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Does state cluster policy really promote regional development? The case of Russia

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Abstract. From the moment of adopting in 2008 the Conception of long-term socio-economic development of the Russian Federation up to 2020, containing basic provisions about the necessity of creating a network of clusters as a condition for modernization of economy and realization of competitive potential, 10 years have passed. In this article estimation of influence of cluster policy in Russia on indicators of socio-economic development of territorial entities of the Russian Federation is given. On the basis of methods of analysis of panel data economic models have been prepared which allow estimating the effects of realizing cluster policy. Panel data is characterized by a large quantity of observations and that increases the number of degrees of freedom and decreases multicollinearity of factors by means of accounting individual differences. It helps to get more efficient estimates. The analysis of influence of cluster policy on socio-economic indicators of regional development has been carried out on the basis of using models with fixed and random effects. Calculations have been made in the Statistics package Stata 13. Results of the investigation have shown that economic growth of regions on the territory of which clusters have got financial budget support is largely due to their initially high level of development.

1. Introduction

Today, competition for promising markets and attracting production factors from one side and mutually profitable cooperation and partnership from the other side lie in the basis of any forms of economic relations. At that, mechanisms of state support act as important tools of achieving high competitive ability of economic entities. One of such mechanisms is represented by clusters which have become a significant part of industrial and economic policy in many countries.

Cluster policy in the Russian Federation (RF) began in 2008 as a result of adopting the Conception of long-term socio-economic development of the Russian Federation up to 2020. This document contained provisions about the necessity of creating a network of territorial-production clusters as a condition for modernization of economy and realization of competitive potential of regions. Provision was made for forming two types of clusters — innovative high-technology (in urbanized regions) and territorial-production (on insufficiently assimilated territories focused on deep raw material processing



and energy production with the help of modern technologies). 2012 is the year of official creation of innovative clusters in Russia, when the Ministry of Economic Development of Russia announced a competition for selection of pilot programs of developing innovative territorial clusters [1].

According to data in the beginning of 2018 there are 115 clusters on the territory of 43 territorial entities. They include about 3500 enterprises with the staff number exceeding 1400 thousand people [1]. According to the Ministry of Economic Development of the RF data, for the period of 2013–2016, the total volume of financial support for cluster initiatives exceeded 7.61 billion dollars (including about 1.52 billion dollars from budgets of different levels and more than 6.09 billion dollars as investments from non-budgetary sources) [2]. Wide support of clusters from Russian authorities has objectively contributed to appearing a significant number of national studies and publications in this sphere ([3]–[10] and others). This activity of scientists is partly related to the fact that clusters are one of the few instruments which have gained a reputation of efficient practical leverage. Thus, according to the Ministry of Economic Development data, the volume of production within the framework of clusters has increased in 2013–2015 by 27% — to almost 30.45 billion dollars and the number of new highly-productive places has increased by almost 30% — to 36.1 thousand units in 2015 [11].

Our previous studies have confirmed that the regions where the clusters are based exceed other territories in terms of socio-economic development indicators [12].

At the same time, according to the Ministry of Economic Development explanations, clusters with higher degree of preparation have gained advantage during selection in the competition for financial support. Those who, even before the announcement of the competition, have passed a certain path in terms of organizational development, strategy development and project development aimed at the development of the cluster. Thus, financing was received by clusters located in territories with a deliberately developed production and scientific and technical potential. Therefore, determining the actual reasons of achieving the difference in indicators of development of territories with or without clusters is of objective scientific interest. Consequently, the aim of this study is estimation of influence of cluster policy on the development of regional economies in Russia.

2. Problem setting and literature review

The first local programs of supporting clusters in European countries began to be implemented in 1970–80's. By now, national programs of clusters development are being implemented in 26 European countries [13].

Experts in this field note that clusters positively influence development of economy by means of their impact on productivity, innovations and entrepreneurship [14]. This thesis was confirmed by multiple empirical studies. Presence of clusters contributes to increasing such important parameters of economic development of territories as employment, the level of salaries, licensing, the number of enterprises [15], stability of companies [16] and their development [17]. According to the analytical report of the European Commission, enterprises-participants of clusters undertake studies twice as often as Central European innovative companies [18], and the presence of strong clusters in a region increases the potential of growth of other branches and clusters [15]. Besides, scientists have demonstrated long ago the positive influence of clusters on indicators of competitive ability of national economies [19]. As a result, programs of clusters development in many countries are aimed at solving a wide complex of socio-economic problems of developing corresponding regions [20]. The main tasks of implementing cluster policy in Russia are: contributing to increase of competitive ability of enterprises and organizations which are a part of regional innovation clusters, improving the quality of life on the territories of their location; developing innovative, production, transport, energetic, engineering, residential and social infrastructure of RIC; attracting investments to the territory of RIC location, also attracting skilled workforce; developing the system of professional and continuous education; developing small and medium-sized entrepreneurship; developing international scientific-technical cooperation. In accordance with the aim of this study, we carried out economic-mathematical evaluation of the influence of the state cluster policy on the quality of solving problems set by the government.

3. Data and method

The study was undertaken by means of carrying out two subsequent stages: forming a base of data and constructing models of evaluating the implementation of cluster policy in RF regions. We'll consider each stage in detail.

Stage 1. Forming a data base for undertaking the study

In order to develop econometric models for estimation of cluster policy implementation we have constructed a base of statistical data for the regions of Russia where officially supported clusters are located. The statistical data for socio-economic indicators of Russian regions have been collected within 7 years (from 2009 to 2015) in 40 territorial entities of the RF on the basis of the official information of the Federal State Statistics Service of the RF [21]. The period for analysis is chosen not by coincidence: 3 years till the start of implementing cluster policy and 3 years after that, and also the year of starting direct implementation of cluster policy (2012). Information on the availability of clusters and their characteristics was collected from the site A Map of Clusters in Russia [21].

In order to reveal the effect of cluster policy influence on a region economy, we have analyzed the problems of cluster policy in Russia specified previously. We have highlighted four main problems; the results of their solving obviously influence socio-economic indicators of a region development (table 1).

Table 1. Statistical indicators reflecting the problems of cluster policy.

Tasks of cluster policy	Corresponding statistical indicators	Designation	Units of measurement
1. Increase of life quality on the territory of locating a cluster	Monthly average nominal accrued wages of employees	w	rub.
2. Contribution to attracting investments to the territory	Investments in the basic capital	inv	mln rub.
3. Development of small and medium-sized entrepreneurship	Small enterprises turnover (without micro-enterprises)	small	thousand rub.
4. Development of international scientific-technical and production cooperation	Foreign trade expressed in the amount of export and import with CIS countries and countries outside the former Soviet Union	im_ex	mln rub.

Thus, statistical indicators which reflect the tasks of cluster policy (table 1) appear in the models as dependent variables.

The following aspects are selected as regressors in the study:

1. the presence of a cluster in the region (cl) — a dummy-variable equal to 1, if there is a cluster in the region in t period and equal to 0 if there is no cluster in the region in t period;
2. the total number of clusters in the region in t period (ncl);
3. shares of clusters of the high (hl), medium (ml) and low (ll) levels of organizational development — the values are calculated by authors as the ratio of the number of clusters of the high, medium and low levels of development to the total number of clusters in the region in t period;
4. the level of subsidy assistance in t period, granted from the federal budget to the budgets of the RF territorial entities for implementing complex investment projects on clusters development (fin);
5. gross regional product per head in t period (grp). Its inclusion is aimed at preventing displacement of specification mistakes because it's the most common indicator of regional development.

Stage 2. Constructing models of evaluating implementation of cluster policy in the RF regions

For constructing models panel data is used, which is represented by a two-dimensional array: one of the dimensions — 'spatial' — is for economic regions ($i = 1, \dots, 40$), the other one is temporal ($t =$

2009, ..., 2015). An important advantage of panel data in comparison with a separate time sequence or a cross section is that they enable accounting and analyzing individual differences between sample units. In particular, they allow explaining why a certain sample unit behaves differently at various times. Besides, panel data is characterized by a large number of observations and that increases the number of degrees of freedom and decreases multicollinearity of factors by means of accounting individual differences. It helps to get more efficient estimates.

For constructing models on the basis of panel data regression models are used with fixed individual effects (fixed effect model) and regression models with random effects (random effect model).

We have conducted statistical tests in order to confirm substantial arguments for selecting the best models for evaluating the effects of cluster policy on socio-economic indicators.

F-test helps to choose between models estimated by the least squares method (LSM) and models with fixed effects. With the help of Breusch–Pagan test, selection is made between models estimated by LSM and models with random effects. Hausman test allows choosing between models with fixed and random effects.

For estimating the effects of cluster policy on the small enterprises turnover logarithm (1), specification of models is used with fixed effects:

$$\ln(\text{small}_{it}) = \alpha_i^1 + \beta^1 * cl_{it} + \gamma^1 * ncl_{it} + \delta 1^1 * ll_{it} + \delta 2^1 * ml_{it} + \delta 3^1 * hl_{it} + \mu^1 * \ln(\text{fin}_{it}) + \lambda^1 * \ln(\text{grp}_{it}) + u_{it}^1 \quad (1)$$

where $i = \overline{1, 40}$ — the region number; $t = \overline{2009 - 2015}$ — moments of time; u_{it} — a random mistake, all u_{it} independent and equally distributed, $u_{it} \sim iid(0, \sigma_u^2)$; α_i^1 — fixed effect of the i region. With the help of the fixed effect unobservable variables are simulated which do not change in the time of regions (cultural, climatic conditions and geographical and other indicators). The superscript in the models corresponds to the ordinal number of the model.

For estimating the influence of cluster policy on the salary logarithm (2), the level of investments in basic capital logarithm (3), the logarithm of foreign trade with CIS countries and countries outside the former Soviet Union (4) specification of the model with random effects is used:

$$\ln(w_{it}) = \theta^2 + \beta^2 * cl_{it} + \gamma^2 * ncl_{it} + \delta 1^2 * ll_{it} + \delta 2^2 * ml_{it} + \delta 3^2 * hl_{it} + \mu^2 * \ln(\text{fin}_{it}) + \lambda^2 * \ln(\text{grp}_{it}) + \varepsilon_{it}^2 \quad (2)$$

$$\ln(\text{inv}_{it}) = \theta^3 + \beta^3 * cl_{it} + \gamma^3 * ncl_{it} + \delta 1^3 * ll_{it} + \delta 2^3 * ml_{it} + \delta 3^3 * hl_{it} + \mu^3 * \ln(\text{fin}_{it}) + \lambda^3 * \ln(\text{grp}_{it}) + \varepsilon_{it}^3$$

$$\ln(\text{im_ex}_{it}) = \theta^4 + \beta^4 * cl_{it} + \gamma^4 * ncl_{it} + \delta 1^4 * ll_{it} + \delta 2^4 * ml_{it} + \delta 3^4 * hl_{it} + \mu^4 * \ln(\text{fin}_{it}) + \lambda^4 * \ln(\text{grp}_{it}) + \varepsilon_{it}^4 \quad (4)$$

where θ — constant; $\varepsilon_{it} = \alpha_i + u_{it}$, that is it is supposed that an individual region effect α_i is not a fixed value but a random value, at that $\alpha_i \sim iid(0, \sigma_\alpha^2)$; a random individual effect is a part of a random mistake.

In order to get a correct value of the coefficient of determination in models with fixed effects we calculated the coefficients of the model, estimated by means of LSM but with individual dummy-variables in the region. Estimation of models and conducting tests was implemented in the Statistics package Stata 13.

4. Results and discussion

Results of the constructed models for estimating implementation of cluster policy in the RF regions are represented in table 2. We interpret the models obtained.

4.1. The influence of cluster policy on salary

Salaries and wages in a region are greatly impacted by the level of GRP per head and the volumes of financing the entities of cluster structures. At that, increasing subsidy assistance for clusters by 1% will increase the wages only by 0.006%. This result is explained by the fact that in general subsidies are devoted to the development of the innovative and educational infrastructure. Whereas we are interested only in cluster policy indicators, from now on we'll not interpret the estimation of GRP influence on indicators of economy of regions. We should also note that in accordance with the estimations received, the fact that clusters exist in the region significantly influences the wages.

4.2. The influence of cluster policy on the level of investments in basic capital

In accordance with the estimations received regarding model coefficients, as the number of cluster increases the level of investments in basic capital increases as well.

4.3. The influence of cluster policy on small enterprises turnover

In accordance with the results, the growth of the share of clusters with a low level of organizational development negatively influences the volume of turnover of small enterprises. We reckon that it is related to the fact that when small business is included into clusters their turnover decreases. Probably it happens because of a flight of capital to the cluster core where large business is concentrated.

4.4. The influence of cluster policy on volumes of foreign trade with the countries of the FSU and beyond

Using the model with random effects, estimates of influence of the cluster policy on foreign trade volumes have been received. Thus, the fact that clusters exist on the territory of regions doesn't influence the volumes of import and export.

Table 2. Evaluation of influence of cluster policy on regional development indicators.

Variables		Small enterprises turnover logarithm	Salary logarithm	Level of investments in basic capital logarithm	Foreign trade volume logarithm
		Model with fixed effects		Model with random effects	
Dummy of cluster presence	cl	0.169**	0.051*	0.234**	0.117
Number of clusters	ncl	0.006	0.008	0.097***	0.003
Share of low-developed clusters	ll	0.138*	0.033	-0.158	0.039
Share of medium-developed clusters	ml	-0.136	0.057	-0.144	0.034
Share of highly-developed clusters	hl	-0.198	-0.063	0.019	0.174
Amount of financing	ln_fin	-0.002	0.006***	0.006	-0.007
GRP per head	ln_grp	0.823***	0.622***		
Constant	cons	8.463***	1.901***	11.587***	8.216***

Variables	Small enterprises turnover logarithm		Salary logarithm	Level of investments in basic capital logarithm	Foreign trade volume logarithm
	Model with fixed effects		Model with random effects		
Number of observations	N	280	280	280	280
Coefficient of determination	r ²	0.718			
Corrected coefficient of determination	r ² _a	0.662			
F- test		$F(39, 233) = 168,41$ $Prob > F = 0,0000$			
Breusch – Pagan test			$chibar2 = 407,43$	$chibar2 = 649,38$	$chibar2 = 591,37$
			$Prob > chibar2 = 0,0000$	$Prob > chibar2 = 0,0000$	$Prob > chibar2 = 0,0000$
Hausman test		$\chi^2 = 27,49$	$\chi^2 = 5,41$	$\chi^2 = 11,96$	$\chi^2 = 11,01$
		$Prob > \chi^2 = 0,0003$	$Prob > \chi^2 = 0,6098$	$Prob > \chi^2 = 0,0629$	$Prob > \chi^2 = 0,0880$

* $p < 0,05$; ** $p < 0,01$; *** $p < 0,001$

5. Conclusion

In this article the influence of cluster policy of the state on regional development indicators was evaluated. As a result of evaluating models with the help of the generalized least squares method (GLS) it was found out that the set cluster policy problems haven't been solved to the full extent. Thus, regarding the problem of increasing the quality of life on the territory of a cluster location, we should note that increasing subsidy assistance for clusters by 1% contributes to salary increase only by 0.006%; regarding the problem of contributing to attracting investments to the territory of clusters location we can say that the fact of their presence on the territory of the region increases investments amount; regarding the problem of developing scientific-technical and production cooperation we should note that the cluster policy does not influence the corresponding indicators; regarding the problem of developing small and medium-sized entrepreneurship we should note that the growth of the share of clusters with a low level of organizational development has negative influence on small enterprises turnover volume.

At the same time, according to the constructed models, the level of economic development of a region, in terms of GRP per head, greatly influences the indicators being studied – the objects of the cluster policy. Thus, the growth of the general economic position of regions of locating clusters, in comparison with other regions without clusters, is explained by the initial difference of territories in their development level.

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