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ANDREY PUSHKAREV
Ural Federal University, Russian Federation

OLEG MARIEV
Ural Federal University, Russian Federation

NATALIA DAVIDSON
Ural Federal University, Russian Federation

THE EFFECT OF SPATIAL CONCENTRATION ON THE BUSINESS PERFORMANCE IN VARIOUS TYPES OF RUSSIAN CITIES

Abstract:

This paper empirically analyzes the effect of spatial concentration of economic activities on enterprise productivity, using Russian firm-level data. Panel data allows us to control for endogeneity biases associated with estimation of agglomeration economies, using fixed effects method. Our results show that Russian firms benefit from the share of similar enterprises in the total city revenue and urbanization, also that these advantages differ by city type. We also find a lack of connection between the level of wages and the revenues of firms for cities within agglomerations (while for other types of cities this effect is significant and positive). We assume that this is primarily due to the role of the agglomeration center, which determines the level of wages in all cities of the agglomeration. The results show that for the optimal development of territories it is necessary to pursue a diversified regional policy.

Keywords:

spatial concentration, localization, urbanization, home market potential, Russian cities

JEL Classification: D24

Introduction

It is well known that the territories within the countries develop unevenly. Some cities flourish and show high economic development, while others have steadily declining economic activity.

This fact raises several crucial questions. First, whether the enterprises choice of location is the optimal one. If the distribution of enterprises is not optimal, it may be important to use certain regulation, for example, cluster policy. Second, whether the economic policy should strengthen spatial equality or, vice versa, support successful territories. On the one hand, successful territories contribute to the overall economic growth of the country. On the other hand, excessive inequality between territories leads not only to social instability, but also to a reduction of human capital that ultimately undermines economic growth. In this article, we try to shed light on these problems. We study the influence of the spatial concentration of economic activity on the productivity of enterprises, while considering urban and regional characteristics.

Usually agglomeration defines as the spatial concentration of economic activity on a limited territory. Such high concentration leads to the external agglomeration effects, i.e. economies of scale and high volume of economic activity, which can have both positive and negative impacts (Neffke, 2009). The evaluation of economies of scale caused by agglomerations is vital for regional policy development. For example, studies of French territories indicate that firms choose territories with the optimal level of localization by their own disregard to special policy implications (Martin et al., 2011). However, in Russia the situation may differ. In the Soviet Union the location choice of the enterprise was lead mostly by social need and political factors, not by economic efficiency (Mikhailova, 2011). Moreover, it can be assumed that there is a significant path dependence in the location of firms. That means that firms are located in the same territories where other firms of the field are based and the decision making about location is made by the same principles as it was made by firms which were allocated before.

Following Davidson and Mariev (2018) to make a distinction between different aspects of agglomerations, in this paper we study localization and urbanization economies. Localization economies are associated with the concentration of economic activity in the same field within the location (city), while urbanization economies are associated with economies of scale from diversity and external effects from the economic activities of firms in different industries in the same city (Rosenthal and Strange, 2004; Jacobs, 1969).

Research results regarding agglomeration externalities are contradictory. Beaudry and Schiffauerova (2009) in their review show that in more than 60% of empirical studies, only positive localization effects are present, both positive and negative external effects are present in 13% of articles, and in 24% of studies external effects are considered insignificant. De Groot et al. (2009) presents a meta-analysis of existing studies and concludes that the choice of a dependent variable, control variables, and the method of constructing agglomeration indices affect their effects and significance levels. In addition, differences between observation periods and

country-specific characteristics affect the estimates of the effects of agglomeration (Neffke, 2009).

A high concentration of economic activity can also be associated with a number of negative effects, for example, such as "overcrowding", high transport costs, environmental and social problems. In this regard, some researchers propose a hypothesis about an inverted U-shaped form of economy from agglomerations (Mirrlees (1972)).

However, there is strong evidence that agglomerations economies have a positive impact on enterprise productivity (Brunow and Blien, 2014). For instance, in Russia enterprises in urban agglomerations, show 17-21% higher labor productivity than outside the agglomerations. Other studies show that localization and clustering in the city are not the cause of the increased labor productivity, while regional intra-industry clustering explains the observed increase in productivity (Gonchar and Ratnikova, 2012). Our study contributes to the existing literature, shedding some light on the features of localization and urbanization for different types of cities.

With regard to the economic foundations of economies of agglomerations, there are three main mechanisms: sharing, matching, and learning (Duranton and Puga, 2004). Sharing mechanisms imply that agglomerations facilitate the sharing of some common indivisible resources between firms: infrastructure, a variety of intermediate resources, qualified workforce and shared risks. Comparison mechanisms (associations on the labor market) determine the creation of groups of qualified workers who reduce the costs associated with employees training. Finally, more effective learning mechanisms (technological and secondary knowledge) enable more intensive innovations in a diverse agglomeration environment, stimulated by secondary information effects. The localizations economies are explained by all three fundamentals, but the coordination mechanisms are especially important. Diversity economies are mainly based on the learning mechanism, which also contains a sharing mechanism.

Data. In this study we use data from the SPARK-Interfax firm level, supplemented by regional and city data of the Federal State Statistics Service (Rosstat). The data also contains an investment risk indicator calculated by the analytical agency Expert. Such a data set provides a detailed overview of the business climate in the considered cities and regions. The sample contains 7111 firms in manufacturing enterprises [Enterprises in Section C of NACE ver. 2.] The study considers the period from 2000 to 2008, thus, the period includes years after the crisis of the late 90s and until a series of crises after 2009. We consciously choose such a period of observation, in order to reflect, on the one hand, the dynamics of location and productivity of firms during a period of dynamic growth, and, on the other hand, to exclude the effects of crises that can create additional noises not related to the research question.

We choose manufacturing enterprises producing tradable goods for analysis as it is difficult to estimate the economies from agglomerations for firms producing non-tradable goods, since, such firms often have a local monopoly, which leads to an increase in their profits. In addition, companies producing traded goods are relatively more sensitive to economies from agglomerations compared to, for instance, the

mining industry, which location depends on the availability of natural resources in a region.

Classification of locations. Our sample contains 1027 cities from 76 regions of the Russian Federation. We divide cities by agglomeration centers, cities within the boundaries of agglomerations, single-industry towns within the agglomerations, single-industry towns without agglomerations, and other cities. The studies do not consider urban-type villages and villages, since they are usually quite small and Rosstat does not provide data on them.

Following the logic presented in the work (Gonchar (2010)), and based on the possibilities of cities to take advantage of the proximity of the agglomeration center, we define cities within the agglomerations as cities located 60 km from the agglomeration center. Agglomeration centers are cities with a population of more than a million people and cities with high economic activity. Single-industry towns can be described as cities with one or several firms of the same industry employing the majority of residents. We analyze 17 agglomeration centers, 105 cities and towns within agglomerations, and 94 single-industry towns. 24% of firms in the sample are located in the agglomeration centers, 29% - within agglomerations; 5% of firms are located in the single-industry towns.

Econometric model. We evaluate the impact of agglomerations on the revenue of enterprises, considering indicators at the level of enterprises, industries, cities and regions. The following model is used for analysis:

$$\ln(revenue)_{ti}^{jz} = \beta_0 + \beta_1 \ln(capital)_{ti}^{jz} + \beta_3 \ln(labour)_{ti}^{jz} + \beta_4 \ln(loc^2)_{ti}^{jz} + \beta_5 \ln(core)_{ti}^{jz} + \beta_6 \ln(urb)_{ti}^{jz} + \ln(wage)_t^z + \ln(autoraod)_t^r + \ln(rwroad)_t^r + \ln(grppc)_t^r$$

where *j* is a field index *z* city index, *r* regional index, *i* firm index, and *t* – period. The estimations are based on the logarithmic Cobb-Douglas function. The description of dependent and independent variables can be found in Table 1.

The econometric analysis includes fixed effects at the enterprise level. Robust standard errors were used in the analysis. Analysis is provided for both the overall data set and for sub-samples for different cities types.

Table 1**.** Variables list

Variable	Definition
Enterprise Characteristics	
$\ln(revenue)_{ti}^{jz}$	Logarithm of the company's revenue (in rubles)
$\ln(capital)_{ti}^{jz}$	Logarithm of fixed assets (in rubles)
$\ln(labour)_{ti}^{jz}$	Logarithm of the number of employees
Agglomeration Indexes[1].	
$(\ln(loc)_{ti}^{jz})^2$	The square of the localization logarithm calculated as:

[1] All coefficients are calculated based on three digits in Russian Classifier of Types of Economic Activities

Variable	Definition
	$\ln(loc)_{it}^{jz} = \ln(revenue_t^{jz} - revenue_{it}^{jz} + 1)$, Where $revenue_t^{jz}$ – revenue of all firms in the field *j* in the city *z*; $revenue_{it}^{jz}$ – revenue of the firm *i*, in the field *j* and allocated in the city *z;*
$\ln(core)_t^{jz}$	Industry share *j* in the city z
$\ln(urb)_{ti}^{jz}$	The logarithm of the coefficient of urbanization $\ln(urb)_t^z = \ln(revenue_t^z - revenue_t^{jz} + 1)$ where $revenue_t^{jz}$ – revenue of all firms in the field *j* in the city *z;* $revenue_t^z$ – revenue of all firms in the city *z;*
City level Characteristics	
$\ln(wage)_t^z$	Average nominal wage, rub. (proxy variable for human capital)
Regional Characteristics	
$\ln(autoraod)$	The density of roads in the region r, kilometers of roads 1000 square kilometers
$\ln(rwroad)_t^r$	Density of railways in the region r, kilometers of roads 1000 square kilometers
$\ln(grppc)_t^r$	GRP per capita, rubles.

The model was evaluated for all firms belonging to industries that produce tradable goods, for the entire sample, as well as for various types of cities. The dependent variable was the logarithm of the revenue of enterprises, the results of constructing econometric models are presented in Table 2.

Table 2. Evaluation of econometric models for various types of cities

	(1) All cities	(2) Agglomeration centers	(3) Other cities within agglomerations	(4) Single-industry cities	(5) Other
ln(capital)	0.213***	0.241***	0.225***	0.248***	0.193***
	(0.005)	(0.050)	(0.011)	(0.012)	(0.003)
ln(labour)	0.518***	0.438***	0.437***	0.352***	0.589***
	(0.0035)	(0.006)	(0.016)	(0.012)	(0.00458)
ln(loc)^2	0.000116*	0.000248	-0.00108***	-0.000698***	0.0000887
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
core	3.946***	4.819***	4.020***	3.456***	3.908***
	(0.052)	(0.258)	(0.171)	(0.149)	(0.058)
ln(urb)	0.266***	0.106***	0.257***	0.238***	0.273***
	(0.007)	(0.032)	(0.027)	(0.022)	(0.008)
ln(wage)	0.299***	0.311***	0.00273	0.199***	0.344***
	(0.018)	(0.048)	(0.111)	(0.063)	(0.022)

	(1) All cities	(2) Agglomeration centers	(3) Other cities within agglomerations	(4) Single-industry cities	(5) Other
ln(a_road)	-0.0391**	-0.101***	-0.0776	-0.137*	-0.0222
	(0.016)	(0.034)	(0.069)	(0.070)	(0.020)
ln(rw_road)	-0.123***	-1.163**	-8.219***	-0.0111	-0.128***
	(0.027)	(0.532)	(1.644)	(0.069)	(0.028)
ln(grp_pc)	0.0846***	0.203***	0.396***	0.186***	0.0329
	(0.02)	(0.047)	(0.114)	(0.069)	(0.024)
Firm-level fixed effects	Yes	Yes	Yes	Yes	Yes
adj. R^2	0.434	0.412	0.484	0.516	0.444

Standard errors are provided in brackets
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Control variables at the firm level all behave as expected. The localization indicator in a number of city types turned out to be statistically insignificant; for cities in agglomeration areas and single-industry towns; it has a weak negative effect.

The core effect is positive for all types of cities, while the strongest effect is observed for agglomeration centers and cities included in the agglomeration, which corresponds to the economic intuition. The effect of urbanization is the strongest for ordinary cities, and the least for agglomeration centers. We also obtain an interesting result, showing the effects of wage levels in cities that are part of the agglomeration, but are not the center of them. The salary effect is positive for all cities, but insignificant for cities within agglomerations. It may be explained by the fact that the labor market within the agglomerations is very closely connected with the labor market of the agglomeration center, and the labor flows to the agglomeration centers.

The density of roads and railways show inconsistent effects. For some samples, they are insignificant, and for some they have negative effect. This result most likely indicates a weak level of development of the transport system of Russia. Overall weak role of the indicator. As expected, the GRP per capita have the positive effect on the revenue.

Conclusion. Our results show that Russian enterprises benefit from industrial shares in territorial revenue (core) and urbanization, and that these benefits vary in different types of cities, but remain positive. Enterprises located in single-industry towns significantly benefit from the above factors, which deserve further study. The obtained results show that agglomeration factors in the formation of regional economic policies and spatial development policies are extremely important.

Our findings allow us to give an answer to the debatable question of whether economic policy should adhere to a strategy of uniform development within the country or support already successful territories. The obtained results indicate that cluster policy can contribute to approaching the optimal level of localization economies in Russia. In addition, the firms located in small towns should appear in political initiatives focus. Measures such as improving the business climate and promoting the formation of agglomerations with neighboring territories, in particular by improving transport infrastructure, can be beneficial for small towns.

We assume that enterprises located in territories with localization level exceeding the optimal one face competition for resources and consumers. Such enterprises will benefit from trading outside their city. For these firms the policies aimed at improving legislation, the business climate, business services and transport infrastructure would be the most beneficial.

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