IMPORTANCE OF SPATIAL PROXIMITY IN THE PHARMACY RETAIL MARKET

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Abstract

The paper analyses the effects of competition on the retail pharmacy industry. Using aggregated firm-level data for the Slovak pharmacy market, our results suggest very elastic demand regarding doctors' and pharmacies' distance. These results are in line with other findings that competition prevailed in the form of spatial proximity to doctors after industry deregulation. If a pharmacy aims to maximise the market share on prescriptions, the proximity to a doctor is crucial since almost half of all prescriptions are taken in the closest pharmacy from the prescribing doctor. In terms of policy recommendation, this dependency can be used to preserve the wide accessibility of deregulated pharmacy retail industry through regulation of doctor's entry.

Keywords

Pharmacy Retail Market, Doctors, Healthcare Competition, Distance, Spatial Proximity

I. Introduction

In the common EU market, the regulatory framework of the pharmacy retail market remains heterogeneous. The most intense regulation is often based on demographic or geographic criteria. Examples of this type are pharmacy retail industries in Austria, Spain, and Italy.

On the other hand, some countries focus instead on a definition of pharmacy ownership and the role of pharmacists within the industry (Germany), while others prevent multiple ownership and chain formation in general (Finland, Norway). Countries like Czechia, Netherlands, Sweden, or the UK are known for the liberalised pharmacy retail industry, except for price and margins regulation of prescription drugs.

Another example of a mostly deregulated industry is the Slovak pharmacy retail market which went through a series of regulations and liberalisations during the last 30 years. Currently, the industry is focused on price and reimbursement regulation for prescription drugs and the pharmacist's role. The chain formation is *de facto* allowed even though only pharmacists can own a pharmacy. Most importantly, since 2002, entry in terms of demographic or geographic criteria is free, and pharmacies are not limited by licensing process anymore.

These periods of deregulation defined the market structure of the industry. The average entry of new pharmacies was just 26 per year until the year 2003. After the revocation of regulation, entry increased to 112 per year with as many as 206 new pharmacies in 2005. This immense growth of outlets and change of market structure intensified the industry competition.

Moreover, a significant part of pharmacy turnover has been based on regulated margins during the whole period. According to the National Health Information Centre, approximately 70 % of

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pharmacy's revenues in 2017 were based on prescription drugs, and this share is relatively stable over time.

The main questions are where the competition has prevailed after the deregulation periods and how the pharmacies compete after such an immense market structure change. Specifically, the paper aims to examine the role of distance in the pharmacy retail market and the importance of spatial proximity to doctors. For this purpose, we use a unique dataset of individual prescriptions in the Slovak Republic for four months of the year 2017. In general, we estimate the demand for pharmacy prescriptions with respect to doctor-to-pharmacy distance and calculate elasticities accordingly.

Our results suggest a highly elastic market with respect to distance, which contributes to the expectation of intense competition for location between pharmacies. A percentual change in average distance from a doctor's location is associated with a ten percentual decrease in the pharmacy's market share.

Therefore, if the pharmacy's strategy is to compete for prescriptions, doctors' proximity plays a crucial role. This result is evident from the fact that 43 % of all prescriptions were taken in the closest pharmacy from prescribing doctors. Our results suggest that the deregulation of entry restrictions led to the competition bottleneck in the form of a location.

Our paper contributes to the ongoing discussion of the effects of competition in the deregulated healthcare market with limited price competition. We provide new evidence of where the competition after the liberalisation prevails and precisely what role plays a distance in the pharmacy retail industry.

II. Literature review

There is a vast body of literature concerning the effect of deregulation on the pharmacy retail market. Vogler et al., (2014) provide an excellent summary of regulation and liberalisation benefits in the pharmacy retail market. In general, competition could increase accessibility through the entry and help to sustain low national pharmaceutical bills. On the other hand, it could harm the quality of provided services, potentially raise the market power of some players, and reduce accessibility in remote areas.

By comparing deregulated UK and regulated Spain pharmacy retail industry, Lluch and Kanavos Panos (2010) highlight the benefits of both competition and regulation in terms of accessibility, price competition, and efficiency. These results point out an intense trade-off between the two policies. On the other hand, Gorecki (2011) found only limited evidence of raised service quality after introducing entry restrictions in terms of quality. The regulation increased the ratio of pharmacists to pharmacies, the size of the pharmacies and the possible exploitation of scale economies. In terms of a potential decrease in quality, Rudholm (2008) stated that after the liberalisation of the Norwegian market, the costs of individual pharmacies have not decreased. Contrary to the previous paper, however, the Norwegian deregulation did increase accessibility for patients.

In the empirical investigation of the Slovak transformation process for the healthcare sector, Lábaj et al. (2018) found a sharp decline in pharmacies' profitability after entry deregulation. This casts doubts about local monopolies' benefits in the pharmacy retail market as they enjoy sufficient market power if entry remains regulated. These results are in line with findings in Barbarisi et al. (2019). According to the authors, the market liberalisation in Spain was mainly at the expanse of incumbents. Due to a significant business-stealing effect, incumbents were often unable to keep an adequate market niche after changing the market structure. However, the general accessibility of services increased only by limited scope when entrants preferred to locate in highly populated areas. The business-stealing effect can help to interpret the insignificant difference in turnover between urban and rural areas after the deregulation in Germany. Heinsohn and Flessa (2013) did not find a correlation between population size and turnover. On the other hand, the rise of market power through horizontal and vertical mergers was pointed out as the main shortcoming of deregulation in Norway and Iceland (Anell, 2005).

The deregulation process in many countries created an opportunity for new entrepreneurship activities of pharmacies. According to Martins and Queirós (2019), Portuguese pharmacies in more competitive markets offered a larger variety of services, e.g. vaccination or more sophisticated pharmaceutical care programmes. Similar results can be found in studies investigating the effects of liberalisation in the OTC drug market. New entrants typically represent other retail shops accustomed to the competition, which should, according to this policy, bring competition into the traditionally regulated pharmacy industry (Moura and Queirós, 2015). After such deregulation, Castaldo et al. (2015) highlight the pharmacist's position, who plays a crucial role in the customer's loyalty-building path for community pharmacies. With the change in market structure and new entrants of a different type, the role of pharmacies and pharmacists is challenged and discussed (Garattini et al., 2021).

Moreover, these new activities are often partially substituting services offered by doctors. Therefore, some competition, primarily in liberalised markets, can be expected between doctors and pharmacies too. Berenbrok et al. (2020) found that Medicare beneficiaries visited pharmacies approximately twice as frequently as they visited the primary care physician. Although the authors concluded that most of them visited pharmacies for products-based services, he suggests that pharmacists could potentially substitute some of the physician's work.

However, more traditionally, we expect a rather beneficial collaboration between doctors and pharmacists. Using English data, House of the Commons Health (2003) found that 47% of patients go to the pharmacy immediately after their physician's visit. Schaumans and Verboven (2008), using the entry model, found that the population needed by a pharmacy to survive on the market decreases with the number of physicians on the market.

This is in line with findings in a survey conducted by Van et al. (2007). Authors found that most general practitioners (GP) believed that cooperation with pharmacies was beneficial for GPs and patients. Similar interviews conducted by Bradley et al. (2012) stipulated that GP-pharmacist cooperation is mutually beneficial, and the key drivers of collaboration are proximity, location, historical relation and trust, perceived roles, and professional respect.

In general, the pharmacy retail industry's liberalisation leads to a significant change in market structure due to the entry of new outlets. According to the aforementioned papers, the entrants increase the accessibility of services, at least in urban areas. Therefore, in the case of price regulation and strong beneficial effects from the doctor's presence, the deregulation can lead to competition for a good location spot. Chen (2019) analysed the effect of spatial pharmacy competition. By examining the distance variables between pharmacies and the customers' distance and travelling time, the author concluded that pharmacies within the United States asked for lower prescription drug prices than the pharmacies with a longer distance to their competitors. However, he did not analyse the proximity of other healthcare professions, such as GPs or specialists. Concerning the distance between doctors and pharmacists, Rubio-Valera et al. (2012) concluded that collaboration is more likely in areas with a low density of healthcare-providing actors. The larger the city, the less likely the collaboration will occur. Moreover, Borrell and Fernández-Villadangos (2012) found that the inflow of new pharmacists led to the expected increase of pharmacists on the market. However, results suggested that only the first and second pharmacies in the areas with a health centre were established in the proximity of the health centre.

According to the literature, the liberalisation process can lead to different outcomes and changes. Among others, accessibility, quality, costs, new services, and doctor-pharmacy relationships are the main variables influenced by deregulation. Our paper contributes to the discussion on the effects of competition in the previously regulated pharmacy retail market. We predominantly focus on the role of distance in the doctor-pharmacy relationship and fulfil the empirical literature gap within the topic.

III. Industry background

The section provides more information on the different regulations and liberalisation processes of the Slovak pharmacy retail market. Furthermore, we describe national-level data used to understand the effects of competition in the pharmacy retail market.

From 1993 Slovakia changed the legislation extensively twice. In 1998, parliament passed Act 140/1998, which regulated the conditions for providing pharmaceutical care. Based on this law, only individuals with a pharmaceutical degree could apply for permission to provide pharmaceutical services. Legal entities were not allowed to establish a pharmacy, and those already existed before 1998, had to appoint a professional representative. Legal exclusion of the legal entities was lifted by the novelisation of Act 140/1998, which allowed these entities to enter the market from December 2004 onwards.

The Act also determined geographic and demographic rules, stating that it is unethical to open a pharmacy within a 500 metres radius of another pharmacy. Also, the pharmacy should not be situated in an area with less than 5000 people. However, the restriction was not the first regulation of this type in the Slovak pharmacy retail industry. According to Kolář (2020), we summarise all entry restrictions in the following table.

Table 1: overview of the regulations in the Slovak pharmacy market

Date of entry into force	Geographic criteria (minimal distance between pharmacies)	Demographic criteria (Number of patients per pharmacy)
1992	No restriction	No restriction
1994	50m	3000
1996	300m	3000
1998	No restriction	No restriction
2000	500m	5000
2001	No restriction	No restriction
2001	500m	5000
Since 2002	No restriction	No restriction

As is evident, the entry regulation was constantly changing during the process of transformation. These frequent changes continued until 2002 when the Slovak Competition Authority revoked the Slovak Chamber of Pharmacists' competence to issue licenses based on entry restrictions (Antimonopoly Office of the Slovak Republic, 2002).

Further deregulation came in 2011 as an Act 362/2011. According to the Act, both individuals and legal entities could own a pharmacy and receive permission. Moreover, the Act did not restrict the number of pharmacies, which created a space for chain formation. The regulation was later reversed in 2013, and the novelisation allowed to open of only one pharmacy and one branch of that pharmacy. Moreover, if the applicant of the permission does not fulfil the professional competence set by law, he must appoint a professional representative with a University degree in pharmacy and five years of professional practice. If an individual owns the pharmacy, his obligations are guaranteed by his whole property. For more details on the Slovak pharmacy retail market and its legislation's development, see Smatana et al. (2016) and Szalayová (2014).

III. Econometric specification

Our estimation strategy is based on cross-section data for the national pharmacy retail market. We estimate the effects of the predictors on the firm-level market share for two specifications *i.* model without and *ii.* with market fixed effects (FE). We write the general model as:

$$y_{i,j} = \boldsymbol{x'_{i,j}}\,\beta + u_j + \varepsilon_{i,j} \quad (1)$$

where $y_{i,j}$ is the market share of *firm* i in the municipality (market) j calculated as a share on all prescriptions in the market. We consider only transactions between doctors and pharmacies located within the same municipality. Furthermore, $\boldsymbol{x'_{i,j}}$ is transformed vector of control variables. u_j is the market-specific fixed effect. and $\varepsilon_{i,j}$ is a normally distributed random error term. The vector $\boldsymbol{x'_{i,j}}$ includes:

- *The average distance from pharmacy* i *to all doctors* within the municipality j. The distance enters the model in logarithms as $(1 + average\ distance)$. The distances are calculated in a way "as the crow flies".
- *The average distance from pharmacy* i *to other pharmacies* within the market j. Again, in the logarithmic form $(1 + average\ distance)$.
- Control variable: *Median surcharge* (Eur) and *Median insurance co-payment* (Eur) in pharmacy i and market j. Structure of patients captured through average *Age* and share of *Men* varying across i and j. Binary information whether the pharmacy i located in market j is in a *Shopping* centre.

IV. Data and empirical results

Our dataset consists of all prescriptions prescribed for Slovak patients. Data are provided by the Ministry of the Health of the Slovak Republic between 1st April and 30th June 2017. Basic descriptive statistics of the dataset are presented in Table 1.

Table 1 Descriptive statistics for the national market

	Slovak healthcare sector 1st April – 30th June 2017
Individual patients in dataset (number)	2,860,897
Share of total population (percentage)	52 %
Number of prescriptions (observations)	15,364,553
Unique doctors in dataset (number)	30,591
Unique pharmacies in dataset (number)	1,956
Operated markets (number of municipalities)	594

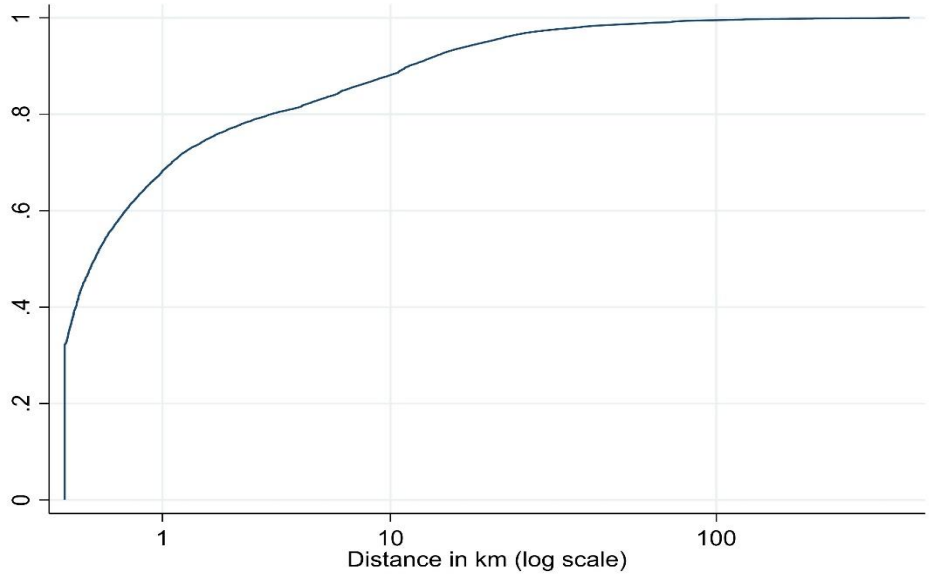
Source: Author's own calculation based on data provided by Ministry of Health of the Slovak Republic

To describe the distribution of the distance for all transactions between doctors and pharmacies, we plot the cumulative distribution function in **Chyba! Nenalezen zdroj odkazů.**. Note the *log* scale of t he horizontal axis. The average distance[1] for a transaction is approximately 4.13 km; however median distance is only 0.23 km. Observe the steepness of the cumulative distribution function. More than 70 % of all prescriptions are taken in a pharmacy within 1 km from the prescribing doctor. Generally,

[1] If not said otherwise, we measure the length as the shortest path between two points along the surface of a mathematical model of the earth i.e. "as the crow flies".

78 % of all prescriptions are taken in a pharmacy located in the same city where a drug was prescribed[1].

Figure 1 Cumulative distribution of distance



Source: Author's own calculation based on data provided by the Ministry of Health of the Slovak Republic
Note: distance in logarithmic scale on the horizontal axis

Chyba! Nenalezen zdroj odkazů. does not include information about the number of pharmacies. W e would see the same distribution function in the case of many pharmacies similarly close to a prescribing doctor or a single pharmacy in a monopolistic position. Therefore, Table 2 shows the average distance for the ten closest pharmacies from the prescribing doctor. Even though we present only ten pharmacies, the truncated dataset represents approximately 75 % of the national pharmacy retail market for prescribed drugs. More than 43 % of all prescriptions are taken in the closest pharmacy, which is, on average, just 0.14 km from a prescribing doctor. The difference between the two closest pharmacies is, on average, only 0.4 km, but the cost in terms of lost prescriptions is 75 %. The share of pharmacies located relatively further from a doctor falls rapidly.

Table 2 Choice of pharmacies by distance

Pharmacy order from doctor	Frequency	Cum. Freq.	Average distance (km)
1	43.13	43.13	0.14
2	10.58	53.70	0.57
3	5.56	59.26	0.88
4	3.67	62.93	1.40
5	2.96	65.89	2.24
6	2.37	68.25	1.94
7	2.04	70.30	2.64
8	2.02	72.31	2.58
9	1.55	73.86	2.99
10	1.39	75.25	3.15

Source: Author's own calculation based on data provided by Ministry of Health of the Slovak Republic
Note: data shows only the ten closest pharmacies, which represent 75 % of the whole dataset.

In the first model, Model 1 (model without market FE), we obtained somewhat different coefficients than expected for our control variables. First, note contradicting effects of median prices. The *Median insurance co-payment* is significant but negative. Similarly, the significantly positive effect of the *Median surcharge* is also in the opposite direction than expected. Moreover, the average age of the patient plays only a limited role. Furthermore, we include information about whether

[1] This is the main reason why we define market as a municipality and we will not consider transactions between different municipalities.

the pharmacy is located in a shopping centre, which is negatively associated with the market share of prescriptions. Last, the geographic market power represented through the distance to other pharmacies is not associated with the market share change.

Using the model that includes market FE, we obtain expected (but not always significant) results for all control variables. Furthermore, by including market-specific fixed effects, the geographic market power measured as the *Average distance* from *pharmacy* to other pharmacies has an expected negative effect on market shares. A percentual increase in the average distance from other pharmacies is associated with a 6.2 percentual points market share increase.

Most importantly, the effect of *Average distance to doctors* is similar for both specifications. A percentual increase in the average distance is associated with an approximately ten percentual points decrease in market share. Observe the similarity with the case study of single municipality estimation.

Table 1 Market shares regression

Variable	Model 1	Model 2
Average distance pharm-doc (km in *log*)	-0.106***	-0.101***
Average distance pharm-pharm (km in *log*)	-0.011	0.062**
Median insurance co-payment (Eur)	-0.016***	0.000
Median surcharge (Eur)	0.036**	-0.007
Shopping (binary)	-0.038*	-0.006
Age (number)	0.005***	0.002***
Male	-0.164*	0.028
Constant	-0.038	-0.116*
Market fixed effects	No	Yes
Number of observations (pharmacies)	1546	1546
R^2	0.150	0.615
Adjusted R^2	0.146	0.559

Source: Author's own calculation based on data provided by Ministry of Healthcare of the Slovak Republic
Note: 379 monopoly markets were omitted due to lack of local competition.

V. Conclusion

The Slovak pharmacy retail market has experienced a series of regulation and liberalisation periods during the last 30 years. Compared to other national pharmacy retail systems, it can be described as deregulated, focusing on price and margin regulation. Therefore, the main question is where the competition prevailed in the deregulated market.

In our paper, we analysed the role of pharmacy locations in terms of their distance from doctors and other competitors. The data used consists of aggregated prescriptions for four months of the year 2017. Since approximately 78 % of all prescriptions were taken in the same municipality as prescribed and more than 70 % of these prescriptions were taken up to one kilometer from prescribing doctor, the pharmacy retail market can be considered local. We defined a market as a single municipality. Moreover, 43 % of all prescriptions were taken in the closest pharmacy from prescribing doctor, and this share falls rapidly with increasing pharmacy distance from a doctor. This, even more, highlights the importance of distance.

We used the cross-section fixed effects model with municipality-level market shares. The results suggest that location is an essential strategic variable in pharmacy retail competition. First, we found that a percentual increase in the average distance from the prescribing doctor is associated with an approximately ten percentual points decrease in the pharmacy's market share. Moreover,

the model with fixed effects better reflects possible differences in market structure, i.e. presence of different types and numbers of doctors with varying specialisations, different structures of patients in terms of diagnoses and more variety of drugs offered in pharmacies.

Our results suggest that the bottleneck of competition in the local pharmacy retail market can prevail in the form of a location. Since prescription drugs can represent 70 % of the pharmacy's revenue, the strategically valuable location is close to doctors, as the closest pharmacy takes almost half of all prescriptions. These findings are in line with simple Hotelling's model of firm localisation with regulated prices and homogeneous products.

Moreover, as a crucial question is the accessibility of pharmaceutical services after liberalisation, the importance of doctor's proximity suggests that it can be secured through regulation of doctor's entry. At the same time, consumers can continue to benefit from pharmacy retail competition.

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