant	-5.086***
	(0.528)
Observations	290
R-squared	0.972

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The overall results from the regressions above suggest that the pharmacy stores in the current market experience a slightly higher competitive pressure when more stores enter. Due to the ongoing adjustment process, it is not possible to draw any conclusions of the development over time reflected by the interaction term. There is, nonetheless, visible patterns of that the number of pharmacies is currently not increasing as rapidly as during the first years of the new market, which can reflect that the adjustment process is approaching a new equilibrium. In addition, when the analysis is extended to the chain level, the results show no significant change in competition when more chains enter the market. This finding suggests that even if the number of pharmacies has increased, the chains do not compete to any significant extent. Moreover, the correlation analysis between pharmacies and chains states that there are more pharmacies in the market when there are more chains, everything else equal. This suggests that business stealing is common in the market and an indication of that the existing chains use the number of pharmacy stores as a way to compete.

Further, as discussed in Chapter 2, through the social responsibility as well as the risk of cannibalization of the own sales, the former monopolist can be assumed to not take the number of inhabitants into consideration for opening new stores as much as the pharmacies in the current market. The current market incumbents care more about the number of inhabitants because they are purely maximizing profit. These results can explain why the largest increase in pharmacies is observed in the more densely populated areas, where it is more profitable to establish for the incumbents. It is also more often several chains in urban areas which increases possibilities for taking over competitors' customers.

As stated by the Swedish Agency for Public Management (2013), the reform has resulted in longer opening hours, higher availability and lower costs of medicines. Despite the indications of weak competition among the pharmacy chains in the current market, the reform seems to have benefitted the consumers and the largest improvement is observed in urban areas.

8. Conclusions

During the first six years after the deregulation of the state monopoly in the Swedish pharmacy market, the number of pharmacies increased by 44 percent. The largest increase has been mainly attributed to urban areas and not to such a large extent to less densely populated areas. The major objective of this thesis is to analyse the competition in the Swedish pharmacy market and describe the development since the regulated monopoly market. For this purpose, the chosen methodology is to analyse data for all pharmacies in the market in 2009, 2011, 2012, 2013, 2014 and 2015, by applying a theory which uses the number of inhabitants as proxies for margins. Panel data estimation with the Random Effects model is the chosen empirical strategy. This allows for taking unobserved municipality differences into account.

The hypotheses investigated are that there is competition in the market and that it has increased over time since the deregulation. According to the results, pharmacies in the current market experience weak competitive pressure when additional stores enter. Also, new pharmacies continue to enter but at a decreasing rate which is an indication of that the market is still adjusting to its new competitive structure. The ongoing adjustment deters any conclusions of the development of competition over time. Moreover, extending the analysis to the chain level shows that competition is not significant, which implies that despite the large increase in pharmacies, there is weak competition between the different agents. A correlation analysis shows that business stealing is common in the market, which can partly explain the bias towards higher establishment in densely populated areas where many chains often are present.

This study contributes to previous studies by using a quantitative methodology to measure the strength of competition in the pharmacy market. This is made by investigating current data, which is important in the constantly ongoing adjustment process to the new structure in the market. In addition, this thesis can help to explain the incentives of the market incumbents which have driven the establishment patterns after the deregulation. An interesting suggestion for further research is to estimate how far the adjustment process in the current market has developed and thereby determine the optimal number of pharmacies in the market.

9. References

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10. Appendix

Table 1: Municipality Statistics

Variable		Mean	Std Deviation	Min	Max
Number of pharmacies	Overall	3.7	4.29	1	29
	Between		4.22	1	24.67
	Within		0.8	-5.97	8.04
		Mean	**Std Deviation**	**Min**	**Max**
Number of chains	Overall	2.14	1.55	1	10
	Between		1.31	1	7.67
	Within		0.82	-4.53	4.47
		Mean	**Std Deviation**	**Min**	**Max**
Number of inhabitants	Overall	27434	31007	3612	210283
	Between		31060	3646	203370
	Within		753	18815	34347
		Mean	**Std Deviation**	**Min**	**Max**
Areakm2	Overall	922.83	840.18	56.9	6859
	Between		841.9	59.16	6809.79
	Within		3.19	903.95	971.77
		Mean	**Std Deviation**	**Min**	**Max**
Pharmacies per km2	Overall	0.0049	0.0051	0.00052	0.05
	Between		0.0049	0.00052	0.05
	Within		0.0011	-0.01	0.01
		Mean	**Std Deviation**	**Min**	**Max**
Inhabitants per km2	Overall	38.8	42.77	4.79	398.35
	Between		42.85	4.83	385.44
	Within		1.08	24.06	51.7
		Mean	**Std Deviation**	**Min**	**Max**
Share 65 years or older	Overall	0.23	0.03	0.13	0.34
	Between		0.03	0.15	0.31
	Within		0.01	0.19	0.26
		Mean	**Std Deviation**	**Min**	**Max**
Share incoming commuters	Overall	0.1047	0.04	0.02	0.25
	Between		0.04	0.02	0.23
	Within		0.006	0.07	0.13

		Mean	Std Deviation	Min	Max
Share living in densely populated area	Overall	0.73	0.1204	0.37	0.96
	Between		0.1205	0.37	0.96
	Within		0	0.73	0.73
		Mean	**Std Deviation**	**Min**	**Max**
Mean income per capita	Overall	230581	19414	179760	336292
	Between		15161	198910	306385
	Within		12163	193836	260489

Table 2: Breusch and Pagan Lagrangian Multiplier Test Regression 1

```
Breusch and Pagan Lagrangian multiplier test for random effects

        lphdensity[Id,t] = Xb + u[Id] + e[Id,t]

        Estimated results:
                        |       Var     sd = sqrt(Var)
                ---------+-----------------------------
              lphdens~y |   .6770387       .8228236
                      e |   .0236779       .1538763
                      u |   .0729569       .2701054

        Test:   Var(u) = 0
                             chibar2(01) =   118.44
                          Prob > chibar2 =   0.0000
```

Table 3: Breusch and Pagan Lagrangian Multiplier Test Regression 2

```
Breusch and Pagan Lagrangian multiplier test for random effects

        lchaindensity[Id,t] = Xb + u[Id] + e[Id,t]

        Estimated results:
                        |       Var     sd = sqrt(Var)
                ---------+-----------------------------
              lchaind~y |   .5827413       .7633749
                      e |   .0270894       .1645887
                      u |   .0700475       .2646649

        Test:   Var(u) = 0
                             chibar2(01) =   107.08
                          Prob > chibar2 =   0.0000
```

Table 4: Hausman Taylor Test Regression 1

```
Note: the rank of the differenced variance matrix (4) does not equal the number of
        coefficients being tested (5); be sure this is what you expect, or there may be
        problems computing the test.  Examine the output of your estimators for anything
        unexpected and possibly consider scaling your variables so that the coefficients are
        on a similar scale.
```

	Coefficients (b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
linhkm2	1.318325	.9036597	.4146648	.9618862
linhkm211	-.0293346	-.0347457	.0054111	.0145363
linh65	-.0609974	.0635089	-.1245063	.4953312
linpc	-.051748	-.729467	.677719	.4121756
dum2	.0392136	.0010584	.0381552	.0638081

```
                         b = consistent under Ho and Ha; obtained from xtreg
          B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        3.68
                Prob>chi2 =      0.4516
```

Table 5: Hausman Taylor Test Regression 2

```
Note: the rank of the differenced variance matrix (4) does not equal the number of
        coefficients being tested (5); be sure this is what you expect, or there may be
        problems computing the test.  Examine the output of your estimators for anything
        unexpected and possibly consider scaling your variables so that the coefficients are
        on a similar scale.
```

	Coefficients (b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
linhkm2	.2956259	.9572417	-.6616158	1.030854
linhkm211	.0020885	.0062563	-.0041678	.0155783
linh65	.1608481	-.3358607	.4967088	.5309577
linpc	.3755323	-.515878	.8914103	.4520873
dum2	.0033318	-.1277032	.131035	.0689289

```
                         b = consistent under Ho and Ha; obtained from xtreg
          B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        5.22
                Prob>chi2 =      0.2656
                (V_b-V_B is not positive definite)
```

Table 6: Hypothesis Test of Coefficient Regression 1

```
( 1)  linhkm2 = 1
```

lphdensity	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
(1)	-.0963403	.0308829	-3.12	0.002	-.1568696	-.035811

Table 7: Hypothesis Test of Coefficient Regression 2

```
( 1)  linhkm2 = 1
```

lchaindens~y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
(1)	-.0427583	.0309921	-1.38	0.168	-.1035017	.0179852

Table 8: Number of Pharmacies per Municipality 2009-2015

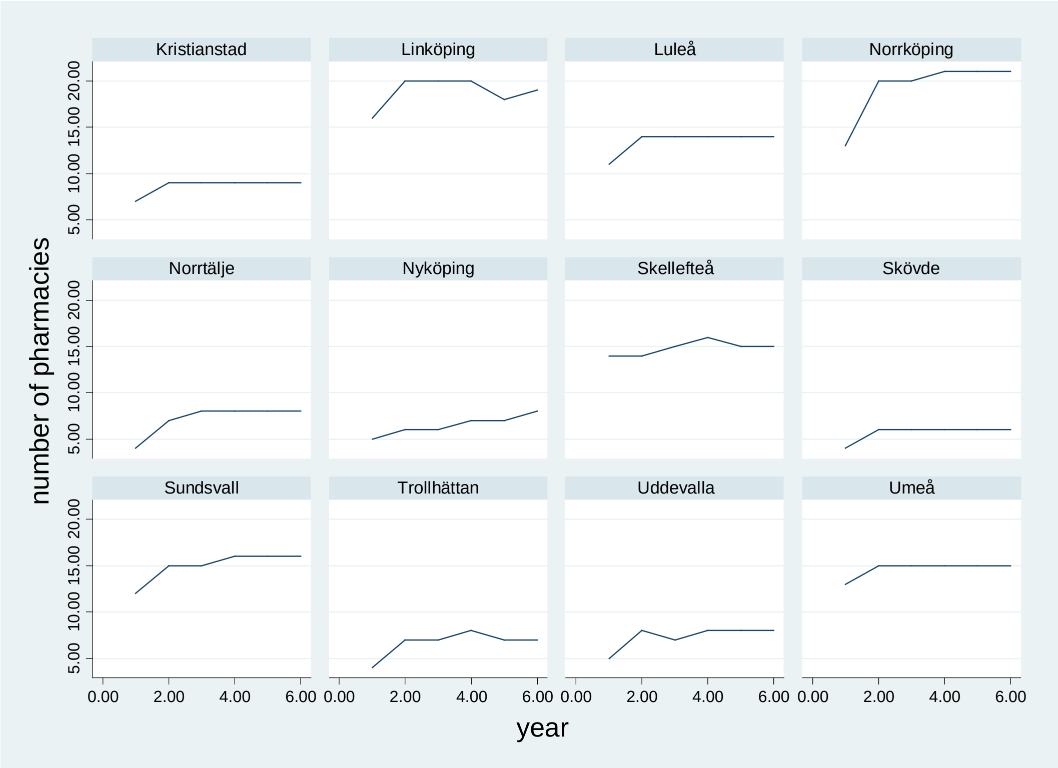

Table 9: Number of Pharmacies at Municipality Aggregated Level 2009-2015