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P.O. Syomin

Perm State University, Russia, Perm
e-mail: ntsp@ya.ru

SPATIAL AND REGRESSION ANALYSIS OF PROVISION OF COMMERCIAL LEGAL SERVICES IN RUSSIAN CITIES

The article examines the relationship between the number of employees at law firms, or lawyers, and the provision of legal services in Russian cities. It aims to identify whether the increase in the number of lawyers leads to an enhanced level of legal services provision. In addition, it attempts to discern geographical patterns in the provision of legal services in Russia. To achieve these objectives, open data from the Federal Tax Service of Russia is utilized as the primary source of information. Linear regression is employed to estimate the hypothesized relationship, and data plotting and mapping are used to visualize it. The study demonstrates an overall positive square root relationship between the number of lawyers and the provision of legal services in cities, as well as a linear relationship between these variables in distinct city population size groups. It supports a widely held proposition about the pivotal role of the largest cities in the provision of services and also offers partial confirmation of the commonly accepted view about the positive impact of service concentration on their delivery. However, the study argues that there are multiple approaches to achieving a high level of legal services provision, with an increase in the number of lawyers being only one of the potential options. The findings of this research may serve to inform data-driven policymaking decisions of governmental bodies.

Key words: legal services, law firms, availability, cities, spatial analysis, regression analysis, small and medium-sized businesses, open data

П.О. Сёмин

Пермь мемлекеттік ұлттық зерттеу университеті, Ресей, Пермь қ.
e-mail: ntsp@ya.ru

Ресей қалаларында коммерциялық заң қызметтерін көрсетудің кеңістіктік және регрессиялық талдауы

Мақалада заңгерлік фирмалардың (заңгерлер) қызметкерлерінің саны мен Ресей қалаларында заңгерлік қызмет көрсету арасындағы байланыс қарастырылады. Зерттеудің мақсаты – адвокаттар санының артуы заң қызметтерін көрсету деңгейінің артуына әкелетінін анықтау. Сонымен қатар, Ресейде заң қызметтерін көрсетудің географиялық заңдылықтарын анықтау әрекеті жасалуда. Ақпараттың негізгі көзі ретінде Ресейдің Федералдық салық қызметінің ашық деректері пайдаланылады. Сызықтық регрессия болжамды қатынасты бағалау үшін қолданылады, ал графикалық және карталау бақыланатын заңдылықтарды визуализациялау үшін қолданылады. Зерттеу қалалардағы заңгерлер саны мен заң қызметтерін көрсету арасындағы оң қисық сызықты (квадрат түбір функциясына жақын) қатынасты, сондай-ақ қалаларды халық саны бойынша топтастыру кезінде осы айнымалылар арасындағы сызықтық байланысты көрсетеді. Бұл қызмет көрсетудегі ірі қалалардың шешуші рөлін кеңінен бекітумен сәйкес келеді, сонымен қатар қызметтердің шоғырлануы қызмет көрсетуге оң әсер етеді деген ойды ішінара растайды. Дегенмен, зерттеу заң қызметтерін көрсетудің жоғары деңгейіне қол жеткізудің әртүрлі тәсілдері бар екенін көрсетеді, адвокаттар санын көбейту тек бір ғана ықтимал нұсқа болып табылады. Зерттеу нәтижелері уәкілетті органдардың деректерге негізделген шешімдер қабылдауына негіз бола алады.

Түйін сөздер: заң қызметтері, заң фирмалары, қауіпсіздік, қалалар, кеңістіктік талдау, регрессиялық талдау, шағын және орта бизнес, ашық деректер.

П.О. Сёмин
Пермский государственный национальный исследовательский университет, Россия, г. Пермь
e-mail: ntsp@ya.ru

Географический и регрессионный анализ обеспеченности коммерческими юридическими услугами в городах России

В статье исследуется связь между числом сотрудников юридических фирм (юристов) и обеспеченностью юридическими услугами в городах России. Цель исследования – определить, приводит ли увеличение числа юристов к повышению уровня обеспеченности юридическими услугами. Кроме того, предпринимается попытка выявить географические закономерности обеспеченности юридическими услугами в России. В качестве основного источника информации используются открытые данные ФНС России. Для оценки предполагаемой взаимосвязи применяется линейная регрессия, а для визуализации обнаруженных закономерностей используются построение графиков и картографирование. Исследование показывает положительную криволинейную (близкую к функции квадратного корня) связь между количеством юристов и обеспеченностью юридическими услугами в городах, а также линейную связь между этими переменными при группировке городов по численности населения. Оно согласуется с широко распространённым утверждением о ключевой роли крупнейших городов в предоставлении услуг, а также частично подтверждает представление о положительном влиянии концентрации услуг на обеспеченность ими. Тем не менее, результаты исследования говорят о том, что существуют разные подходы к достижению высокого уровня обеспеченности юридическими услугами, причём увеличение количества юристов является лишь одним из потенциальных вариантов. Результаты исследования могут послужить основой для принятия решений органами власти на основе данных.

Ключевые слова: юридические услуги, юридические фирмы, обеспеченность, города, пространственный анализ, регрессионный анализ, малое и среднее предпринимательство, открытые данные.

Introduction

Geography of services is a significant and well-established branch of geographical studies. The discipline's history can be traced back to the second half of the 20th century, as documented by Tkachenko and Fomkina (2016). Two distinct research approaches exist within the field of geography of services. The first may be described as economic, while the second may be designated as social. The economic approach, as its name suggests, treats the services as a regular part of the economy. It considers their role in GDP or employment, their impact on growth, and the interplay between services and other business activities. For instance, a study by Wójcik (2021) offers an economic-based overview of FihTech geography. The social approach, while closely related to the economic one, focuses on the services as the foundation of people's well-being and studies the provision, availability, and accessibility of services, as well as their diversity and quality. For example, the study in Indonesia (Pratiwi et al. 2021) employs a variety of socio-economic data from the national health insurance system to discuss, among other issues, the equity problems that arise from geographical differences. The problem of access to various services has been a significant concern for decades (Mark Blacksell 1990; Keleher and Ellis 1996), as it is directly related to the quality of life and the guarantee of human rights. Furthermore, research has been conducted on the relationship between geographical properties and service availability (Holzer, Goldsmith, and Ciarlo 2000; Johnson et al. 2006).

Cities have traditionally been regarded as regional hubs that provide goods and services to smaller surrounding settlements (Christaller and Baskin 1966). Consequently, urban studies are closely intertwined with the geography of services (Reilly 1931; Brush 1953). It is widely acknowledged that professional and business services tend to cluster, and their spatial distribution is closely linked to urban hierarchies (Bennett, Graham, and Bratton 1999; Keeble and Nachum 2002; Rubalcaba et al. 2013; Kekezi and Klaesson 2019). The concentration of businesses provides economic benefits for the companies and, as such, the concentration is likely to become self-sustaining. It is reasonable to assume that such concentration not only leads to economic growth but also positively impacts the service provision, thereby being productive in both economic and social dimensions. It is a common observation that the largest cities and regional centers offer a greater variety and quantity

of diverse services than smaller settlements and rural areas, where the availability of services is limited due to the low number of providers. Nevertheless, it must be asked: is this relationship truly valid? The common-sense notion that the number of service providers is correlated with the provision of services may be incorrect. Thus, rigorous data-driven testing of this hypothesis is necessary.

This paper empirically examines the relationship between the number of employees at law firms (designated here for simplicity as lawyers) in Russian cities and the provision of legal services. The existing literature on the availability of services typically focuses on medical services (Joseph and Bantock 1982; Doorslaer, Masseria, and Koolman 2006; Weiss et al. 2020; Maleki et al. 2024), with relatively little attention paid to legal services. Nevertheless, there is a growing recognition that spatial aspects of legal services, though understudied by geographers, are worthy of investigation (M. Blacksell et al. 1988; Patel, Balmer, and Pleasence 2008). This is because they are directly related to the rule of law, the protection of human rights, and the support of social order and stability. The analysis is based on the open data about small and medium-sized businesses (SMB) published by the Federal Tax Service (FTS) of Russia. The primary research question is how the specific provision of legal services is influenced by the number of lawyers (employees at law firms). Additionally, the study aims to identify geographical patterns of the legal services provision.

Materials and methods

Data. This research uses a geocoded dataset on small and medium-sized law firms incorporated in Russia. The dataset is derived from FTS open data dumps (archives) of the state SMB Registry (Federal Tax Service of Russia 2024b) and FTS open data on the average number of employees of organizations (Federal Tax Service of Russia 2024a), which were processed using the Python command-line tool *ru-smb-companies* developed by the author of the paper. The dataset contains information about distinct companies, including their names, taxpayer IDs, regions and settlements of incorporation, and main activity codes.

Law firms were selected based on a main activity code equal to 69.10. This selection technique was derived from the analytical paper on the Russian legal services market prepared by the members of the Institute for the Rule of Law (Moiseeva and Skougarevskiy 2016). Furthermore, the dataset was subjected to the following filters: the year was set to 2021, the company was identified as an organization rather than a sole entrepreneur, the company had declared non-zero revenue and expenditure for the target year (implying that the company was active), and the company's address of registration was in a city rather than in a rural area. In addition to the main dataset, data on city populations was utilized from a freely distributed commercial source (HFLabs 2021).

During the exploratory data analysis, six cities were identified as outliers and subsequently excluded from the dataset. Two of the cities, Moscow and Saint Petersburg, were removed due to the extremely high number of employees at law firms: 18,866 and 5,550, respectively. In contrast, the next city had a considerably smaller number of employees, with less than 2,000. The remaining four cities (Innopolis, Kirovsk, Bronnytsy, and Krasnoarmeisk) are distinguished by a markedly elevated proportion of law firms' employees in their respective populations. This proportion ranges from 38 per 10,000 in Krasnoarmeisk to 417 per 10,000 in Innopolis, in stark contrast to less than 20 per 10,000 in all other cities. After applying all the filters and removing the outliers, the dataset contains information about 576 cities.

Methods. The primary analytical technique employed in this study is linear regression. The independent variable in the regression is the number of lawyers (employees at law firms) in a city, which is denoted as n. In theory, either the number of law firms or their employees may be used as the independent variable, but law firms in different cities may have different sizes, and thus the number of employees seems to be a more stable and consistent metric. The value for each city is calculated as the sum of the number of employees of each law firm incorporated in that city. If a law firm reports a zero count of employees, it is assumed that the number of employees is equal to one. The dependent variable in the regression is the specific provision of legal services which is denoted as p and calculated by dividing the number of employees at law firms in the city by the city's population and multiplying the result by 10,000. In other words, it is the number of lawyers per 10,000 people. This formula represents a modified version of the legal market saturation metric used in the analysis of the Russian legal services market conducted by the Institute for the Rule of Law (Moiseeva and Skougarevskiy 2016).

Cities were classified according to their population size. The population-based categorization is conducted following the classification system proposed by Lappo (1997). This is done to ascertain whether the hypothesized relationship is dependent on the city size. Linear models were constructed for the entire dataset, without accounting for the groups, or within each group separately. If necessary, the variables were log10-transformed. The results are then presented in graphical form on the plots. The analysis was conducted in the R programming language in conjunction with additional packages. The source code for this paper can be accessed via the public repository: https://github.com/PavelSyomin/ru-smb-companies-papers/tree/main/legal-services-provision.

Theoretical model. Although the modeling described earlier appears straightforward, it is based on a theoretical mathematical framework, and several potential outcomes can be identified before analyzing the data. It is known that a simple linear model is described by the two coefficients: the intercept, which is a term of the linear equation showing the relative shift of the regression line along the y-axis, and the slope, which is a coefficient of the independent variable showing the angle between the regression line and the x-axis. The slope can be either positive, negative, or zero. As a special edge case, it can be also infinite (that is, the regression line is vertical), although, strictly speaking, such a dependency is not a mathematical function. Consequently, the linear fit previously described can yield a result of one of four types, each corresponding to one of the slope options and, subsequently, the pattern of relationship between the number of lawyers and the provision of legal services. These types are illustrated in Figure 1.

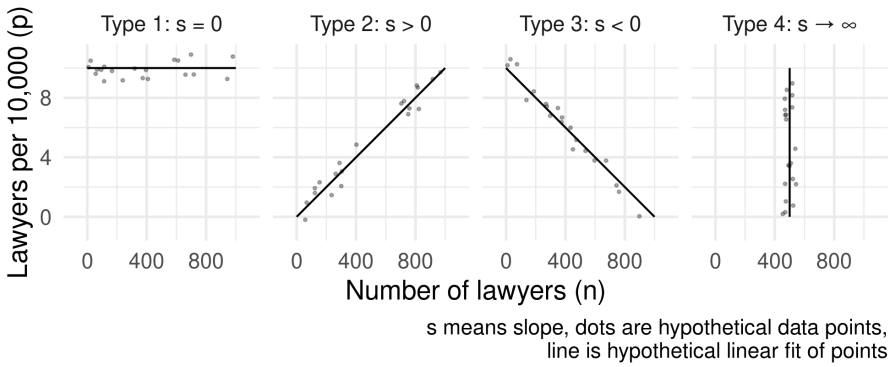

Figure 1 – Four plots showing four types of the theoretical relationship between the number of lawyers and the provision of legal services in citie**s**

In the context of regression analysis, Type 1 corresponds to the zero slope. In this instance, the regression line is horizontal. From the standpoint of legal services provision, it describes the absolute equality in the delivery of legal services across cities and its independence of the number of lawyers. This type can be also described as optimal, as it ensures equitable access to legal services (at least in spatial terms). Type 4, similarly to Type 1, also indicates the independence between the number of lawyers and the provision of legal services. However, in this case, the number of employees at law firms is fixed, rather than their proportion in the population.

Type 2 is defined by the positive slope and, consequently, a positive linear relationship between the number of lawyers and the provision of legal services. It appears that in a free market, this type is the most probable, although the specific value of the slope may vary. In such a scenario, the greater the number of lawyers, the easier it is to find a lawyer, and vice versa. In contrast to Type 2, Type 3 exhibits a negative regression slope and a negative relationship between the number of lawyers and the provision of legal services. This type may emerge when there is an unexpected and rapid migration of people from the smallest cities to the largest with a nearly uniform (Type 1) distribution of legal services provision as a prerequisite. In such circumstances, the specific provision of legal services in the smallest cities increases at a high rate due to the population loss. However, in the largest cities, the number of lawyers cannot grow as fast as

the population, leading to a decline in the specific provision of legal services. As a result, the slope of the regression line becomes negative.

Results and discussion

Figure 2 depicts the relationship between the number of lawyers and the provision of legal services. The overall connection between these variables appears to be nonlinear, with a square root function providing a satisfactory fit. However, the same relationship within each population size group is well-fitted by a linear model in most cases. As illustrated in Table 1, the coefficients of these linear models differ, and the slope declines as the city population increases. The regression line for small cities is close to Type 4, and the small coefficient of determination ($R^2 = 0.11$) indicates that the provision is almost independent of the number of lawyers, likely due to the low variance of the latter. The modeled relationship in millionaire cities resembles Type 1, which is another option for independence caused by relatively uniform and equal provision regardless of the number of lawyers. The coefficient of determination here is also relatively low ($R^2 = 0.51$), although greater than in the group of small cities. Cities of medium to extra-large size are characterized by a positive correlation between the number of lawyers and the provision of legal services, which can be classified as Type 2. The coefficient of determination is high (R^2 is approximately 0.9), indicating that nearly all the variance in the provision of legal services can be explained by the number of lawyers.

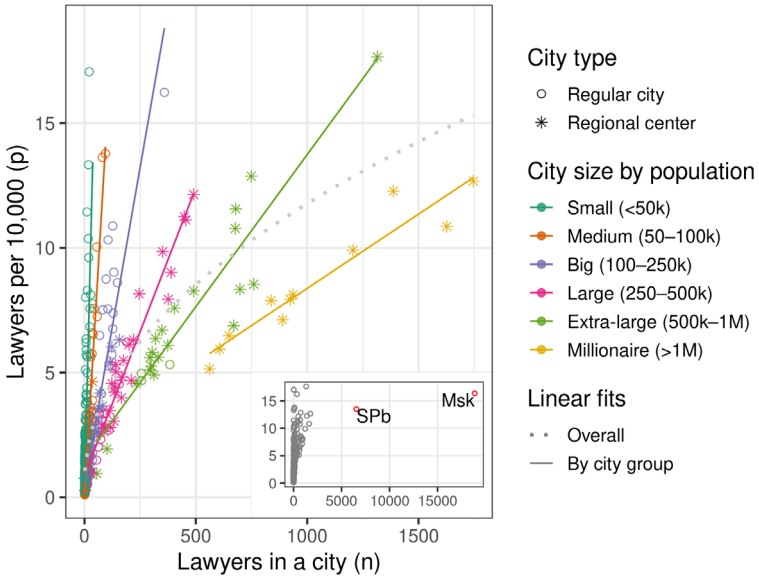

Figure 2 – The relationship between the number of lawyers and the provision of legal services in cities

Table 1 – Summary of linear models fitted for each city population size group. All models and coefficients are statistically significant ($p < 0.05$), except for intercepts in small and medium cities

City size	Intercept	Slope	R^2	# of cities
Small (<50k)	1.87	0.3502	0.11	268
Medium (50–100k)	-0.07	0.1503	0.95	144
Big (100–250k)	0.45	0.0511	0.87	91
Large (250–500k)	0.88	0.0231	0.94	36
Extra-large (500k–1M)	1.55	0.0122	0.88	24
Millionaire (>1M)	8.15	0.0005	0.52	13

In general, regional centers have a relatively high number of lawyers and a considerable level of legal services provision. This observation is likely attributable to the phenomenon of regional centralization: economic activity and commercial services are concentrated in the administrative centers of regions, which host the governmental bodies and are often the most populous cities within a region. Moscow and Saint Petersburg, although excluded from the data analysis and shown separately on a subplot (see bottom right frame in Figure 2), are two notable outliers with an extremely high number of lawyers and a high level of legal services provision. Moscow accounts for approximately one-third of all employees at law firms, while Saint Petersburg accounts for approximately 10%. The position of the corresponding data points relative to the main regression lines suggests that there is a saturation point, at which a further increase in the number of lawyers has little effect on the provision of legal services.

The general tendencies observed in Figure 2 should be supplemented by an analysis of the cities distribution shown in Figure 3, which extends Figure 2 and displays the binned count of cities according to the number of lawyers and the provision of legal services. The overwhelming majority of cities exhibit a low level of both legal services provision and law firm development. A mere 18 cities are distinguished by a high number of lawyers, exceeding 500. It is noteworthy that a high number of lawyers is favorable to the legal services provision, as all of these cities are at least at the medium level of provision, and none of them has less than 5 lawyers per 10,000 people. However, cities with a relatively low number of lawyers can reach top performance in legal services provision that is on par with the cities with the highest number of lawyers. Moreover, it appears that such small yet well-served cities are even more prevalent than cities with a high level of both law firm development and legal services provision. The relative location of bin counts in Figure 2 suggests that, in addition to the dominant bottom left corner, there are two main clusters of cities representing two distinct approaches to achieving a high level of legal services provision. One approach is to increase both the absolute number of lawyers and the relative number of lawyers per population, which is characteristic of the largest cities. A second approach is to have a relatively small yet sufficient number of lawyers, which may be typical of small and medium cities.

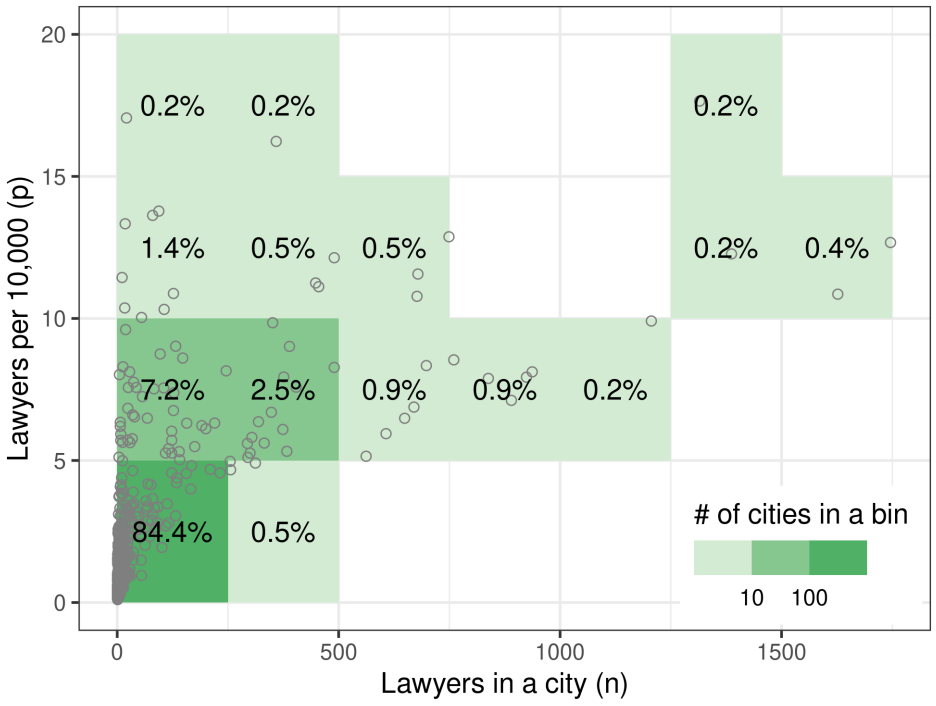

Figure 3 – Count and proportion of cities with various combinations of number of lawyers and the level of legal services provision

Figure 4 presents a map of cities with relatively high (more than 5 lawyers per 10,000 people) provision of legal services. The most prominent cluster is formed by Moscow and its satellite cities. Other notable cities with high provision include Krasnodar and Stavropol in the south of Russia, Yekaterinburg and Chelyabinsk in the Urals, and Tyumen and Novosibirsk in Western Siberia, as well as Irkutsk in Eastern Siberia. There are several regions with no cities that provide a high level of legal services provision (in particular, the Far East, North, and Caucasus). Conversely, the majority of cities with a relatively high level of legal services provision are located in five economic regions of the country, as categorized by Leyzerovich (2010): Central, Central-Chernozem, Volga-Vyatka, Volga, Ural.

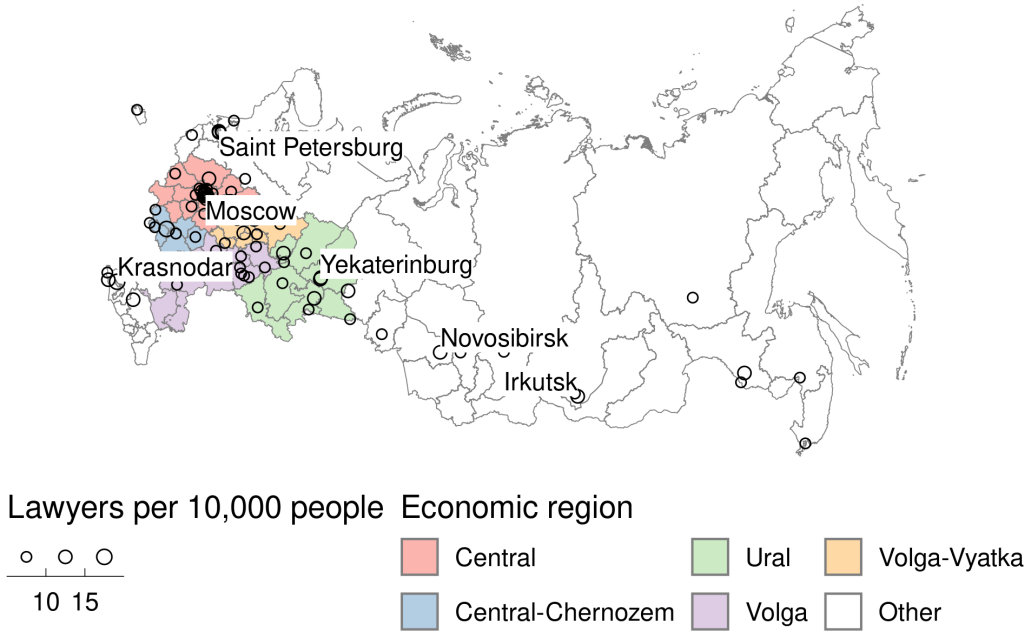

Figure 4 – Map of legal services provision in Russian cities.
Only cities with more than 5 lawyers per 10,000 people are shown

Conclusion

The provision of legal services in cities has a positive relationship with the number of lawyers. The overall trend can be approximated by a square root curve, while the relationship in distinct population size groups is close to linear with varying slopes of the regression line. In small cities, the increase in the number of lawyers has a minimal impact on the level of legal services provision. In larger cities, the relationship is linear and positive. In cities with a population above one million, the impact of the growth of the number of lawyers on the provision of legal services is less pronounced, as the latter is already high and uniform in these cities. Regional centers typically have a relatively high provision of legal services. Moscow and Saint Petersburg are distinguished by the highest number of lawyers and the high provision of legal services. Empirical data indicates that there may be a saturation limit beyond which the increase in the number of employees at law firms does not have a substantial impact on the provision of legal services

The majority of cities (approximately 85%) are characterized by a paucity of lawyers and a correspondingly limited level of legal services provision. Two distinct groups of cities can be identified based on their approach to achieving a high level of legal services provision. The first group is comprised of cities with a large number of lawyers. The second group, in contrast, has a small number of lawyers that nevertheless meet the needs of local communities. Moscow and its surrounding region exhibit a relatively high level of legal services provision. Similarly, Saint Petersburg, Krasnodar, Stavropol, Yekaterinburg, Chelyabinsk, Tyumen,

Novosibirsk, and Irkutsk also have a satisfactory provision of legal services. Most of the cities with high levels of legal services provision are situated within five economic regions of the country: Central, Central-Chernozem, Volga-Vyatka, Volga, and Ural. Conversely, in numerous regions of the Far East, North, and Caucasus the provision of legal services is notably limited.

The findings of this study can serve as a scientific foundation for data-driven decision-making by federal and regional government bodies, local authorities, and private actors. The federal government can use the results to develop a policy framework for supporting the establishment of small and medium-sized law firms, particularly in the regions and cities where the availability of legal services is limited, or for stimulating the export of legal services from cities with a high level of provision to the peripheries. This could be achieved, for instance, by creating local offices of central law firms or providing online consultations. Regional and local authorities may utilize the findings to make informed decisions about the actions required for the development of local law business, taking into account the city population size and the identified strategies for achieving a high level of legal services provision. It is important to note, however, that in certain instances, a "do nothing" approach may be optimal, because it has been found that some cities with a small number of law firms nevertheless provide a high level of legal services, and therefore no government intervention is necessary. Private actors, such as law firms, may use the results of this study to inform their spatial expansion plans. For consumers, the results of this study may provide knowledge about the spatial patterns of legal services provision, enabling them to make decisions about where to seek legal advice. Finally, the data acquisition technique described in this study can be used to re-obtain information about the individual law firms and perform its additional analysis aligned with specific objectives.

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Information about author:

Pavel Syomin – 3rd year PhD student of the Department of Social and Economic Geography of Perm State University (Perm, Russia, e-mail: ntsp@ya.ru)

Автор туралы мәлімет:

Павел Сёмин – Пермь мемлекеттік университетінің әлеуметтік-экономикалық география кафедрасының 3 курс PhD докторанты (Пермь қ., Ресей, эл.пошта: ntsp@ya.ru)

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