

Entry and Competition of Healthcare Providers in Slovakia: A Spatial Analysis¹

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Abstract

We study the relationship between market size and the number of firms in several healthcare professions in Slovakia to provide new evidence about their entry decisions and the toughness of competition on the market. The local market size that would support the entry of the first general practitioner was estimated at 1,400 inhabitants. This threshold equaled 1,700 inhabitants for the first pharmacy to enter and 2,300 for pediatricians. The population would have to more than double for the second professional to enter. To support the second firm, the population per firm in the market would have to increase by 30% for pharmacies, 25% for general practitioners, and almost 40% for pediatricians. However, after the entry of the second firm, the intensity of competition did not change, except for pediatricians. The results were robust to spatial interactions. Our estimates of spatial interactions showed negative (but decreasing) spatial spillover effects for pharmacies, general practitioners, and dentists between 1995 and 2010. In this period, competitive effects prevailed and outweighed demand spillovers. We document that the demand effect continued to grow after 2010 and in 2017 outweighed the competition effect for pharmacies. We show that an increase in the total number of pharmacies since 2010 led to diffusion into smaller markets and that the number of markets without a pharmacy decreased.

Keywords: *entry models, healthcare market, industrial organization*

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Introduction

According to OECD study (OECD, 2019), the spatial distribution of healthcare providers in Slovakia is among the most pressing issues that should be addressed by its policymakers. Slovakia is among the countries with the highest differences in the density of doctors between urban and rural regions. In this paper, we provide new empirical evidence about their spatial distribution over time. We focus on entry decisions and toughness of competition with and without spatial interactions in several healthcare professions in Slovakia. Our research falls into the intersection between healthcare economics and industrial organization, an expanding subject of current research (Snyder and Tremblay, 2018).

Since 1970, OECD countries have experienced a significant increase in expenditures in the healthcare sector. Average health expenditures as a share of GDP in OECD countries rose from 4.6% in 1970 to 8.9% in 2017. The most rapid increase in the ratio was recorded by the U.S., from 6.2% to 17.2%. Significant GDP growth in the Slovak economy during the transition (real GDP more than doubled between 1995 and 2017) was linked to strong growth in healthcare expenditures. The ratio of healthcare expenditures to GDP increased from 5.7% in 1997 to 8.0% in 2009 (OECD, 2019).

Industrial organization provides powerful tools to examine the entry (and exit) decisions of firms (in this case, healthcare providers) and the determinants of their location decisions. By studying the entry behavior of firms and the relationship between market structure and market size for different regional markets, economists can gain insight into the determinants of firm profitability, the role of fixed and sunk costs, and the nature of competition. Investigating these issues in economies that went through a transition process is especially relevant as they implemented policy reforms that introduced competition in previously regulated and centrally planned sectors.

A new empirical framework for measuring the effects of entry on competition in concentrated markets was pioneered by Bresnahan and Reiss (1991). Using data on geographically isolated monopolies, duopolies, and oligopolies, the authors studied the relationship between the number of firms in a market, market size, and competition. This approach assumes that if the population per firm required to support a given number of firms in a market grows with the number of firms, then competition must be getting more intense. The competition shrinks profit margins and therefore a firm needs a larger market to generate the variable profit necessary to cover entry costs. Empirical results suggest that competitive conduct changes quickly as the number of incumbents' increases. Their approach was later extended in various ways.

Berry (1992) extended the literature on empirical models of entry decisions in oligopoly markets with a focus on the role played by the differences between firms. Later, Mazzeo (2002) proposed an empirical model to analyze product differentiation and oligopoly markets. The entry model was estimated using data from oligopoly motel markets along U.S. interstate highways. The results demonstrate a strong incentive for firms to differentiate.

Several studies have concluded that larger cities have attracted more physicians, but a subsequent increase in the total number of physicians led to diffusion into smaller cities (Newhouse et al., 1982a,b; Rosenthal et al., 2005; Brown, 1993). Newhouse et al. (1982a) claimed that the U.S. was training too many physicians and they were geographically maldistributed, with too few in rural areas. The authors found that the size of a town affected the probability of having a physician located there. Rosenthal et al. (2005) revisited the analysis provided by Newhouse et al. (1982a). They found that communities of all sizes gained physicians over this period, but that the impact was larger for smaller communities, as predicted by the theory.

The first empirical evidence on changes in entry barriers, the determinants of firm profitability, and the nature of competition for a transition economy was provided by Lábaj et al. (2018b) and Lábaj et al. (2018a). The authors estimated the thresholds required to support different numbers of firms for a large number of geographic markets in Slovakia. In both papers, three times (1995; 2001; 2010) were analyzed to characterize different stages in the transition process, taking spatial interaction between local markets into account.

Lábaj et al. (2018a) studied the relationship between market size and the number of firms in the healthcare industry. Market-size thresholds were estimated for three occupations: pharmacies, physicians, and dentists. The results suggested that the relationship between market size and the number of firms differed both across industries and across periods. Pharmacies, as the only wholly liberalized market in the data set, experienced the most substantial change in competitive behavior during the transition process. Furthermore, correlation in entry decisions across administrative borders suggested that further market analysis should aim to capture these regional effects.

In this paper, we study the relationship between market size and the number of firms in several healthcare professions in Slovakia. The paper builds on Lábaj et al. (2018a) and extends the literature in several dimensions. First, we extend the research of the Slovak healthcare market to other healthcare providers, such as pediatricians, ophthalmologists, cardiologists, and surgeons. We also provide new estimates for pharmacies, general practitioners, and dentists, which enables us to identify changing patterns in entry decisions and spatial interactions in

these markets. Second, we study the spatial interactions of healthcare providers following market deregulation. Due to the significant liberalization of pharmacies, Slovakia provides a good case study to explore these interactions over time. Several studies have concluded that healthcare providers have first concentrated in urban areas, but a subsequent increase in the total number of healthcare providers has led to the diffusion of professionals into smaller cities (Newhouse et al., 1982a,b; Rosenthal et al., 2005; Brown, 1993). Lábaj et al. (2018b) studied a relatively short period of time after the deregulation of pharmacies in Slovakia and found concentration into urban areas. In this paper, we study the development since 2010. We document that the subsequent increase in the total number of pharmacies led to diffusion into smaller markets and the number of markets without a pharmacy decreased by 68.

The paper is organized as follows. First, a brief review of the healthcare system and regulation in Slovakia is provided. Then, in Section 2, the methodology and data are explained. Empirical results are provided in Section 3. Section 3.1 provides descriptive results on market structure and the spatial distribution of healthcare providers in Slovakia. In Section 3.2, the results from entry models without and with spatial interactions are presented. The effects of deregulation in the retail pharmacy market on the entry decisions of community pharmacies are studied in Section 3.3. Conclusions and avenues for further research are provided at the end.

1. The Healthcare System and Regulation in Slovakia

Since 1993, the healthcare sector in Slovakia has experienced several reforms, mainly as a result of changes in government. We summarize the most important regulatory changes in Table 1. The regulatory overview, as well as the overview of the healthcare system in Slovakia in this section, is based on the health system reviews provided by Szalay et al. (2011), Smatana et al. (2016), and Lábaj et al. (2018b) and a healthcare spending review by Kišš et al. (2018).

The healthcare system in Slovakia is based on universal coverage, compulsory health insurance, a basic benefits package, and a competitive insurance model with selective contracting and flexible pricing. After fulfilling certain explicit criteria, there are no barriers to entry for healthcare providers or into health insurance markets. All health insurance companies (there were three in 2020 in Slovakia) must operate nationwide, although their market shares show significant regional variation. This results in regional differences between health insurance companies in negotiating positions vis-à-vis healthcare providers (Szalay et al., 2011).

Fundamental reforms to the healthcare system were introduced in 2004. The health reform was based on a set of structural and functional changes that were supposed to transform the centralized system into a decentralized system. The principal objective of the reform was to increase the independence and financial responsibility of healthcare providers. Since that year, flexible prices, contractual relations with selective contracting, and flexible basic benefits packages were decentralized to health insurance companies and a flexible healthcare network (with the definition of a minimum network) and drug policy measures accompanied by the liberalization of pharmacy ownership were implemented.

The reform aimed to make the process of entry into the healthcare provider market more transparent and to remove barriers to entry. After the 2006 elections, however, some of the pro-market reforms were discarded (selective contracting was restricted, health insurance companies were no longer allowed to make a profit, user fees were scaled down or wholly abolished), but the critical reform acts remained unchanged.

Table 1

Overview of Main Regulatory Changes in the Slovak Healthcare Sector

Year	Subject of regulation	Regulation
1990		Reintroduction of market principles and fragmentation of the system.
1995	Pharmacies and physicians	Most pharmacies and ambulatory physicians went into private practice.
1998	Pharmacies	The Slovak Chamber of Pharmacists approves the establishment of new pharmacies.
	Pharmacies	Entry of pharmacies was not explicitly restricted by population or location.
	Pharmacies	Only a pharmacist can provide pharmaceutical care, limited to one pharmacy and one subsidiary of the pharmacy.
2000	Pharmacies	Demographic and location restrictions for pharmacies.
2001	Doctors	Decline in the number of doctors due to hospital restructuring and migration abroad.
2004	Pharmacies	Reform aimed at transparent entry and a decrease in entry barriers.
	Pharmacies	Legal persons can also receive permission to own and run a pharmacy.
2006	Doctors	User fees were largely abolished.
2009	Pharmacies	Price referencing of medicines to the average of the three lowest prices in the EU.
2011	Pharmacies	No limit to the number of pharmacies that one person can own.
2013	Pharmacies	Liberal rules on pharmacy ownership were reversed. Only one natural/legal person can own only one pharmacy and one subsidiary.
2014	Doctors	Introduction of residential programme.

Source: Based on Smatana et al. (2016), Lábaj et al. (2018b), and Kišš et al. (2018).

1.1. General Ambulatory Care in Slovakia

One of the main goals of ambulatory care is to ensure prevention. Ambulatory care in Slovakia consists of general care and specialized care. General care includes general practitioners (GPs) for adults, pediatricians, gynecologists, and

dentists. In Slovakia, almost half of all visits to ambulatory care include visits to specialists. Kišš et al. (2018) concluded that the healthcare system in Slovakia could save resources by shifting a part of care from specialized to general care.

To be able to make this shift, however, there has to be a sufficient network of GPs in place. Szalay et al. (2011) stated that after 2001, Slovakia witnessed a continuous fall in the number of physicians and nurses in relation to the population. These changes are closely linked with the migration of doctors and nurses abroad and the restructuring of healthcare facilities. According to Kišš et al. (2018), the total number of doctors in Slovakia is currently slightly below the EU28 average and above the V3² average. However, the specialization structure of doctors is different – Slovakia has significantly fewer GPs than the EU average. The analysis also emphasized that these problems will grow in the future because over 40% of GPs are older than 60. On the other hand, the number of pediatricians is above the V3 average and relatively similar to the EU28 average. However, the age structure is almost the same as for GPs.

Almost all GPs and the vast majority of specialized physicians provide healthcare services in their private medical practices. The state owns the largest healthcare providers, including university hospitals, large regional hospitals, highly specialized institutions, and almost all psychiatric hospitals and sanatoria (Szalay et al., 2011). Hospitals with attached polyclinics have a significant market share in specialized ambulatory care. Given that patients (except for soldiers, police officers, prisoners, and migrants seeking asylum) are free to choose their health care providers for both general and specialized care, doctors can engage in non-price competition.

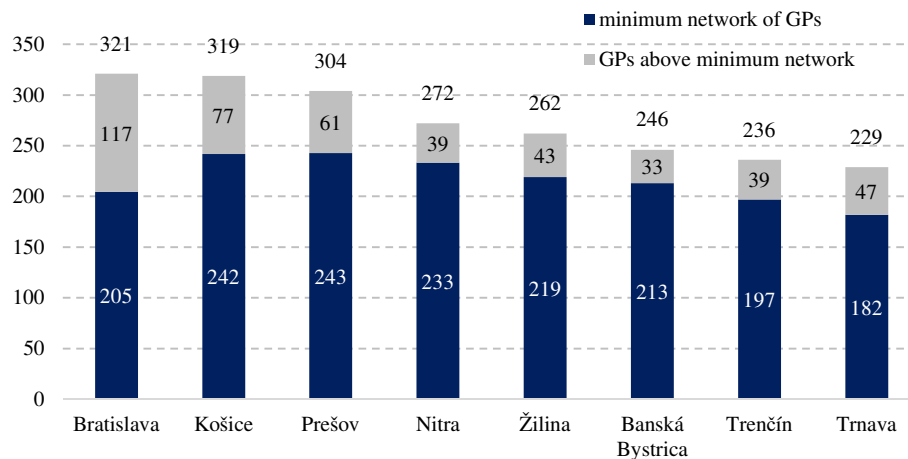
1.2. Minimum Network of Healthcare Providers

A minimum network of physicians was set to guarantee the accessibility of physicians for patients. This network is based on calculations of the minimum number of physicians for each of the eight self-governing regions. Minimum capacities are calculated per capita, but they currently do not consider the specific healthcare needs of the population, such as age, income structure, or inhabitants. Health insurance companies then have the option to contract more providers if they have enough resources (Smatana et al., 2016).

The minimum network is calculated using the share of insured inhabitants with a given insurance company in the total number of inhabitants in a given region. Figure 1 shows the minimum network of GPs in Slovak regions in 2017. Health insurance companies had to contract at least 1,733 GPs in 2018.

² Vysegrad countries (Czechia, Hungary, and Poland) without Slovakia.

Figure 1
Minimum Network of GPs in Slovakia, 2017



Source: Based on data from Government Resolution 59/2019 Z. z. and the RHP.

1.3. Pharmaceutical Market

Pharmacy services represent an inseparable part of healthcare. A nonfunctioning pharmaceutical market or lower accessibility of drugs could lead to worse health (Mandžák and Hronček, 2019). Pharmacies are traditionally among the strictly regulated sectors to ensure the quality and broad accessibility of medication. Typical regulation covers the establishment of new pharmacies, restrictions on ownership (e.g., only a pharmacist can own a pharmacy in some countries), or the required education level for pharmacists (Vogler et al., 2006).

The Slovak pharmaceutical sector has undergone several reforms in recent years. Until 1998, the entry of new pharmacies was not explicitly regulated by demographic or population criteria.

However, the Ministry of Health of the Slovak Republic had to approve the establishment of a new pharmacy. A new act from 1998 gave the Slovak Chamber of Pharmacists the explicit right to approve requests for the establishment of new pharmacies in Slovakia. Later, the Slovak Chamber of Pharmacists approved demographic and population criteria for the establishment of new pharmacies. The minimum distance between pharmacies was set to 500 m and the minimum population per pharmacy to 5,000 inhabitants.

One of the effects of market liberalization could be the concentration of firms in attractive areas (Lábaj, 2019). This development in the spatial location of pharmacies has been confirmed by several partial analyses of the developments after 2004, for example by Smatana et al. (2016).

Market liberalization led to a substantial increase in the number of new pharmacies. Together with the abolishment of distance and population criteria, non-pharmacists were granted the right to own a pharmacy but under the condition of guaranteeing a trained pharmacist at the premises. In 2005, Slovakia had 1,152 pharmacies (1 pharmacy per 4,678 people), but by 2014 there were 1,931 pharmacies (1 pharmacy per 2,805 people). The increase in the number of pharmacies contributed to reductions in regional disparities compared to 2005 (Smatana et al., 2016). On the other hand, after 2004, pharmacies have tended to enter mainly city markets, with higher densities. Despite the good accessibility of pharmacies on average, Lábaj (2019) stated that the question of stricter regulation arises.

2. Methodology and Data

2.1. Methodology

We followed the entry model approach pioneered by Bresnahan and Reiss (1991) as a baseline model. This was then extended with a spatial dimension in line with Lábaj et al. (2018b) and Lábaj et al. (2018a). We started with a market populated by N competitors with per-firm per-capita variable profit $v(N)$ generated by each of the S consumers on the market. Fixed costs of f are independent of the number of firms. Therefore, per-firm profits are given as:

$$\pi(N) = v(N)S - f$$

Ideally, we would like to observe variable profit $v(N)$ and fixed costs f directly. Unfortunately, we are not able to observe them, so it is not possible to examine the effect of the number of competitors on variable profits directly.

However, from observing a specific number of firms in the market of size S , we can infer that N incumbents break even, whereas the $N + 1$ potential entrant does not:

$$\pi_{N+1} = v(N+1)S - f < 0 < v(N)S - f = \pi_N \quad (1)$$

or equivalently:

$$\ln \frac{v(N+1)}{f} + \ln S < 0 < \ln \frac{v(N)}{f} + \ln S \quad (2)$$

We estimate $\ln \frac{v(N)}{f}$ with data on market characteristics (matrix X), a firm fixed effect θ_N , and an unobservable error term ϵ :

$$\ln \frac{v(N)}{f} = X\beta + \theta_N + \epsilon \quad (3)$$

Combining equations 2 and 3, we obtain the following entry rule:

$$y = N, \text{ if } \theta_N \leq y^* < \theta_{N+1}$$

$$y^* = X\beta + \ln S + \epsilon$$

Parameters θ_N and θ_{N+1} measure the changes in the ratio of variable profits to fixed costs that can be attributed to market structure. If the two parameters are significantly different from each other, one would conclude that market profitability changes substantially with the entry of the $N + 1$ competitor.

Once parameters are estimated, entry thresholds can be calculated. For example, the population size necessary for the first firm to break even (monopoly entry threshold S_1) is calculated as:

$$S_1 = \exp(\theta_1 - X^- \beta) \quad (4)$$

where X^- represents the average of the variables in vector X . Entry thresholds are affected by a combination of the change in the toughness of competition due to entry and the change in fixed costs due to entry (Abraham et al., 2007).

Aside from evaluating the ease of entry for the first firm to break even (a monopoly position), it is possible to assess how competitive pressure is exerted by each successive entrant. We quantify competitive effects by comparing the per-firm break-even population for each market structure:

$$s_1 = \frac{\exp(\theta_1 - \bar{X} \beta)}{N} \quad (5)$$

$$ETR_N = \frac{S_{N+1}}{S_N} \quad (6)$$

If entry of an additional firm does not change competitive conduct, then $s_{N+1}/s_N = 1$. Bresnahan and Reiss (1991) noted that departures of successive entry threshold ratios from 1 measure whether competitive conduct changes as the number of firms increases. However, this statistic does not measure the level of competition. Instead, it measures how the level changes with the number of firms.

Standard errors and significance levels for estimated entry thresholds and entry threshold ratios were calculated using the delta method.

To capture the spatial correlation in the market structure and market characteristics, we estimated a spatial ordered probit model, as a secondary model. This model suggests that the entry of a firm does not only depend on local market characteristics but can also be influenced by neighboring markets:

$$y = N, \text{ if } \theta_N \leq y^* < \theta_{N+1} \quad (7)$$

$$y = \rho W y + X \beta + \ln S + \theta_N + \epsilon, \text{ where } \epsilon \sim N(0,1) \quad (8)$$

where W is a row-standardized spatial weight matrix and ρ captures the effect of competition, demand spill-overs, or unobserved differences in entry barriers across regions. To compare the results with Lábaj et al. (2018b) with use the same weight matrix. We discuss these effects in more detail in section 3.2.

A Bayesian Markov chain Monte Carlo procedure from the R package spatial probit, provided by Wilhelm and de Matos (2013), was used to estimate the spatial ordered probit model. The spatial weight matrix W was created using K nearest neighbors for each municipality. This is because we expected that the willingness of consumers (inhabitants) to travel is not unlimited. The average number of municipalities per district in Slovakia is 40, so we set $K = 40$. The restriction of the spatial effect to the 40 nearest municipalities also makes the estimation of the parameter easier since the full sample contains data on 2,928 municipalities, because we do not restrict our sample for this model.

2.2. Data

In this paper, we used data obtained from the Register of Healthcare Providers (RHP). The RHP is a list of all healthcare providers in Slovakia that provides information about the location of each individual healthcare provider, such as GPs, pharmacies, and healthcare specialists. Market characteristics at the municipality level and data on the population were obtained from the 'Urban and Municipal Statistics' of the Statistical Office of the Slovak Republic.

For a market definition, we followed existing empirical studies (mainly Schaumans and Verboven, 2008) and defined the relevant market at the municipality level. For our baseline model, ordered probit model without spatial effect we also restricted our sample to municipalities with a population below 15,000 or a population density below 800 inhabitants per km² to avoid any problem with overlapping markets in line with Schaumans and Verboven (2008). These restrictions reduced the number of observations by the 76 largest markets (less than 3% of markets), mainly city districts in Bratislava and Košice. These restrictions had a greater impact on markets with at least four GPs and pharmacies and only limited impact on other market structures. The average market population in the sample was above 1,100. However, the average population for markets with 1 GP or pharmacy was above 2,000.

The population in Slovakia is geographically dispersed, with greater density in western and north-western Slovakia. The majority of the population (around

57%) lives in cities and urban areas. The lowest population density is found in the regions of Banská Bystrica (69.9) and Prešov (88), the highest density in the Bratislava region (291.8).

Table 2 contains descriptive statistics of the variables for market characteristics that we used in our baseline model. For our baseline model (ordered probit model without spatial effects), we restricted our sample with regards to population and density (as described above), the sample had 2,852 observations. As markets with more than four firms were seldom observed, we pooled them to increase the precision of the estimates. We did this to have sufficient observations to identify each threshold. This is in line with previous literature, such as Lábaj et al. (2018b) and Schaumans and Verboven (2008).

Table 2
Descriptive Statistics of Market Characteristics

	Obs.	Mean	Std. dev.	Min.	Max.
pop	2,852	1,112	1,504	7	14,914
lnpop	2,852	6.5	1.7	2.0	9.6
wage	2,852	855	108	658	1,450
unem rate	2,852	0.05	0.04	0.00	0.31
density	2,852	79	79	0.46	784
old share	2,852	0.16	0.05	0.01	0.56
young share	2,852	0.15	0.05	0.00	0.45

Source: Based on data from 'Urban and Municipal Statistics' of the Statistical Office of the Slovak Republic.

The population is the key explanatory variable in the model. It represents the market size. The average population per market in our restricted sample is over 1,100. The relatively low population per market is due to the fragmentation of municipalities in Slovakia, average number of inhabitants in a municipality in Slovakia is one third of the EU28 average and one fifth of the OECD average.

The population density in Slovakia is relatively heterogeneous. The average population density in 2017 was 79 inhabitants per km², with the same standard deviation. The population density ranged between 0.5 and 784 inhabitants per km².

Substantial variability in the unemployment rate across municipalities can be observed. The average unemployment rate was around 5%, with almost the same standard deviation. The highest unemployment rate (31%) was recorded in Gemerská Ves in the Revúca district.

The main demographic factor is age. We expected that the proportion of the population 65 years of age and older in a particular market would be positively correlated with the demand for medical services. In other words, we expected that older people visited GPs and pharmacies more often. In Slovakia, the average share of the older population per municipality was 16%. However, there were also some regions where the older population had higher shares. The maximum

share of the older population was 56%. On the other hand, we also included the share of the young population in the model. The shares of young and old population were almost the same on average.

We also included income as a factor affecting demand. We observed the income per capita at the district, not municipality, level, which decreases its variation. But there are no data on incomes at the municipality level available in Slovakia. The average wage in our sample was EUR 855, varying between EUR 660 and EUR 1,450.

3. Empirical Results

3.1. Market Structure and Spatial Distribution of Healthcare Providers

GPs are the most common healthcare providers in Slovakia. In 2017, 2,353 GPs operated in Slovak healthcare markets. Within other healthcare providers, pharmacies are right behind them (over 2,300), followed by dentists (2,100).

Table 3

Chosen Healthcare Providers in Slovakia, 2017

Physician	Total	Max	Inhabitants per physician	Number of markets
GPs	2,353	77	2,312	712
Pharmacies	2,321	66	2,343	600
Dentists	2,130	69	2,554	517
Pediatricians	1,159	31	4,693	455
Ophthalmologists	482	27	11,285	119
Surgeons	453	14	12,007	124
Cardiologists	277	16	19,636	91

Source: Based on the RHP; full sample.

Table 4

Observed Market Configuration for Pharmacies and Physicians, 2017

Number of GPs	Number of pharmacies					Total
	0	1	2	3	4+	
0	2,165	43	3	2	0	2,213
1	158	300	17	1	1	477
2	3	48	25	4	2	82
3	0	8	13	5	5	31
4+	0	1	4	8	36	49
Total	2,326	400	62	20	44	2,852

Source: Based on the RHP; restricted sample.

Although the total numbers of GPs and pharmacies were very similar, their market configurations slightly differed. Most of the markets in Slovakia were without any physician or pharmacy at the same time (more than 2,000). There were 43 markets with one pharmacy and without a GP. On the other hand, there

were almost 160 markets with one GP, but no pharmacies. There were also several markets with two or three pharmacies but no doctors present. When there was a GP present on the market, we observed an increased number of markets with at least one pharmacy. The spatial distribution of firms in Slovakia, however, is affected by the fragmentation of municipalities, as noted above.

3.2. Entry Models for Healthcare Providers

Table 5 presents the results from the univariate ordered probit models. Changes in competitive pressure from the entry of new firms were measured by the ordered probit parameters (θ , cut parameters). All cut values were significant and increasing, which suggests that market structure played an important role in determining profitability.

Table 5
Univariate Ordered Probit Model Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	pharm4	GP4	ped4	dent4	surgeon	cardio4	ophth4
lnpop	1.856*** (0.677)	1.931*** (0.065)	1.722*** (0.073)	1.782*** (0.07)	2.164*** (0.204)	1.494*** (0.193)	1.980*** (0.199)
wage	-0.0001 (0.00036)	-0.0006 (0.0003)	-0.0001* (0.0004)	-0.0002 (0.0003)	0.0002 (0.0009)	-0.0002 (0.001)	0.002 (0.0009)
density	0.0006 (0.00042)	-0.0002 (0.0004)	0.0015*** (0.0004)	0.0008 (0.0004)	-0.0005 (0.0007)	0.0008 (0.0007)	0.0005 (0.0007)
unem rate	4.423*** (1.343)	7.117*** (1.182)	3.178* (1.539)	4.194** (1.477)	12.77** (4.461)	4.696 (5.78)	6.176 (5.54)
young share	-6.448*** (1.357)	-7.22*** (1.23)	-5.509*** (1.508)	-5.006*** (1.424)	-12.59* (5.07)	-13.60* (6.354)	-12.80* (5.41)
old share	2.462 (1.712)	3.754* (1.50)	0.409 (1.999)	4.714** (1.801)	1.047 (5.427)	-5.089 (6.573)	-2.098 (5.56)
θ_1	13.42*** (0.72)	13.29*** (0.66)	11.95*** (0.79)	13.56*** (0.76)	17.89*** (2.44)	11.29*** (2.59)	17.24*** (2.47)
θ_2	15.20*** (0.75)	15.05*** (0.69)	13.69*** (0.82)	15.16*** (0.79)	19.00*** (2.48)	12.15*** (2.61)	18.31*** (2.5)
θ_3	16.02*** (0.76)	15.89*** (0.70)	14.75*** (0.84)	15.84*** (0.80)	19.54*** (2.48)		18.92*** (2.52)
θ_4	16.48*** (0.77)	16.50*** (0.71)	15.40*** (0.86)	16.40*** (0.82)	19.84*** (2.49)		19.34*** (2.54)

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors in parentheses.

Source: Authors' calculations.

The coefficients estimated were consistent with our expectations. Market size (measured by the logarithm of the population) had a significant impact on the number of specialists per market. The profitability of healthcare providers grew with market size. Wage and density had only minimal and insignificant effects. The coefficients were significant only for the number of pediatricians.

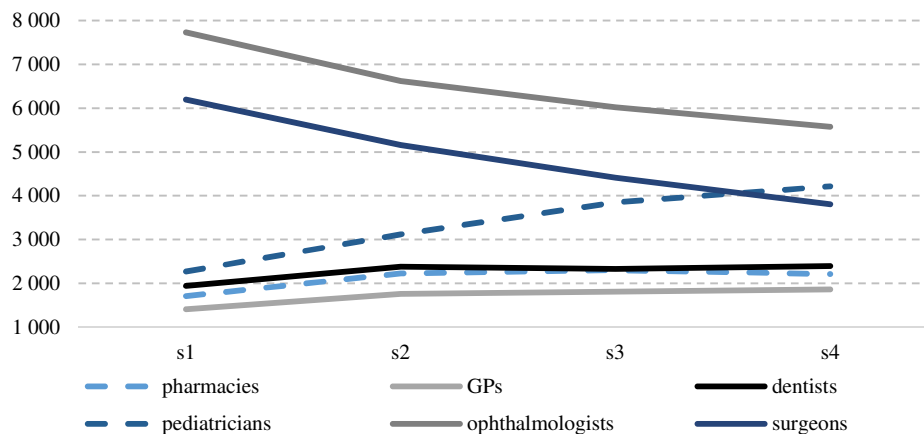
The unemployment rate and share of the young population had the most robust effects on the number of providers, although in different directions. The unemployment rate had a positive effect on the number of healthcare providers. GPs and ophthalmologists seemed to benefit from higher unemployment rates the most, together with surgeons.

Younger people need to go to the doctor less often. The share of the young population in the market (compared to the productive population) reduced profitability for all healthcare providers. It was especially true for surgeons, cardiologists, and ophthalmologists – professions whose presence is generally associated with older populations. Healthcare professions in Slovakia had different market size thresholds for entry.

Figure 2 plots entry thresholds, i.e. the population necessary for a first, second, third, and fourth provider to enter the market in 2017. The highest entry thresholds were recorded for ophthalmologists and surgeons. The lowest thresholds were found for GPs and pharmacies. Entry thresholds per firm surprisingly decreased with the number of firms for ophthalmologists and surgeons. Table 6 also shows the entry thresholds per firm with standard errors for the chosen specialists.

Figure 2

Entry Thresholds for Different Specialists in Slovakia, 2017



Source: Authors' calculations.

Entry thresholds ratios (ETRs) measure the change in population per firm with the entry of additional firms. The theory proposed by Bresnahan and Reiss (1991) suggests that if the population per firm required to support a given number of firms in a market grows with the number of firms, then competition is getting more intense. For pharmacies, GPs, dentists, and pediatricians, the ETRs gradually declined toward 1 with the successive entry of additional firms. After

the entry of a fourth firm, the ETRs were close to 1. The population per firm had to grow by 30% (1.3 times) for a second pharmacy to enter the market. However, for the third and the fourth pharmacies, the population per firm remained the same. The intensity of competition therefore did not change after the entry of the third pharmacy.

Table 6
Entry Thresholds for Different Specialists, 2017

	pharm	GPs	dentists	peds	ophth	surg
s1	1,705 (45)	1,408 (30)	1,940 (58)	2,270 (81)	7,730 (890)	6,193 (541)
s2	2,222 (109)	1,754 (71)	2,375 (130)	3,118 (207)	6,618 (976)	5,154 (605)
s3	2,300 (149)	1,809 (100)	2,324 (160)	3,850 (373)	6,019 (1071)	4,415 (624)
s4	2,210 (167)	1,858 (126)	2,390 (196)	4,215 (512)	5,577 (1151)	3,803 (604)

Note: Standard errors in parentheses; all estimates significant at the 1% level.

Source: Authors' calculations.

Table 7
Entry Threshold Ratios for Different Specialists in Slovakia, 2017

	pharm	GPs	dentists	peds	ophth	surg
s2/s1	1.30 (0.06)	1.25 (0.05)	1.22 (0.06)	1.37 (0.08)	0.86 (0.07)	0.83 (0.06)
s3/s2	1.4 (0.05)	1.3 (0.04)	0.98 (0.05)	1.23 (0.09)	0.91 (0.08)	0.86 (0.06)
s4/s3	0.96 (0.05)	1.3 (0.05)	1.3 (0.06)	1.9 (0.1)	0.93 (0.09)	0.86 (0.06)

Note: Standard errors in parentheses; all estimates significant at the 1% level.

Source: Authors' calculations.

Since the costs of traveling between regions are relatively small compared to the value of healthcare services, consumers might be able to travel larger distances for a specific provider. In the next step, we therefore extended the previous analysis for spatial spillover effects between markets and the spatial dimension of competition in line with Lábaj et al. (2018b) and Lábaj et al. (2018a). While the entry threshold approach assumes local markets to be isolated, spatial interactions might be especially important in healthcare services. In contrast to the analysis in the previous section, we did not restrict our sample of municipalities to obtain only rural areas. We included all markets, in line with the empirical analysis in Lábaj et al. (2018b).

Lábaj et al. (2018a) summarized three different effects from these spillovers on the number of firms. Over 70% of markets had no physician or pharmacy in Slovakia. However, the inhabitants of these markets also have demand for

healthcare services. Neighboring markets can therefore benefit from positive demand spillovers. A countervailing effect can be assigned to competitive pressure from firms in neighboring markets. Firms in the local market are exposed to competitive pressure from the firm in other nearby markets. Strong competition spillovers would imply a negative parameter for ρ . The last spatial interaction effect could be the result of differences in entry barriers across markets. Unobserved differences in the economic environment would imply a spatial correlation of the error term and would therefore lead to a positive parameter estimate for ρ (Lábaj et al., 2018a).

Table 8 reports the results from the spatial ordered probit model. The parameter ρ measures the impact of spatially weighted neighborhood profitability and an unobserved measure of profitability in the local market. All cut values (θ) were significant (the same as in the model without spatial interactions), which suggests that even after taking spatial interactions into account, market structure played an essential role in determining profitability.

The results are relatively consistent with the models without spatial interactions. However, taking spatial interactions into account increased the significance of the parameter estimates. The effects of population density remained small and insignificant. After controlling for spatial interactions, the share of the older population had adverse effects on the number of healthcare providers.

Table 8
Results from Spatial Ordered Probit Models, 2017

	pharm4	GP4	ped4	dent4	surgeon4	ophth4
lnpop	0.9447*** (0.04)	0.9423*** (0.038)	0.9196*** (0.048)	0.8807*** (0.042)	0.865*** (0.095)	0.8494*** (0.092)
density	0.00005 (0.00006)	-0.000001 (0.00006)	0.0001 (0.00006)	0.0001 (0.00006)	0.000002 (0.00006)	-0.00002 (0.00006)
wage	-0.002*** (0.0003)	-0.003*** (0.0003)	-0.002*** (0.0003)	-0.002*** (0.0003)	-0.002*** (0.0005)	-0.002*** (0.0005)
unem_rate	0.0008*** (0.0002)	0.0008*** (0.0003)	0.001*** (0.0002)	0.001*** (0.0002)	0.002*** (0.0003)	0.002*** (0.0003)
young_share	-16.77*** (0.850)	-15.57*** (0.773)	-16.31*** (0.886)	-16.24*** (0.867)	-26.24*** (2.453)	-27*** (2.015)
old_share	-16.38*** (1.058)	-14.33*** (0.949)	-17.33*** (1.232)	-15.07*** (1.063)	-15.47*** (1.769)	-15.33*** (1.664)
ρ	0.3272*** (0.044)	0.2384*** (0.046)	0.2338*** (0.050)	0.2923*** (0.047)	0.1825 (0.079)	0.2941** (0.079)
θ_1	0	0	0	0	0	0
θ_2	1.268*** (0.071)	1.231*** (0.044)	1.207*** (0.064)	1.149*** (0.039)	0.6549*** (0.069)	0.6723*** (0.089)
θ_3	1.741*** (0.092)	1.734*** (0.051)	1.815*** (0.074)	1.56*** (0.063)	1.041*** (0.071)	1.21*** (0.134)
θ_4	1.989*** (0.096)	2.061*** (0.052)	2.082*** (0.083)	1.874*** (0.061)	1.407*** (0.083)	1.737*** (0.140)

Note: * p < 0.05, ** p < 0.01, *** p < 0.001; Standard errors in parenthesis.

Source: Authors' calculations.

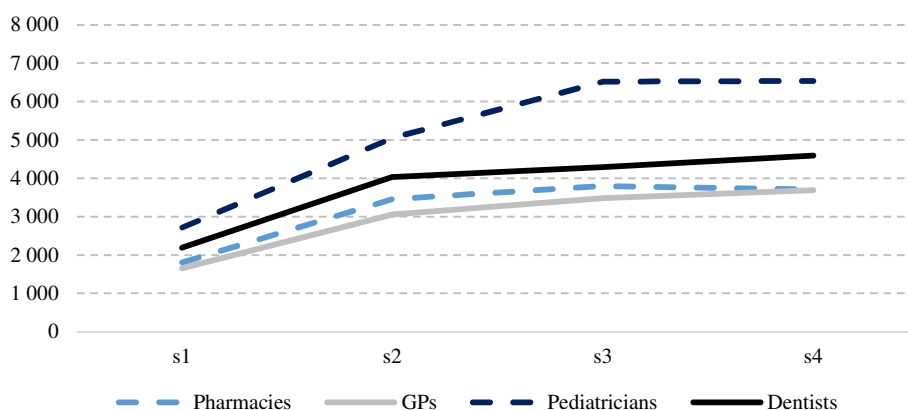
Parameter ρ in Table 8 showed a positive and significant spatial correlation for all occupations but surgeons, which indicates that spatial interactions were essential for profitability and the number of firms in the markets. The positive signs of the effect suggest that the effect of demand linkages (or maybe a positive correlation in regional characteristics) seems to have prevailed over negative effects associated with competition between neighboring regions. The effect seems to have been more significant for pharmacies than for GPs.

Our estimates of spatial interactions complement the results from Lábaj et al. (2018b), where the authors found negative (but decreasing) spatial spillover effects for pharmacies, GPs, and dentists at three times (1995; 2001 and 2010). At these times, the authors suggested that competitive effects outweighed demand spillovers. Our results suggest that the demand effect continued to grow since 2010 and in 2017 outweighed the competition effect.

Based on estimates from Table 8, we calculated the entry threshold population (Table 9 and Figure 3). ETRs are reported in Table 10. The extension of the entry model for spatial interactions increased the entry threshold. If other small markets surrounded a small market (unprofitable on its own) without healthcare providers, it was easier for the first firm to enter. Municipalities with a small population were therefore able to attract an incumbent due to these demand spillovers. Since a simple ordered probit model cannot take this effect into account, it will lead to lower entry thresholds.

Figure 3

Entry Thresholds with Spatial Interactions, 2017



Source: Authors' calculations.

Development of the entry thresholds and also the ETRs was very similar as in the simple model (without spatial interactions). The results are therefore robust regardless of the estimation strategy. With the entry of a second firm, entry

thresholds increased significantly. The population required to support one firm in a duopoly had to almost double, compared to monopoly (increase by 90% for pharmacies and 84 – 86% for the three other professions). However, except for pediatricians (both for the spatial and simple models), the population per firm remained relatively stable. For pediatricians, the population needed to increase by 30% for a third firm to enter.

Table 9

Entry Thresholds with Spatial Interaction, 2017

	pharm	GPs	peds	dentists	surg	ophth
s1	1,805	1,657	2,717	2,188	13,567	10,095
s2	3,455	3,060	5,047	4,034	14,463	11,138
s3	3,800	3,479	6,517	4,288	15,067	13,984
s4	3,706	3,691	6,535	4,594	17,252	19,505

Source: Authors' calculations.

Table 10

ETRs with Spatial Interactions, 2017

	pharm	GPs	peds	dentists	surg	ophth
s2/s1	1.91	1.85	1.86	1.84	1.7	1.10
s3/s2	1.10	1.14	1.29	1.6	1.4	1.26
s4/s3	0.98	1.6	1.00	1.7	1.15	1.39

Source: Authors' calculations.

3.3. The Effect of Deregulation on Entry Decisions: The Case of Community Pharmacies

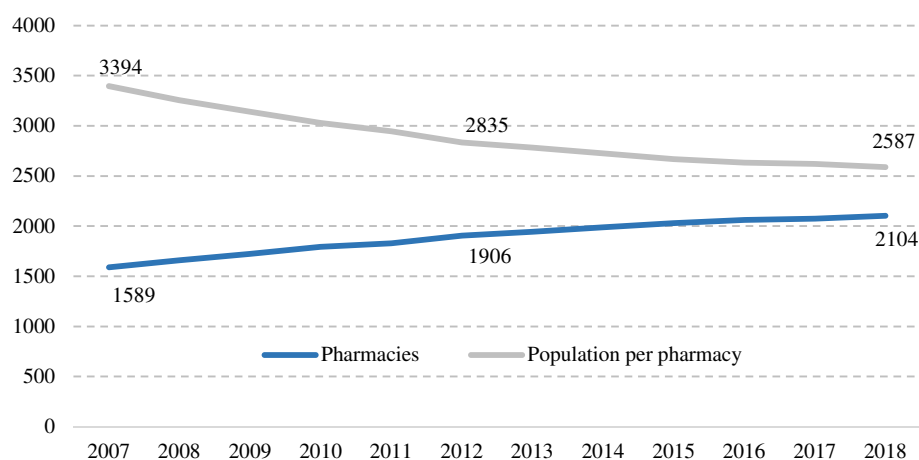
Between 2007 and 2018, an increase in the number of pharmacies can be observed when over 500 pharmacies entered regional markets in Slovakia. According to data from the RHP, the total number of pharmacies increased from 1,589 (in 2007) to 2,104 (in 2018). With this entry of new pharmacies, the population-to-pharmacy ratio declined. The entry of new pharmacies was possible mainly due to gradual easing of entry restrictions in this profession (see Table 1 for details on changes in regulation over time). Reform in 2004 aimed at transparent entry and a decrease in entry barriers in the pharmacy market. For example, legal persons were allowed to own and run a pharmacy. Demographic and location restrictions for pharmacies were also abolished shortly before the period.

To ensure comparability with the study by Lábaj et al. (2018b), Table 11 shows the observed market configuration for pharmacies in 2010 (rows) and 2017 (columns). The numbers on the main diagonal (from the top left corner to the bottom right corner) contain the number of markets with the same number of pharmacies in both years. The numbers above the diagonal represent the number of markets entered by a pharmacy during the period. The numbers below the

diagonal represent the number of markets with a pharmacy that exited from the given market. During the examined period, 53 new monopoly markets emerged from markets that originally had no pharmacy. Moreover, 25 new duopoly markets were created from monopoly markets. On the other hand, another 22 monopoly and 4 duopoly markets were not present in 2017.

Figure 4

Development of the Number of Pharmacies since 2007



Source: Authors' calculations.

Table 11

Observed Market Configuration of Pharmacies in 2010 and 2017

Pharmacies 2010	Pharmacies 2017					Total
	0	1	2	3	4+	
0	2,278	53	1	0	0	2,332
1	22	370	25	1	0	418
2	0	4	31	8	4	47
3	0	1	2	11	9	23
4+	0	0	0	0	108	108
Total	2,300	428	59	20	121	2,928

Note: Based on the RHP, full sample.

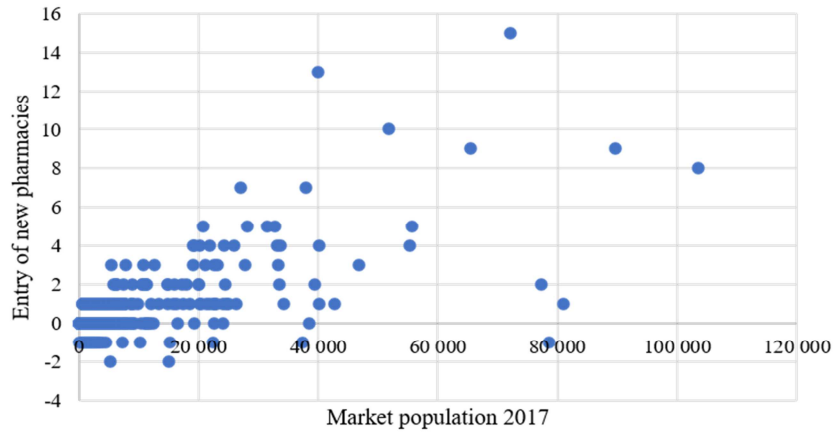
Source: Authors' calculations.

Most pharmacies entered markets with up to 20,000 inhabitants (Figure 5). In most cases, however, only a few pharmacies entered these markets. The entry of more firms (above four new pharmacies) can be observed mainly in larger markets, but less frequently.

These findings are in contrast to developments in the pharmacy market between 1995 and 2010, described in Lábaj et al. (2018b). These authors concluded

that smaller villages did not benefit from the entry of new pharmacies, but rather lost services to larger neighboring markets. Development between 2010 up to 2018 seems to have gone in another direction, with more pharmacies entering vacant markets.

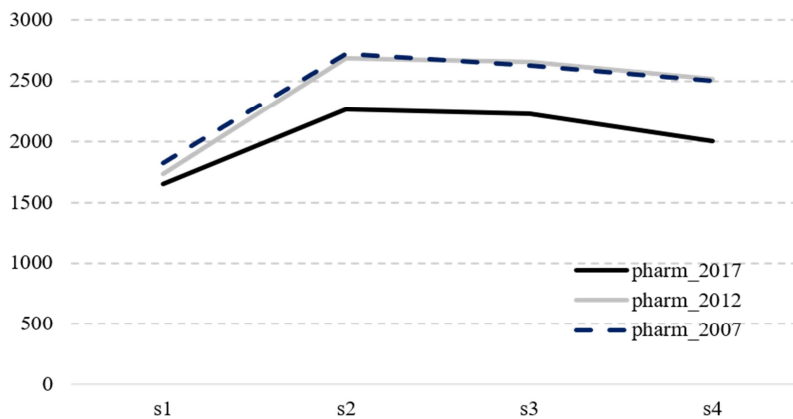
Figure 5
Entry of Pharmacies since 2010, By Market Population



Source: Authors' calculations.

The entry thresholds changed significantly over time. Figure 6 shows the entry thresholds for pharmacies at three times: 2007, 2012, and 2017.

Figure 6
Change in Entry Thresholds for Pharmacies over Time



Source: Authors' calculations.

The development of the ETRs is especially interesting to study because we can link our results to the study by Lábaj et al. (2018b). Competition with the entry of a second pharmacy increased in 2012 compared to 2007. However, in 2017 the entry of a second firm led to less intense competition. The ETR for entry of a second firm increased in 2012 but declined under the initial level in 2017. In other words, the population per firm had to increase more significantly for a second pharmacy to enter a market in 2012 than in 2007. However, in 2017 it was easier for a second pharmacy to enter since the population had to increase only 1.4 times compared to 1.6 times in 2012. After the entry of a third firm onward, competition conduct remained the same.

Table 12

ETRs at Three Times

	pharm 2007	pharm 2012	pharm 2017
s2/s1	1.5 (0.08)	1.54 (0.09)	1.30 (0.06)
s3/s2	0.96 (0.05)	0.99 (0.05)	1.04 (0.05)
s4/s3	0.95 (0.05)	0.95 (0.05)	0.96 (0.05)

Note: Standard errors in parentheses.

Source: Authors' calculations.

Conclusions

This paper extends the existing literature on the entry decisions and spatial distribution of healthcare professionals in Slovakia in several dimensions. First, we studied other professions such as pediatricians, ophthalmologists, cardiologists, and surgeons to see if their behavior is similar to those studied in previous literature such as pharmacies, physicians, and dentists. Second, we provided more recent evidence on entry decisions, toughness of competition, and spatial effects for GPs, pharmacies and dentists. This enabled us to identify changing patterns in the development of these markets that are relevant for up-to-date and evidence-based policy responses.

Several studies have concluded that healthcare providers concentrate in urban areas, but a subsequent increase in the total number of physicians would lead to the diffusion of professionals into smaller cities (Newhouse et al., 1982a,b; Rosenthal et al., 2005; Brown, 1993). Lábaj et al. (2018b) studied healthcare markets in 1995, 2000, and 2010 and concluded that, after market liberalization, pharmacies entered mainly city markets with higher population densities. Our research aimed to answer whether deregulation after 2010 led to the entry of pharmacies into larger cities or they had already started to diffuse into smaller markets as the literature expected. The results of our research documented that

a subsequent increase in a total number of pharmacies after 2010 led to diffusion into smaller markets. During this period, the number of markets without a pharmacy decreased by 68. There was an increase in the number of pharmacies affected mainly monopoly markets (+34) and duopoly markets (+17) and mostly markets with up to 4,000 inhabitants.

Our research also aimed to estimate the population necessary for the first pharmacy (and other healthcare providers) to enter the market in Slovakia, together with competition changes with the entry of another provider of the same type. Pharmacies and GPs were the most frequent healthcare providers in Slovakia. This was also projected into our estimates of entry thresholds. For these two professions, entry threshold estimates were the lowest among other healthcare providers. The local market, in our case a municipality, needed to have at least 1,400 inhabitants for the first GP to enter and establish a monopoly. It was 1,700 inhabitants for a pharmacy and almost 2,300 inhabitants for a pediatrician. In line with theoretical predictions, however, the population had to more than double for the second professional to enter. To support the second firm, the population per firm in the market needed to increase by 30% for pharmacies, 25% for GPs, and almost 40% for pediatricians. After the entry of a second firm, however, the intensity of competition did not change, except for pediatricians. The results were similar after taking spatial interactions into account. Our estimates for spatial interactions complement the results from Lábaj et al. (2018b), where the authors found negative (but decreasing) spatial spillover effects for pharmacies, GPs, and dentists between 1995 and 2010. In those years, the authors determined that competitive effects outweighed demand spillovers. Our results suggest that the demand effect continued to grow since 2010 and in 2017 outweighed the competition effect.

There are several policy lessons that can be drawn from the analysis. First, the case of pharmacy market liberalization suggests that concerns related to market concentration and under-provision of services in rural areas are important in the short run but these trends can be reversed in the mid-term horizon. Second, more entries do not necessarily imply more intense competition. As firms may enter new markets and the size of the market grows, individual firms may face less competitive pressure to operate in the market. Third, the less intense competition documented in the paper might be a concern for the quality of provided services in the future. Moreover, as the supply of new entrants across analyzed professions is expected to decrease, it is of upfront policy importance to respond. Lastly, more research is required to understand the interactions across professions. In some activities, GPs, specialists, and pharmacists can substitute for one another, but in general they provide complementary services. Thus, improvement in spatial

distribution in one profession can have a positive feedback loop on entry of other healthcare providers. Improvements in the minimal network of healthcare providers, e.g. GPs, can have a positive impact on entry of more liberalized professions such as pharmacies.

References

- ABRAHAM, J. M. – GAYNOR, M. – VOGT, W. B. (2007): Entry and Competition in Local Hospital Markets. *The Journal of Industrial Economics*, 55, No. 2, pp. 265 – 288.
- BERRY, S. T. (1992): Estimation of a Model of Entry in the Airline Industry. *Econometrica: Journal of the Econometric Society*, 60, No. 4, pp. 889 – 917.
- BRESNAHAN, T. F. – REISS, P. C. (1991): Entry and Competition in Concentrated Markets. *Journal of Political Economy*, 99, No. 5, pp. 977 – 1009.
- BROWN, M. C. (1993): Do Physicians Locate as Spatial Competition Models Predict? Evidence from Alberta. *CMAJ: Canadian Medical Association Journal*, 148, No. 8, pp. 1301.
- KIŠŠ, Š. et al. (2018): Revízia výdavkov na zdravotníctvo II. Priebežná správa. Bratislava: Ministry of Finance of the Slovak Republic.
- LÁBAJ, M. – MORVAY, K. – SILANIČ, P. – WEISS, C. – YONTCHEVA, B. (2018a): Market Structure and Competition in Transition: Results from a Spatial Analysis. *Applied Economics*, 50, No. 15, pp. 1694 – 1715.
- LÁBAJ, M. – SILANIČ, P. – WEISS, C. – YONTCHEVA, B. (2018b): Market Structure and Competition in the Healthcare Industry. *The European Journal of Health Economics*, 19, pp. 1087 – 1110.
- LÁBAJ, M. (2019): Konkurencia na regulovaných trhoch: fungovanie lekární na Slovensku. *Monitor hospodárskej politiky*, 3, No. 9, pp. 7 – 10.
- MANDŽÁK, P. – HRONČEK, P. (2019): Podnikanie v lekárenskom biznise. *Monitor hospodárskej politiky*, 3, No. 9, pp. 14 – 18.
- MAZZEO, M. J. (2002): Product Choice and Oligopoly Market Structure. *RAND Journal of Economics*, 33, No. 2, pp. 221 – 242.
- NEWHOUSE, J. P. – WILLIAMS, A. P. – BENNETT, B. W. – SCHWARTZ, W. B. (1982a): Does the Geographical Distribution of Physicians Reflect Market Failure? *The Bell Journal of Economics*, 13, No. 2, pp. 493 – 505.
- NEWHOUSE, J. P. – WILLIAMS, A. P. – BENNETT, B. W. – SCHWARTZ, W. B. (1982b): Where Have All the Doctors Gone? *JAMA*, 247, No. 17, pp. 2392 – 2396.
- OECD (2019): Health at a Glance 2019: OECD Indicators. Paris: OECD.
- ROSENTHAL, M. B. – ZASLAVSKY, A. – NEWHOUSE, J. P. (2005): The Geographic Distribution of Physicians Revisited. *Health Services Research*, 40, No. 6p1, pp. 1931 – 1952.
- SCHAUMANS, C. – VERBOVEN, F. (2008): Entry and Regulation: Evidence from Health Care Professions. *The Rand Journal of Economics*, 39, No. 4, pp. 949 – 972.
- SMATANA, M. – PAZITNÝ, P. – KANDILAKI, D. – LAKTISOVA, M. – SEDLAKOVA, D. – PALUSKOVA, M. – SPRANGER, A. et al. (2016): Slovakia: Health System Review. *Health Systems in Transition*, 18, No. 6, pp. 1 – 210.
- SNYDER, C. M. – TREMBLAY, V. J. (2018): Introduction to the Special Issue on “The Intersection between Industrial Organization and Healthcare Economics”. *Review of Industrial Organization*, 53, pp. 1 – 6.
- SZALAY, T. – PAŽITNÝ, P. – SZALAYOVČ, A. – FRISOVÁ, S. (2011): Health Systems in Transition: Slovakia: Health System Review. Brussels: European Observatory on Health Systems and Policies.

- VOGLER, S. – ARTS, D. – HABL, C. (2006): Community Pharmacy in Europe: Lessons from Deregulation – Case Studies. Vienna: Austrian Health Institute.
- WILHELM, S. – de MATOS, M. G. (2013): Estimating Spatial Probit Models in R. *The R Journal*, 5, No. 1, pp. 130 – 143.

Appendix 1

Testing Different Market Definition

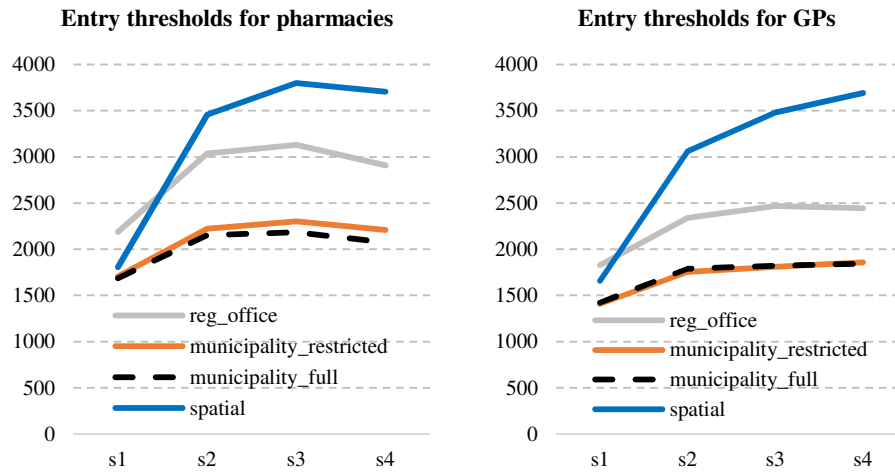
There are several options how to define market for our analysis. In our baseline model, we restricted our sample with municipalities with a population over 15 thousand or population density over 800 inhabitants per km², to avoid problem with overlapping markets. We also estimated secondary model with spatial interactions, which suggests that the entry of a firm does not only depend on local market characteristics but can also be influenced by neighboring markets.

Results from ordered probit models with spatial interactions support the assumption that if other small markets surround the small market (unprofitable on its own) without healthcare providers, it will be easier for a first firm to enter. Municipalities with a small population will be, therefore, able to attract an incumbent due to these demand spill-overs. Since a simple ordered probit model cannot take this effect into account, it will lead to lower entry thresholds.

Figure 7 shows entry thresholds for pharmacies and GPs with market defined at the municipality level with and without restricted sample, registry office, and also model with spatial interactions. The entry threshold for monopoly is relatively similar for all models. Restricting sample for large markets (including Bratislava and Košice) does not have significant impact on entry threshold estimation. On the other hand, entry threshold estimated based on spatial model are the highest. Merging municipalities based on registry office moves thresholds closer to the spatial model.

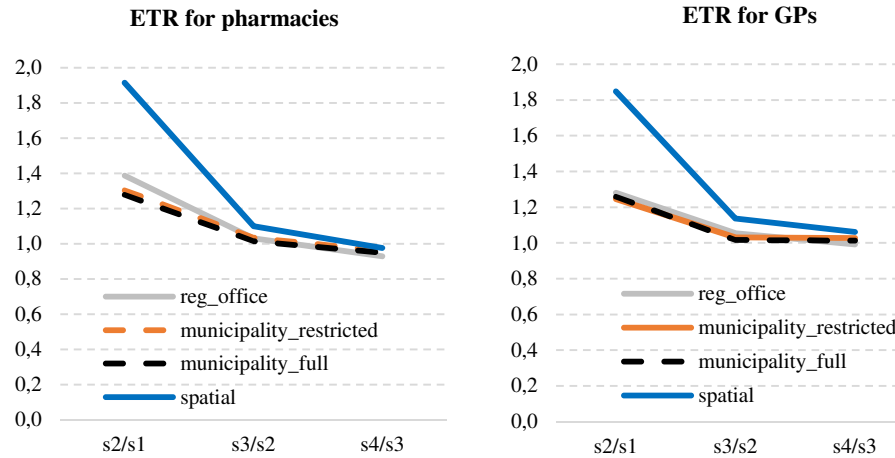
Entry threshold ratios that we use as a measure of the change in competition conduct are identical for market defined at municipal (both restricted and unrestricted sample) and regional office level. Different market specification, however, does not affect the change of competitive conduct with the entry of additional firms. Exception is entry of second healthcare provider in spatial model, where higher ETR suggest intensified competition.

Figure 7
Entry Thresholds for Different Market Definitions



Source: Authors' calculations.

Figure 8
Entry Threshold Ratios for Different Market Definitions



Source: Authors' calculations.

Appendix 2

Different Estimation Methods

In our paper we build on existing industrial organization literature and we estimated ordered probit models. However, different count data models can be also used to test relationship between number of firms and observed market characteristics.

Results from Poisson regression are reported in Table 13. Estimated parameters for pharmacies and GPs are in line with our baseline and spatial models. We can observe strong effect of population on profitability of pharmacies and GPs.

Table 13

Results from Poisson Regression

	pharm4		GP4	
	Coef.	Std. Err.	Coef.	Std. Err.
lnpop	1.55***	0.046	1.47***	0.041
wage	0.0005	0.000	0.0002	0.000
unem_rate	0.99	1.662	4.47	1.340
density	-0.0005	0.000	-0.001**	0.000
young_share	-3.09**	1.520	-4.0 ***	1.332
old_share	1.43	1.914	1.85	1.663
const	-12.8	0.701	-11.6***	0.622

Source: Authors' calculations.