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Changes in availability to pharmacies in a post-monopoly market

A pre-post study of the distribution of pharmacies in Swedish communities after re-regulating the market

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Abstract

In this empirical essay, I explore how the distribution of pharmacies has altered for the Swedish population since the re-regulation of the pharmacy market in 2009. I first review the current situation on the pharmacy market in Sweden and the conditions regarding the change in market structure from a previous state-run monopoly to a less regulated market. Further, I describe outcomes in other countries in terms of my dependent variable; the population to pharmacy ratio. I then perform a panel data analysis, where I study the changes in the linear relationship between the population to pharmacy ratio and population density in Swedish communities before and after the change in market structure. Results show that the increase in accessibility is significantly larger in more densely populated areas than in other regions. I believe this study will be a useful addition to the existing literature on the subject, since it clearly reflects the impact the market policy change has had on the distribution of a vital service such as pharmaceutical goods for the Swedish population.

Key words: population density, rural and urban areas, accessibility, population to pharmacy ratio
Words: 10 436

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1 Introduction

July 1st 2009, the Swedish state abandoned the state-run pharmacy monopoly, one of the few still remaining in the world, and opened up the market for competition. Most other countries had already given up regulating the market of drugs and medications in favour of lower prices and higher accessibility for consumers. By opening up for private actors, the re-regulation was expected to lead to lower prices through price pressure, more pharmacies and more generous opening hours in efforts to be more competitive and provide better service to consumers.

Before the re-regulation there were concerns that rural areas of Sweden would be hit by the "pharmacy death" (*apoteksdöden)*. A fear of that when pharmacies were no longer funded and run by the state, a lot of them would be forced to close down due to too small markets and low profitability. The Swedish pharmacy market now holds both state-owned and private pharmacies, and the re-regulation is in most cases deemed successful. What I want to find out is how a potentially increased accessibility to pharmacies is distributed amongst the Swedish population, and how a less regulated market has affected the geographical distribution and concentration of pharmacies for consumers. It is an important issue in the contemporary Swedish economy and politics given the rare empirical cases of opening up a monopoly for competition.

1.1 Purpose

My research question is how the accessibility to pharmacies has altered for the Swedish population since the re-regulation of the market in 2009. Pharmacies are the least accessible service in the countryside. In 2012, 48% of the Swedish population in very rural areas had more than five minutes travel distance to the nearest pharmacy. However, previous research has shown that this share has actually gone down since the re-regulation of the pharmacy market (Jordbruksverket 2013:17). The total supply of service places (places that provide day to day services or goods), tends to decrease in general in the country. Independently on whether you live in rural or densely populated areas, supermarkets, bank offices etc has been closing down continuously during the past ten years (Jordbruksverket 2013:3ff). It is therefore somewhat surprising to see the opposite trend in number of pharmacies; very few have closed down while several new have opened. In general, competition today has an almost solely positive meaning throughout EU and there is a strive towards less regulation in the field of pharmacies, given its dominant position in the global debate there is surprisingly little evidence to document the effects of competition on behaviour

and market structure (Volkerink, 2007:83ff; Anell 2005), which is why I want to explore it further.

To open up a market from a previous monopoly is a rare and exciting case, and can basically be seen as a natural experiment. We have lots of theories and models for how we think the economy works, so when an event like this occurs it is important to study the empirics of it since we cannot perform any experiments in labs to test our models. Therefore my emphasis in this study will lay on the empirical results, rather than the theoretical development of models that might or might not explain the events. I will investigate how the re-regulation of the Swedish pharmacy market has affected the geographical dispersion of pharmacies for consumers across the country by using the population to pharmacy ratio. The empirical question here is whether or not population density affects the impact of the re-regulation on accessibility.

1.2 Research approach

My hypothesis when performing this study is that the main increase in number of pharmacies has occurred in more populated areas and cities where markets, and therefore profit possibilities, are larger and that there might not be a striking difference at all in more rural areas. Accessibility and costs of time and transportation has clear economic impact on both producers and consumers, and along with political and distributional aspects, I believe it has the potential for an interesting analysis. The study will also add to the evidence from previous evaluations of the intervention through its focus on distribution, rather than to observe all aspects on the re-regulation, such as price and opening hours. Further, I will not divide the data into county level or urban and rural categories like most previous studies, but study the effect on a community level. To do this, I will estimate a regression model with data on pharmacies per community and population density data where the dependent variable is population to pharmacy ratio. I measure the interaction between these variables after the re-regulation to find the effect of population density on changes induced by the reform. The research approach will be developed further in Chapter 4.

1.3 Definitions and limitations

Like in most cases, some difficulties will present themselves along the course of the study, which I in this section will detail along with the definitions used and the rationale behind some ad-hoc limitations.

First of all, the Swedish pharmacy market now holds both obstacles (permit requirement) and fees for entering the market, and that is why I have

chosen to call it a re-regulation, rather than a de-regulation; some very powerful regulation still exists.

The more people living in an area, the larger is the consumption of services. How many inhabitants per service point (place providing public or commercial service needed on a regular basis) show the amount of service provided in an area in relationship to the population. In this case, the service points are pharmacies, which is why the population to pharmacy ratio will be used as the main outcome measure. Generally, service rate is more correlated with population density than population size, thus the sparsely populated areas are the ones with the lowest service rate (Jordbruksverket 2013:11; 64f). Because of this, population density will be used as the independent variable, a proxy for measuring market demand later on. Further, a community is an area within a municipality and the classification can be seen as somewhat of an ad hoc-application for this case. The limitation of using municipalities as a measurement is that a whole municipality can actually contain areas with very diverse population structure, but the municipality will still be labelled as one (Jordbruksverket 2013:69). Community indicates a lower level of abstraction and can thereby provide more observations, but also more detailed observations when it is merged with the population density data. Hence, I chose to use data on pharmacy per community rather than pharmacy per municipality.

For a good access to pharmaceuticals, there are other important aspects next to the total number of pharmacies. Each pharmacy's opening hours and the supply offered is equally important to provide the population with a good and safe distribution of drugs. However, I will not touch upon any of this in my study due to the lack of data. When I talk about accessibility further on, it is thereby entirely the geographical dispersion of pharmacies that I intend. The limitation in time to five years (2009-2013) was likewise a decision based on the availability of data.

2 Background

2.1 The case of Sweden

During recent years there has been a wave of health care reforms throughout Europe, where questions have been raised concerning pros and cons of different policies to try to find the best approach (Mossialos et al 2004:xv). Private expenditures on pharmaceuticals are normally quite high, but the share of public spending on such supplies has declined in most of Europe due to attempts to limit health care costs (Mossialos et al 2004:3). In Sweden in 2012, health care expenditures were 9.6% as a share of GDP, just above the average in OECD-countries. The share of that spent on pharmaceutical expenditure was 12.3% the same year, both of which numbers has gone down 1.5-2% since 2000 (OECD Health Statistics 2014:3). To contain health care costs has become especially relevant since we live longer and longer, and with an ageing population and accompanying long-term health conditions follows higher health care costs (Anderson 2007:244). Sweden is a well expanded welfare state, public expenditure has occasionally risen to around 60% of GDP, and it is the state's responsibility to ensure that markets work efficiently (to not waste scarce and common resources), and correct for market failures such as monopolies and other external effects. Thus, the government must also take responsibility for even distribution and equity in the country by intervening when the market requires so. This is sometimes called "political failures" in the sense that efficiency is not always the top priority among politicians (Kruse & Ståhlberg 2013:14). The state is responsible for providing its citizens with what is called "universal service" such as postal services, education and infrastructure. This supplied service also includes access to pharmacies within a reasonable distance (RiR 2010:19:83). This was previously achieved through a state-run monopoly on pharmaceuticals. Roughly, one can say that a state funded service point such as a pharmacy will remain in rural areas if the state decides so, if they judge there is a need for it, contrary to a private actor who will remain there as long as it is profitable (Jordbruksverket 2013:9). The average turnover in a supermarket in a city area in Sweden is 39 million SEK, to be compared with 24 million SEK in the rural countryside (Jordbruksverket 2013:12), which in some way legitimates the earlier mentioned concern for a 'pharmacy death'. Nevertheless, the state must organize the monopoly efficiently so that equity is accomplished (Mossialos et al 2004:2).

The Swedish pharmacy market has been regulated since 1971, when the government introduced the state-run monopoly which has now been taken out of practice (RiR 2010:19:11). Agreements between Apoteket AB (the state-owned monopolist) and the Swedish government ensured that Apoteket AB had a

nationwide system for the distribution of drugs through local pharmacies, even where demand may have been very low. This was an efficient system in total cost aspects due to economies of scale, but failed in service and access for the consumers (RiR 2010:19:11). For example, before the re-regulation the population to pharmacy ratio in Sweden was one of the highest in Europe, over 10 000 residents per every pharmacy (Sveriges Apoteksförening 2010:17). To a large extent some of this has been harmonized on a transnational level through EU, i.e. are now uniform across all EU-member states. More detailed regulations are of course country-specific, and depend largely on the relationship between pursuing public health policies and industrial policy objectives in each country (Mossialos et al 2004:5).

2.1.1 Pre-regulating

Five overall purposes of the re-regulation were formulated beforehand, and then evaluated by The Swedish Agency for Public Management *(Statskontoret)* in 2011, 2012 and the final report in 2013. The aim of re-regulating the market was to:

- Increase access to pharmaceuticals
- Provide better service and supply of products
- Lower pharmaceutical costs
- Maintain competence and safety in the supply and distribution of drugs
- Acknowledge and use the pharmacists contribution to improved use of medicines

The evaluation was made with these overall goals in mind, and assesses the achievement of the above (Statskontoret 2013:9f). The first goal of increased access to pharmaceutical products is, as mentioned before, the focus of this study. The re-regulation was made so that both small and large actors would be able to exist and prosper on the market in the long run. To accomplish the creation of a market and expose it to competition, parts of the stately owned monopolist company Apoteket AB was sold out to private actors. Through this action, the government could decrease Apoteket ABs market power and open up for competition without compromising the safe distribution of drugs to hospitals and consumers during the transition. Apoteket AB still exists and is owned by the Swedish state, but now in the form of a collection of smaller companies on an open market rather than as a dominant monopolist (RiR 2010:19:7).

At the point of re-regulation Apoteket AB had a market share of about 35% of the community pharmacies in Sweden, the remaining share (65%) had been sold out to other actors. When selling several of the existing pharmacies, a lot of them were sold in clusters of different sizes and orientations to create diversity among actors and owners. About 150 of the 615 pharmacies that were sold created the new state-owned company Apoteksgruppen i Sverige AB. They organize the smaller companies and offer them partial funding in purchases of single pharmacies. There is of course also the opportunity to open up an entirely new pharmacy, the rate of new establishments have been very high since the

beginning of 2010, when 70 new pharmacies opened in the first six months (RiR 2010:19:25ff).

2.1.2 Re-regulating

The re-regulation was performed in four steps. The first step was carried out in March 2008 when nicotine replacement products were allowed to be sold outside pharmacies. Step two in September 2008 altered pharmaceutical provisions to hospitals by allowing different care givers organizing possibilities. The third step was the real privatization in July 2009, when private community pharmacies were allowed on the Swedish market and individual actors could apply for a permit from the Swedish Medical Products Agency. The fourth and last step was when specific non-prescription pharmaceutical products were allowed to be sold outside pharmacies in November 2009 (Statskontoret 2013:9; RiR 2010:19:15). It is the third step that marks the changed conditions in access to drugs on the market, and likewise what this study will focus on. The very first new actor who gained access to the Swedish pharmacy market by opening up a privately owned pharmacy was Åhléns in January 2010. A few weeks later other buyers of pharmacy clusters followed. Since the market officially opened up on the 1st of July 2009, one can understand that there was a large delay in the actual opening of the market; actual market access was gained seven months after the date that the government had initially set (RiR 2010:19:28).

The new law that came with the re-regulation allows anyone the right to own a pharmacy and sell pharmaceutical products, with the exception of producers and prescribers of medicinal products, and The Medical Product Agency can debt an annual charge to all permit holders (SFS 2009:366, 2 kap §1; 7 kap §1; 8 kap §2-3).

2.2 Access in rural areas

Improved access to medicinal products was one of the main goals of the re-regulation. This would be carried out through increased number of pharmacies and better service to consumers through longer opening hours. Although, there were lots of concerns on how this increased access would be distributed across the country, namely that access would increase in urban, densely populated areas, but decrease in more rural parts (RiR 2010:19:83). In a way it has shown to be a justified concern, of all new pharmacies opened after the re-regulation, 99% of them have done so in areas with more than 3000 citizens (Jordbruksverket 2013:14). Over 34% of the Swedish population lives in what is defined as rural areas according to The Swedish Board of Agriculture, but there are several different types of rural areas, some are growing in population, jobs and economy while some are shrinking and being de-populated (*Jordbruksverket)* (Jordbruksverket 2013:3ff). Rural areas are signified by sparseness in structure

and population, and in general long distances to larger service points. This creates a problem in providing commercial and public services to rural population. All investments in infrastructure would come with high fixed costs and shared on few households, which prevents the use of economies of scale (SOU 2006:101:45f). Redistribution objectives are particularly important since incomes in most rural areas tend to be lower than in other parts. One way to compensate for this is to lower the price of welfare services where incomes are lower. However, the cost of accessing a pharmacy includes transport costs in time and money to get there, which means higher costs for services in rural areas rather than lower. By increasing the number of pharmacies and thereby decrease the distances for consumers, one can decrease costs of pharmaceuticals for citizens living in rural areas (RiR 2010:19:83).

When allowing for competition, economic theory says that given normal conditions, more actors will enter the market, pushing producers to compete with lower prices and better service. But will this only happen where markets are large enough to hold many producers? Exceptions exists for natural monopolies, such as the national railways where one to a large extent is dependent on economies of scale, but the pharmacy monopoly is not necessarily one of those cases (Bergh & Jakobsson 2010). For example, when the postal service was re-regulated in Sweden in the 1990's, there was an enclave to guarantee national access for all residents, meanwhile there is no law regulating citizens' rights to pharmacy access. However, during a transition period of three years the state imposed Apoteket AB to provide access in very rural areas as a welfare institution. By keeping its pharmacy agents in an unchanged form during the period, access would be ensured until the government had made agreements with the new pharmacy actors to operate these particularly important and vulnerable pharmacies in the future. The pharmacy companies agreed to make sure that these key service places did not close down and that the level of service was maintained during a certain period of time (RiR 2010:19:85ff). The agreement expired in the beginning of 2013, and the state has now instead made it possible to seek financial support for remote, rural pharmacies (Tandvårds- och Läkemedelsförmånsverket 2014:6f).

2.3 Previous research

Pharmacy markets in both Iceland and Norway were deregulated before the market in Sweden, restrictions to ownership and competition were relaxed in 1996 and 2001, respectively. In both countries the new policies quickly led to high concentration of the market, and by 2004 two and three pharmacy groups controlled 85 and 97% respectively of the markets in each country. In combination with remaining barriers to entry, this type of market concentration may call for additional pro-competitive interventions to prevent unfavourable developments (Anell 2005). In Sweden though, this has not been an issue. In 2013, only three years after the actual opening of the market, there were 24

different pharmacy actors on the Swedish market, six of them are large chains (Sveriges Apoteksförening 2013:17f). A majority of the new pharmacies in both Iceland and Norway opened in city centers or in malls, but there were exceptions to this general trend. From a consumer perspective, pro-competitive policies did result in an improved availability of pharmacies, at least in areas with a dense population. In total, however, the new policies did very little to improve the availability of pharmacies in rural areas (Anell 2005).

To measure the effect of the re-regulation on service rate and increased access, the quota population to pharmacy ratio is commonly used. In Norway the pharmacy to population ratio decreased after de-regulating the market. Although, there are national service criteria guidelines for regulating the number of pharmacies relative to population in many places, depending on population size and locality type. In Italy for example, towns with less than 12 500 inhabitants shall have a pharmacy per every 5 000 people, meanwhile in larger cities the ratio is one pharmacy per every 4 000 people (Mossialos et al 2004:202ff). In France the equivalent regulations strictly set the pharmacy to population ratio to one pharmacy per 2 500 people, regardless of the conditions (Hwang 2014:4). In Germany on the other hand, pharmacies are free to locate wherever there is enough trade to support it (Mossialos et al 2004:204). Generally in Sweden there has also been a quite drastic reduction in population per pharmacy from 10 000 people in 2009, and second worst in Europe, to 7 400 people in 2013. The average in Europe is however 4 000 people per pharmacy (Sveriges Apoteksförening 2013:24f). The county where the ratio is the lowest in Sweden is in Jämtland, a very rural county in the North of Sweden, where one pharmacy is shared by 5 300 people, to be compared with the urban region around Stockholm where the same ratio is 9 600 people! Of course the distance between the pharmacies are longer in Jämtland but in the strict regard of population numbers to pharmacy numbers, there is a broader coverage in Jämtland than in Stockholm (Sveriges Apoteksförening 2010:17f).

Previous research also tells us that the share of the population with more than five minutes' drive to the closest pharmacy has decreased (Jordbruksverket 2013:14ff). Although, this could of course be due to completely other factors, entirely uncorrelated with the re-regulation of the pharmacy market, for example the migration of population from rural to urban areas. The rate of new pharmacy establishments in Sweden evened out during 2013, and we can assume that the improvement in pharmacy availability has now become more long-term (Sveriges Apoteksförening 2013:24ff). One of the very few pharmacies to have closed down during 2013, the first year where a rural, important pharmacy were legally allowed to close, was the pharmacy in Lima in Dalarna (Sveriges Apoteksförening 2013:18).

3 Theory

In analysing the Swedish pharmacy market and determining how accessibility has altered for the population due to the market change, there are lots of different aspects that demand certain attention. In this section I will first briefly explain the basic microeconomics to understand the change in market structure, and then go deeper into how the market can be organized.

3.1 Market structure

Perfect competition is (mainly) a hypothetic market form and explains the conditions when the market holds many producers, all of whose products are perfect substitutes. Consumers have full information, there are no obstacles for entering the market and the producer is a price taker. The opposite is when there is a monopolist on the market and therefore only one producer to meet the entire market demand, making that firm a price setter (Bergh & Jakobsson 2010:176f). The greyer area in between these two polar extremes is the study of imperfect competition, called industrial organization (Pepall et al 2014:3). It is what the current situation on the Swedish pharmacy market can be described as, in that actors must face both obstacles and fees for entering the market, but it is no longer dominated by a dominant monopolist.

3.1.1 The pharmacy market

The current Swedish health care system is to a large extent the product of past national governments. Sweden has a strong tradition of Social Democratic rule, which has strongly influenced the public sector with the importance of equity and reliance. However, the past 25 years governments have turned towards competition and consumer choice as ways to increase efficiency in areas previously dominated by public monopolies. These changes have substantially transformed the Swedish economy, and Sweden now has more liberal rules for market entry than do many European countries with long traditions of regulated private markets. However, despite political intentions to allow individually owned pharmacies, many of them today are part of dominant, national chains owned by pharmacy wholesalers and capital investors (Anell 2015). To this matter, there are tensions between national and transnational objectives that are concerned with the relative performance of Europe to the rest of the world, and the competitiveness on European pharmaceutical markets (Anderson 2007:244). Previous studies

show that the relationship between regulation and productive and allocative efficiency is relatively strong. A reduction in regulation leads to a substantial increase in social welfare (as a result of a reduction in ’dead weight loss’), and significantly enhances productivity. This suggest a societal need for further policies aimed at removing obstacles for freedom of establishment in the field of pharmacy services (Volkerink et al 2007:18f). Although, that type of reform would increase social welfare, but from a societal perspective it would still be desirable to maintain certain restrictive elements of national legislation to safeguard access to medicines in remote and rural areas, if the market does not provide services in these regions by itself (Volkerink 2007:83).

3.2 Market demand

An individual demand curve shows, all else equal, how much a consumer is willing to buy at a specific price (Gillespie 2011:52). However, we are seldom interested in studying the behaviour of a single individual, but rather the behaviour of groups. Thus, the study of individual demand is only a mean to study market demand (Hicks in Hildenbrand 1983:997). Market demand is simply the sum of all individuals’ demand curves put together and the *Law of Demand* states that, all else equal, price and quantity demand of any good are inversely related to each other, meaning that when the price of a product increases, the demand for the same good will decrease and vice versa (Hildenbrand 1994:5ff). Thus, for the purpose of modelling a market demand of a large population it suffices to model the demand behaviour of an individual household, which is dependent on a number of demographic household-characteristics, such as income level, household size etc (Hildenbrand 1994:12f).

3.2.1 Pharmaceutical market demand

Drugs are administered for the purpose of improving the population’s quality of life. This could be done through 1) cure of a disease 2) reduction or elimination of symptoms 3) arresting or slowing of a disease process and 4) preventing a disease or symptom. However, when drugs are given, the potential for outcomes that instead diminish the patients’ quality of life is always present, which is why this sector cannot only be profit-maximizing; they also have a social responsibility (Hepler & Strand 1990:533ff). On the pharmaceutical market, prescription medicines usually account for about 80% of total sales, the total market size is therefore mainly determined by prescriptions from prescribing physicians. Hence, competition across pharmacy groups can in a way be described as a zero-sum game. Pharmacies are not in a position to expand the total sales of prescription drugs since these are in fact limited by another profession, they may only increase their own sales and profit by attracting customers from other actors. But since product knowledge and requirements regarding services has relatively strict

regulations and as medicinal products' price elasticity is relatively low, customers are less sensitive to price changes, making location and availability of the pharmacy the most important competitive attributes (Sveriges Apoteksförening 2010:10; Anell 2005). The importance of location could be one explanation for the substantial increase in number of pharmacies that occurred in both Iceland and Norway following the implementation of new competitive policies. It rapidly changed the industrial organization of the market, with both horizontal (Iceland and Norway) and vertical integration (Norway), and the formation of oligopoly markets (Anell 2005).

3.2.2 Central Place Theory

Price and product choices are not the only decisions for a firm. As indicated above, location is also a vital part of doing business. Economic activity is very unevenly distributed across the geography, and the earliest models of where goods and services are produced, distributed and consumed are built on traditional economic theories (Henning 2011:2ff). Alfred Weber created the triangle of industrial location, where he models for a single manufacturing firm's location choice weighing the locations of two different inputs, and the location of the market (Wood & Roberts 2011:22f). Later on Walter Christaller developed The Central Place Theory which instead of focusing on individual actors studies the location of all types of economic activities within a community (Henning 2011:10f). He created a system of central service places surrounded by more periphery places that could be put together in a much larger, complex urban system. The size of the city or town determined the different supply of economic services that were offered there; the larger the place, the broader the supply of specialized services. All goods are divided into higher or lower order goods, separated by the range a consumer is prepared to pay or travel to consume the good, and the threshold, the minimum required market for the good to be sold in that place (Wood & Roberts 2011:26f). Medicinal products must be considered a lower order good in the sense that they are necessary to keep the population healthy and can be required at any time, in other words, a low threshold market in order to be part of the offered supply even in smaller central places.

3.2.3 Horizontal product differentiation

To understand this theorem we can use the concept of horizontal product differentiation. Hotelling was the first to use this concept when asking where to locate in regard to the market and competitors. To explain Hotelling's model we assume that consumers have identical preferences regarding the quality of the product, and the same willingness to pay. However, consumer preferences differ for the specific features of the good that make it particularly attractive to them. These features may concern taste, colour, style or what we consider here,

location! So if a good is sold nearby, all consumers have the same reservation price. What matters though, is that not all consumers are equidistant from the selling point, they may be located at different travel lengths from it. This makes a significant difference since the time and effort required to be able to purchase the good will affect its perceived value. Even if initially the reservation price was the same for all consumers, those who live far away from the selling point will have a lower willingness to pay than those living close when "costs" for time and travel is taken into account. This is called horizontal product differentiation, and is characterized by the attribute that the product may have individual optimal locations for each consumer, presumably close to their homes. When products are differentiated by location, we talk about the *spatial model of product differentiation* (Pepall et al 2014:143ff). This somewhat relates to the Central Place Theory briefly described above, consumers are prepared to travel different lengths depending on the good they are about to consume. For example, one might be prepared to travel quite far to buy a specific type of furniture or a car, meanwhile, today's lunch or snacks for the evening might not be worth the same type of sacrifice in time and money. The same logic works the other way around, a specific good with exactly the same price at two different pharmacies, such as a certain brand of antibiotics perhaps, will not have the same value for the consumers if the pharmacies are at different lengths from him or her.

To make this even more clear, say a monopolist producer is about to locate in a new town. Assume the population lives evenly spread out along a one mile long Main Street. The firm should then locate in the middle of the town to minimize the travel distances and thereby costs for as many consumers as possible, this way the ones farthest away from the shop will have half a mile to travel. If the monopolist were to set up two shops, these two should be located at ¼ and ¾ of the Main Street, giving the two shops half of the town's market each and thereby cutting the travel distances in half for most consumers. The aggregated market demand of the town increases as price gets lower (remember Section 3.2), but when one decreases travel costs through opening a new shop, a possibility to increase prices appears. As long as the new increased price is lower than the reservation price (or price + travel costs before), more consumers are willing to buy the good and the geographical market that the shop supplies can expand. Price is then determined by the number of consumers and the number of shops operated (Pepall 2014:144ff). A location in the middle of town makes it possible for the firm to supply the entire market at the highest possible price. Simply said, the increase in revenues due to higher prices must be balanced against the additional costs for setting up another shop. Hence, we can expect to find greater product variety, here in terms of number of shops, in markets where there are many consumers (Pepall et al 2014:149). Locality is therefore very important for the consumption of a good.

While considering consumers preferred products, here in terms of minimized travel costs, we touch upon product variety. What level is socially optimal? To maximize social welfare we must maximize the total surplus created on the market, that is the aggregated consumer surplus and producer profits. Although, for a monopolist what matters more than social welfare is producer profits, and

hence monopolists will open more shops than competitive firms because they will continue to open shops even after social welfare is maximized. Thus, there will be more shops under monopoly than under competition, if the monopoly is maximizing profits (Pepall 2014:151ff). This might be interesting further on, since it seems like the state monopoly have in fact been underestimating the demand and operating too few pharmacies rather than too many. It might also be the opposite case, that the state were operating a welfare maximizing number of pharmacies and the re-regulation has in fact lead to too many. However, it is clear that a large increase has occurred in the number of service points.

3.2.4 Agglomeration economies

Economic development based on high population density is normally called agglomeration economies, and we know that closeness and accessibility is important both for economic growth and for the providing of services (Jordbruksverket 2013:16ff, Rosenthal & Strange 2004:2137). A general specification of agglomeration economies is that the aggregate urban external effect arises as the sum of a large number of individual externalities. For example consider two establishments; 1 and 2. The effect of establishment 1 on 2 depends on the distance between the two establishments, where distance is measured over three different dimensions. First, the influence of 1 on 2 depends on the geographic distance between the two establishments. Second, it also depends on the type of industrial activity that takes place at the two establishments, namely the industrial distance. Third, the impact of the interaction may extend temporally, where establishment 1 can be affected by something 2 did at another point in time (Rosenthal & Strange 2004:2126). So, producers want to agglomerate, but not too much. Pharmacies can benefit from having several selling points in one community as long as the geographical distance (and to some extent the industrial, which can only differ very little within the same sector) is large enough. Parallels can again be drawn to the Central Place Theory, smaller rings of central places keeping the distances between services points within a much larger community-ring. The method has been used in research even after Christaller, Rosenthal and Strange writes about how the environment of an establishment can be measured by constructing rings around the centroid of the establishment's zip code. Rings of one, five, ten and fifteen miles are included, and results show that new establishments are more likely to be attracted to zip codes as employment in the own industry within one mile increases. Employment in the own industry just five miles away, however, has a much smaller effect, as does employment further out in the tenth and fifteenth mile-rings (2004:2137ff).

3.3 Impacts

So, what affects how producers locate? We now know that it depends on demand; there needs to be a market so there needs to be people. Demand of course depends on the individual preferences, but we also know that only a small part of pharmacies' sales is based on 'normal', non-prescription, purchases. We also know that locality is important for the consumer in terms of travel costs. In addition, we know that plant births are more likely to occur in areas where there already is an existing concentration of industrial activity. New establishment-rate on the pharmacy market should then be conditional on existing selling points and on market demand, especially since price does not have as strong impact on pharmaceutical goods as on others due to the price-inelasticity. When markets only want to allocate where demand is high, rural areas become very vulnerable and it is the state's responsibility to supply enough support so that public and commercial services can be maintained in areas outside of agglomeration. The purpose of course being that citizens and businesses need access to the basic level of infra-structure and service in order to remain in the area (Dir 2014:4). To study plant births like I do, do though present some difficulties. The principal drawback is that many locations do not receive any births in a given period, which can lead to technical challenges on the econometric side (Rosenthal & Strange 2004:2131). I will come back to that in Chapter 6 in my attempts to find out how accessibility of pharmacies has altered due to the policy change in market structure.

4 Methods

4.1 Data

The data used for the purpose of answering the question of how accessibility has altered for the population due to the re-regulation, comes from The Swedish eHealth Agency *(eHälsomyndigheten)*, and is collected by Caroline Mårder, analyst at The Dental and Pharmaceutical Benefits Agency, (*Tandvårds- och Läkemedelsförmånsverket*). It contains the number of pharmacies with sales in the month of December each year from 2009 to 2013, in each community. The dataset was merged with data from Statistics Sweden *(Statistiska Centralbyrån)* regarding population density for each included community, which is only measured every five years at the required level of abstraction (i.e. the community level). Five years is a relatively short time period for migration patterns to change drastically, and I therefore chose to disregard any small potential variations in population density within each community over the time period.

The degree of abstraction is communities in Sweden having a pharmacy with sales during at least one of the included five years. To instead use municipalities as the level of abstraction was an option, but there can be large differences in population density within a municipality. Further, using the lowest observation level achievable would maximize the number of observations, and even though to have as many observations as possible is not an end in itself, it increases precision and reliability in the study. Hence, the communities included in the data set are the ones with at least one pharmacy with sales in the month of December in any of the years between 2009 and 2013. Further, the pharmacies included are community pharmacies (*öppenvårdsapotek)*, meaning that it does not include different kinds of delivery- and distance pharmacies. Given these criteria, the full panel dataset included 480 groups (communities) and five repeated observations per community. There is only one pre-intervention observation per community to a total of four post-intervention observations. As you might remember from Chapter 2, the policy change came into effect in the beginning of 2010, which is why I could use the data from 2009 as pre-data even though the re-regulation had, on paper, already occurred.

The dependent variable, used to measure accessibility, is the population to pharmacy ratio. It is a common measure throughout Europe to determine accessibility and dispersion of pharmacies (Mossialos et al 2004; Hwang 2014; Sveriges Apoteksförening 2013). The main independent variable used in the analysis is population density (per km^2) in each community. Its maximum value is 3 651 residents/km^2 (in Malmö, Skåne), and its minimum value is 184 residents/km^2 (in Lima, Dalarna). Coincidentally, you might remember Lima from

the previous chapter, since it was one of the very few communities where a pharmacy had closed down during 2013, now leaving the community without any pharmacy at all.

Table 1: Characteristics of the included variables.

	Min	Max	Mean	Median
Population density	184	3 651	1 161	1 027
Population size	192	1 372 565	14 246	4 054
Pharmacies per community	0	83	2.14	1
Population to pharmacy ratio	192	37 852	4 469	3 668

Table 2: Pharmacies in Sweden between 2009 and 2013, with the number of plant births and close-downs.

Year	n pharmacies	n opened	n closed	+/-
2009	918			
2010	1106	189	1	+188
2011	1238	135	3	+132
2012	1267	53	25	+28
2013	1300	43	10	+33
Total		420	39	+381

4.2 Statistical analysis

4.2.1 The Ideal Method to Establish Effects of Policy Changes

When turning to the statistics, it would of course be desirable to perform a controlled, randomized experiment when testing the causal effects of an intervention. However, this is not possible so we will have to do the best of the data we have. When analysing the possible change in geographical distribution of pharmacies across Sweden due to altered market conditions after 2009, I will resort to a panel data analysis. When using panel data one uses a dependent variable which is measured repeatedly within different clusters (such as states or communities), usually over time, so that temporal within-cluster variations can be studied. For example, in the typical panel data model we test outcomes at cluster level in state *s* in year *t*, of a policy that applies to all states in the group (Donald

& Lang 2007:221). The basic intuition of this approach is to study the impact of some 'treatment', one compares the average within-cluster difference in level of the dependent variable pre- and post-treatment (Slaughter 2001:209). It is a good strategy to conclude if a certain intervention has had any significant impact on the outcome of interest, under the assumption that nothing else happened at the same time that can explain the observed changes. In its simplest form, a pre-post panel data model can be expressed as:

$$Y_{st} = \alpha_s + \beta_1 post_t + e_{st} \qquad (1)$$

where Y_{st} is the dependent variable (in this case the population to pharmacy ratio) in community *s* at time *t*; α_s is a set of community-specific intercepts (called fixed effects); post is a dummy variable that switches from 0 to 1 in the time period when the intervention is in place, and e_{st} is the error term. In this case, the parameter of interest gives the average within-community difference in pre-post means of *Y*.

However, a way to increase the internal validity of such an estimate is to compare two different groups of observations, one control group that is not affected by the intervention and one treatment group. By using this method, one can compare within-cluster pre-post differences between two different groups and estimate the effect of the policy change in a so called differences-in-differences (DD) model. Unfortunately, there is no such control group in this data, which is why I will have to deviate from a regular DD model. The method is however briefly described here, in order to be compared with my actual, empirical model later. In DD analysis, one first computes the difference in the mean of the outcome variable pre-post for each group, the difference *within* groups; this is the "first difference". Then the "second difference", which is the difference between the differences calculated for the two groups in the first stage. This second difference measures how the change in outcome differs *between* groups, interpreted as the causal effect of the causing variable (Schlotter et al 2010:20). DD is a 'state-of-the-art' evaluation method from the econometric field that can produce causal evidence suitable for guiding policy in all areas by estimating these two differences (Schlotter et al 2010:28). The differences-in-differences (DD) model is expressed as:

$$\begin{aligned} Y_{st} = \alpha + \beta_1 TREAT_s + \beta_2 POST_t \\ + \delta_1 [TREAT \times POST]_{st} + e_{st} \end{aligned} \qquad (2)$$

where the parameter α is the intercept (which in this model becomes the pre-intervention mean of *Y* in the control group); *TREAT* is a dummy variable used to indicate treatment and control status; *POST* is a dummy coded as 0 in the pre-intervention period (2009) and 1 in the post-intervention period (2010-2013); β_1 is the pre-intervention mean of *Y* in the treatment group; β_2 is the difference in pre-post means in the control group, and δ_1, the parameter associated with the interaction term *TREAT* × *POST*, is the difference in pre-post differences between the treatment and control group (that is, the DD estimate). Under a strong

common trends assumption, i.e. that *Y* would follow parallel paths in both groups in the absence of the policy change, we can use the pre-post path in the control group to estimate a counterfactual post-intervention value for the treatment group as if the intervention never occurred. Note that this indicates that the treatment and control group do not have to be comparable on the levels of Y, only on their regression slope over time (Angrist & Pischke 2014:187ff).

4.2.2 The Method Used

However, when looking through my data I realised that a regular DD model might not be viable for my case since I do not really have an unaffected control group; all pharmacies in Sweden, regardless of location, owner etc, were affected by the policy change to some degree. Furthermore, I wish to test whether the effect of the re-regulation is conditional on population density. Because of this, I instead opted to estimate a DD model with a continuous treatment variable, which in this case measures the effect of what we can call "treatment intensity". The hypothesis is that the more people in one community, the denser the market, so that the within-community pre-post difference should be larger with higher treatment intensity.

The main assumption made in regular DD models (Equation (2)) and which is key for the validity of the results, is that the *trends* would be the same in both groups in the absence of treatment, and that belonging to the treatment group induces a deviation from the common trend (Angrist & Pischke 2009:230). It is called the common trends assumption and presumes that if the policy change hadn't occurred, the groups would follow the same trends. The assumption accounts for pre-treatment differences, since the groups do not need to have the same levels of *Y*, only same trends (Angrist & Pischke 2014:184f).

In this study, all communities are "treated" by the policy change (since all pharmacies are re-regulated). However, as noted in the theory chapter, a less regulated market would be likely to result in a larger treatment effect in denser communities. The treatment effect will therefore instead be estimated as a linear function of treatment intensity, in this case defined as population density (Angrist & Pischke 2009:241). The assumptions of the analysis thus changes somewhat. By using a continuous treatment variable (instead of a binary treatment dummy), I must assume that a community with density *d* would have followed a path equal to that of a community with density *d*-1 in absence of the policy change. The new equation follows:

$$Y_{st} = \alpha + \beta_1 d_s + \beta_2 POST_t + \delta_1 [d \times POST]_{st} + e_{st} \qquad (3)$$

where *Y* is still the population to pharmacy ratio in community *s* at time *t*; α instead becomes the estimated value of *Y* at *d* = 0 and *t* = 0; *d* is the population density in community *s*, and *POST* is still a pre-post dummy variable. In this

model, β_1 becomes the marginal effect of d on Y in the pre-intervention period; β_2 becomes an estimate of the difference in pre-post mean of Y at $d = 0$, and δ_1, still the parameter of interest, becomes the difference in pre-post means of Y between a community with density d and a community with density d-1 (i.e. the marginal effect of density on the difference in within-community pre-post means). The resulting estimate thus gives an estimate of the linear effect of treatment intensity (i.e. population density) on the within-community difference in pre-post level of the population to pharmacy ratio.

4.2.3 Reliability

A common problem we must worry about in panel data is the issue of time-dependent errors, which might violate the standard assumption of regression analysis that all observations are independent. This is a regular issue in time series analysis, where repeated measurements of a single unit (or cluster) will be somewhat correlated since they are subject to the same environment, market policy, prices etc. To avoid this so called autocorrelation problem, I have clustered the standard errors at the community level to account for the within-cluster dependence (Angrist & Pischke 2009:293f). According to Donald & Lang (2007:221), it is important to have a large enough number of clusters, since we need many communities to estimate the within-community correlation reasonably well. Bias from few clusters, that is to underestimate the correlation, is at risk when having clusters below the somewhat randomly chosen minimum number of 42 (Angrist & Pischke 2009:317ff), which is well exceeded here. For reliable inference, a number of 480 cluster groups are well enough for using the standard cluster adjustment (Bertrand et al 2002:3). Further, serial correlation will only affect the standard errors and p-value, and hence is only problematic if the p-value is close to being non-significant (Bertrand et al 2002:5f). However, as seen below, all of my p-values are significant at the 0.001 level, indicating that if any inferences are made even in the presence of autocorrelation, they should still be valid at a chosen alpha level of .05. All analyses were performed in Stata (version 12).

5 Results

In this Chapter I will perform the analysis from above on the panel dataset to try to answer my research question of how accessibility to pharmacies has altered for the Swedish population since 2009, and present my results from the study with tables and figures.

First, I begin by estimating the regression in Equation (1), that is, a simple pre-post comparison of the mean population to pharmacy ratio in the entire sample.

Table 3. The change in pharmacy to population ratio since the re-regulation of the market from 2009 to 2013.

Variable	Model I	Model II
Constant	5161.61***	-1002.40**
	(201.75)	(363.55)
Density		5.297***
		(0.37)
Post	-865.39***	1163.12***
	(94.99)	(217.56)
Density*Post		-1.743***
		(0.23)
R^2	0.01	0.42
n clusters	480	480
n observations	2380	2380

Notes: *The asterisk tells us about the significance of the test, *: p<0.10, **: p<0.05, ***: p<0.01. Standard errors (presented within parentheses) are clustered by community.*

As seen in Table 3, the resulting estimate shows a statistically significant reduction of 865.39 in the average population to pharmacy ratio at the community level after the re-regulation, shifting from a pre-intervention mean of 5 161.61 to 4 296.22[1]. This indicates that in the entire sample, substantially less people have to share the same pharmacy after the re-regulation. Figure 1 shows the changes in population to pharmacy ratio, year by year over the entire study period (2009-2013). The graph clearly shows a greater reduction in the first two intervention years, which then starts to level off in the later years. In 2010 and 2011, the ratio dropped by 9.46% and 9.14% compared to the previous year, respectively. The changes in 2012 and 2013 were much smaller; with a reduction of only 2.25% and 0.85%.

[1] Note that this is calculated based on the population size in the sample, not to be confused with the national mean mentioned in previous chapters.

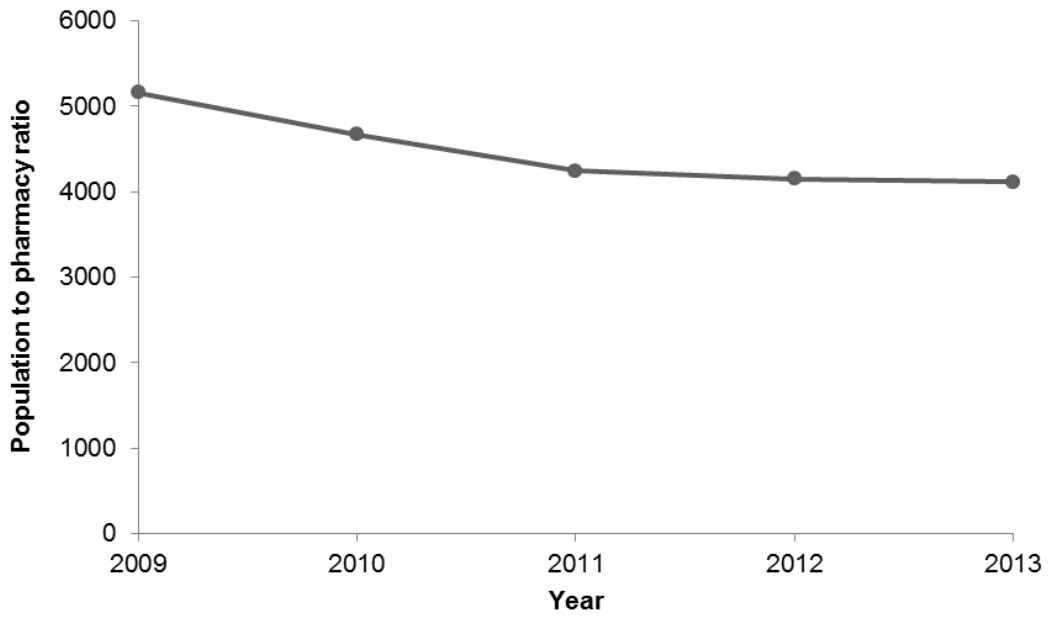

Figure 1. Average population to pharmacy ratio in a sample (n=480) of Swedish communities from 2009 to 2013. The re-regulation of the pharmacy market occurred in 2010.

This analysis however, does not account for the fact that this pre-post mean might be conditional on aggregated market demand (measured here as population density). To test how much one unit increase in population density (per km^2) influences the magnitude of the within-community pre-post difference in the population to pharmacy ratio, I now turn to Equation (3). From Table 3, we can see that the marginal effect of density on the above is -1.743, which is statistically significant. The marginal effect of population density on population to pharmacy ratio was 5.297 before the re-regulation, and after the decrease induced by the market change, it was 3.554. Figure 2 shows the results of this analysis graphically plotted against the observed pre-post values in each community. This suggests that the higher the population density, the larger the effect of the re-regulation on the said ratio. According to the estimate from Equation (3), for every additional 100 inhabitants per km^2 in a community, the restructuring of the market has decreased the number of inhabitants sharing a pharmacy by 174.

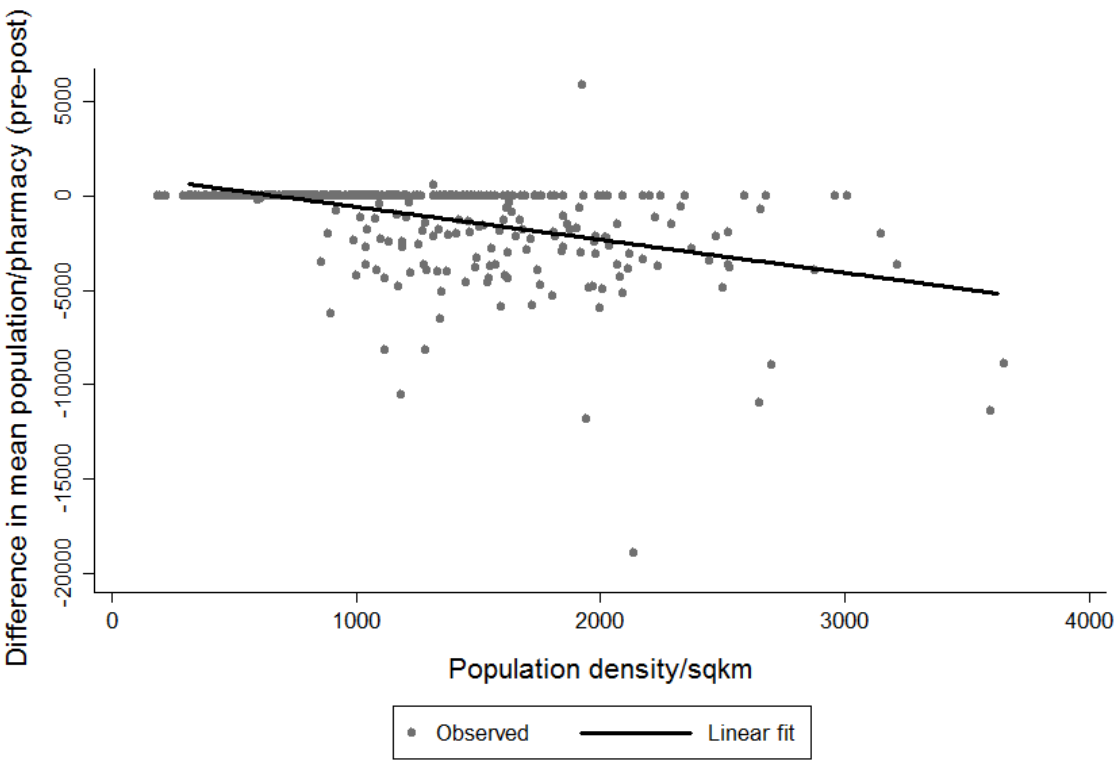

Figure 2. Difference in mean population to pharmacy ratio pre and post the re-regulation of the Swedish pharmacy market in 2010 by population density.

Figure 3 shows the marginal effect of density over time. The largest drop occurred in the very first post-intervention year where the marginal effect decreased by 22.42% compared to the previous year. From 2010 to 2011, the decrease was the more modest 14.73%, and then for the following years only 3.98% and 3.78%, respectively. Hence, more than half of the decrease occurred in the first year after the re-regulation if we look at the marginal effect of density on our ratio.

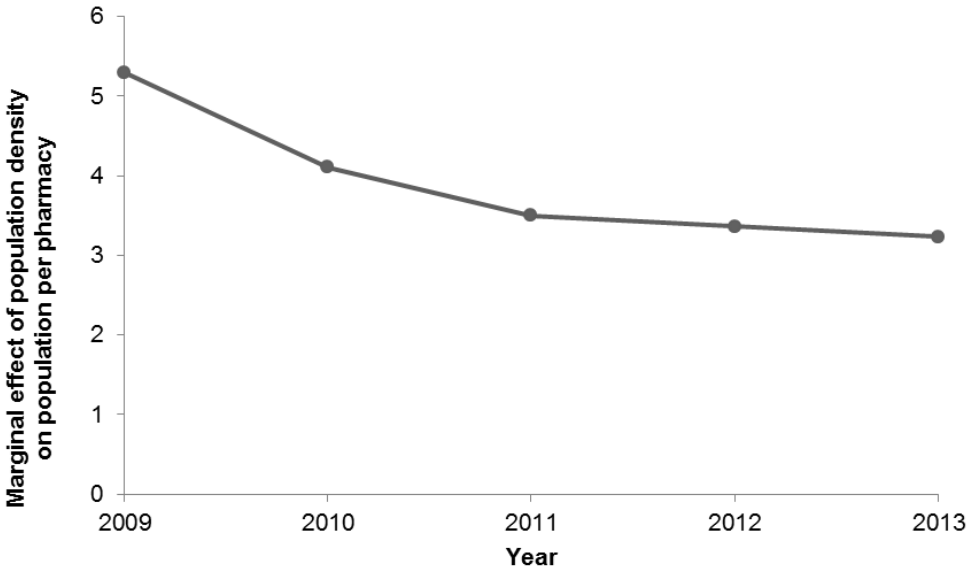

Figure 3. Marginal effect of population density per km^2 on population per pharmacy over time in a sample of Swedish communities (n=480). The re-regulation occurred in 2010.

6 Discussion

From the results presented above we can conclude that the answer to my research question of how accessibility has altered for the whole population since 2009 is that it seems to have increased accessibility more in densely populated areas, such as urban regions where market demand is higher. Maybe this is not an astonishing revelation, but it may still be interesting to provide empirical evidence that a less regulated market allocates where demand is high, but also where competition is high. The key idea is based on case evidence that local competition encourages innovation by forcing firms to innovate or fail, and that the presence of smaller establishments implies a more competitive environment and that competition is good for growth (Rosenthal & Strange 2004:2141ff). Some economic literature even indicates that spatial agglomeration itself is favorable for growth, which can have strong implications for economic policy as it entails a kind of efficiency-equity trade-off, whereby policy makers may be forced to choose between supporting lagging regions or promoting national growth (Brulhart & Sbergami 2008:2f). How this issue will be dealt with in the future is still uncertain, but from my results I would say that there is a need for more regulation to support vulnerable and remote pharmacies in ”lagging regions” if we are to provide a nationwide pharmaceutical coverage.

One reason that the increase has been so much larger in densely populated areas might also be that the state underestimated the market demand under the monopoly. It might not be that demand has increased so much since the re-regulation, rather it is quite possible that it was just as high before but that the market itself could not sufficiently meet the entire demand. When there is a shortage in supply, naturally lots of new pharmacies will open up to meet the extra, previously neglected, demand. In Table 1, we can see that the increase in number of pharmacies was very high the first year, but immediately afterwards the effect went down. A state monopoly is instituted to ensure equity, and maybe the distribution of pharmacies pre re-regulation was based more on geographical equity than market demand and population size equity. It is of course also possible that we cannot yet see the full effect of the policy change. The large boost in number of pharmacies might be because of all the extra attention the re-regulation has drawn to the pharmacy market, giving the producers excellent possibilities to expand their supply of goods and selling points. On that matter though, it should further be noted that the new pharmacies are in many cases not enjoying a very strong economic growth and it has been hard to establish a general profitability in the industry (Sveriges Apoteksförening 2013:16). This could of course be one reason for why pharmacy wholesalers and like do not risk opening selling points in more rural areas at all.

Further, how much service there is in a place does of course not say anything about its quality, but that is something not touched upon in this study. But what perhaps should be considered, is the possibility that people do not wish to use the service point (pharmacy) closest to their homes. For commuters for example, it might be easier to use a service point next to their workplace, or at a larger mall along their daily route than to use the closest one. When service is made more easily accessible it is also easier for citizens to choose how they wish to use it. Individual needs based on movements, medical conditions, disabilities and other preferences determine where and how people use a certain service (Jordbruksverket 2013:20). If you for example live in the countryside but do not have a car, it can be easier to use public transport to a larger town nearby, than to get to the more local service point. In addition, the product supply can often times be much narrower in a smaller, local plant, with the risk of losing customers to larger service points. One should therefore not see geographical dispersion as the main goal in itself, but however make sure concentration does not go too far.

When it comes to questioning the actual results of the study, there might be some objections to clear up. One main issue is of course the fact that I did not have access to enough pre-data to be able to establish a pre-intervention trend. This forced me to assume a common trends assumption without being able to test for common trends in the pre-intervention period using my own data. However, I instead used previous research to provide support for its justification. In that research one can see that from 2003 and up until the point of re-regulation, the percentage change in number of pharmacies has been very close to zero, and more interestingly, the development has followed the same, common trend in both rural and urban areas. We can thereby conclude that it clearly is a reasonable assumption even in this case (Angrist & Pischke 2014:184f; Jordbruksverket 2013:16). As long as we assume this assumption to hold, the internal validity of the study must be considered high. Internal validity addresses whether or not an observed covariation should be considered a causal relationship or not, namely if *a* leads to *b*, and frankly it is quite unbelievable that something else happened at the same time that could explain all or some of the effect shown (Calder et al 1982).

Moving on to external validity and the question of to what extent it is possible to generalize the results to and across other settings, countries or times. The relevance of external validity is highly debated in research literature, with some saying that generalizability is all that matters, and some saying the opposite, that it depends on the interest of the researcher. If the goal is of theoretical or empirical nature with no intention of generalizing, the external validity is of little concern, and is even in many cases sacrificed for the greater statistical power. One does not require external validity for any single research study, but rather as the progress of adding experience from one study to another to prove or disprove earlier theories (Calder et al 1982; Shadish 2002). With that said, I must admit that the external validity here is not excellent. It would be hard to generalize these results to other countries since the results are of course conditional on the way the re-regulation was performed in this case, i.e. protecting important, vulnerable pharmacies from the beginning. Without this clausal for example, the results

would most likely be different, which is why they cannot be generalized to any greater extent. It could thus be particularly difficult to compare with other countries. Furthermore, countries like the Netherlands and Germany have completely different conditions for the distribution of services with regards to spatial distance, so an uneven distribution of pharmacies in sparsely populated areas might not have the same implications for accessibility as in Sweden where travel distances can be relatively large in rural areas. Meanwhile countries like Norway and maybe Canada present better opportunities for generalization since they have similar conditions in terms of geography, containing small settlements in isolated places, with a potential need for subsidies for remote, rural pharmacies to secure access to medicine (Mossialos et al 2003:32ff, 63f). However, there might not really be much use in generalizing to other countries in any case, since there is barely any pharmacy monopolies left today. What we can say though, is that the results seem to be in line with previous studies in other countries, which might imply that it could be a general trend in more than one case (Anell 2005). To consider the long-term effects and the generalizability over time is also mainly speculative. The largest part of the post period (three out of four years) contains a restriction against closing down important and vulnerable pharmacies, which will of course have a large effect on the number of closed down selling points. The potential risk is of course that the shown effect will increase over time, to the point where we either need legislation for the protection of rural pharmacies, or will have no pharmacies in remote areas at all. However, it should be noted that after the restriction on closing pharmacies expired, the state has as of 2014 made it possible to seek financial support for rural pharmacies for the purpose of avoiding ‘pharmacy deaths’ (Tandvårds- och Läkemedelsförmånsverket 2014:6f).

Moving on, since I used a quota as the dependent variable, it was regretfully impossible to include observations for a particular year and community in which there are no pharmacies (since you cannot divide population size by zero). This is unfortunate, but is often the case when studying plant births (Rosenthal & Strange 2004:2131). Furthermore, the number of observations in which this was an issue was few (20 observations in 10 different communities), so their inclusion would probably not have had a major impact on the results either way.

To correct for some of these limitations inherent to my study, I suggest that further studies on the re-regulation should be conducted with updated data in the coming years, when more long-term effects can be estimated. To see what effect the re-regulation really has had on the geographical distribution of pharmacies for the population, one would probably also need more pre-data to study the effect over a longer period of time, both before and after. Furthermore, it would also be interesting to see a study over the differences in profitability between pharmacies, and how this varies over different types of areas and populations.

7 Conclusions

The accessibility to pharmacies appears to have improved since the re-regulation of the pharmacy market in Sweden in terms of population to pharmacy numbers. However, my hypothesis that these improvements are unevenly distributed seems correct; accessibility has increased much more in densely populated areas than in sparsely populated areas, which is in line with previous evidence from other countries. Nevertheless, since accessibility has increased more in urban areas, more people has benefitted than been disadvantaged from the re-regulation, so the aggregated accessibility effect must be deemed positive from a societal perspective.

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