Human Capital Multidisciplinary Research Centre

Does complementarity matter for the emergence of new specialization industries in the regions of Russia?

Kirill Tyurchev, Sabysachi Tripathi, Evgeniy Kutsenko

XI International academic conference
Foresight and science, technology and innovation policy

Moscow, 2021

Why are new specialization industries important?

- The arrival of new industries creates structural changes which are the crucial element of achieving sustainable development and increased wellbeing (Hausmann and Hidalgo, 2011; Boschma, 2017)
- The emergence of new specialization industries is accompanied by an increase in the innovativeness of the economy and the development of the KIBS sector (Fritsch and Slavtchev, 2010; Bishop, 2011)
- The emergence of new specialization industries leads to an increase in labor productivity (Braunerhjelm, 2008)
- New specialization industries leads to an increase in regional exports (Šimanová, 2012; Bhawe and Tyler, 2015)

Regional diversification: why new specialization industries emerge?

- Diversification of the region's economy is usually based on an existing set of local opportunities (Neffke et al., 2011; Rigby, 2015)
- Economic theory suggests that the emergence of new industries is determined by fundamental factors of production, such as the availability of labour, transport infrastructure, a critical mass of capital in a country or region (Hausmann & Klinger, 2006)
- Demand or market potential is also another very important factor that has an impact on the emergence of the new specialization industry (Schmookler, 1966)
- If the region does not have a critical mass or the necessary capital for the development of a certain industry, then the neighboring region can affect this development due to the spillover effect (Content & Frenken, 2016; Hidalgo et al., 2007)

Regional specialization diversification: the role of relatedness

- Industries are more likely to emerge and develop in a region when they are related to preexisting industries in the region (Neffke, 2011)
- Xiao et al. (2018) found that the development of new industry specialization is positively associated with the new industry's relatedness to the region's current industries
- If new industries are not related to the existing industry structure, diversification may have a mixed effect on long-term economic development (Noteboom, 2000)
- A region has a high probability of developing a certain industry if a neighboring region specializes in it (Bahar et al., 2014; Boschma et al., 2017)
- (Balland and Boschma, 2021) on the basis of patent data, empirically confirmed the importance of interregional complementarity in the absence of new technologies in the regions

Hypotheses

New specializations industries are more likely to occur in regions if related industries are located in…

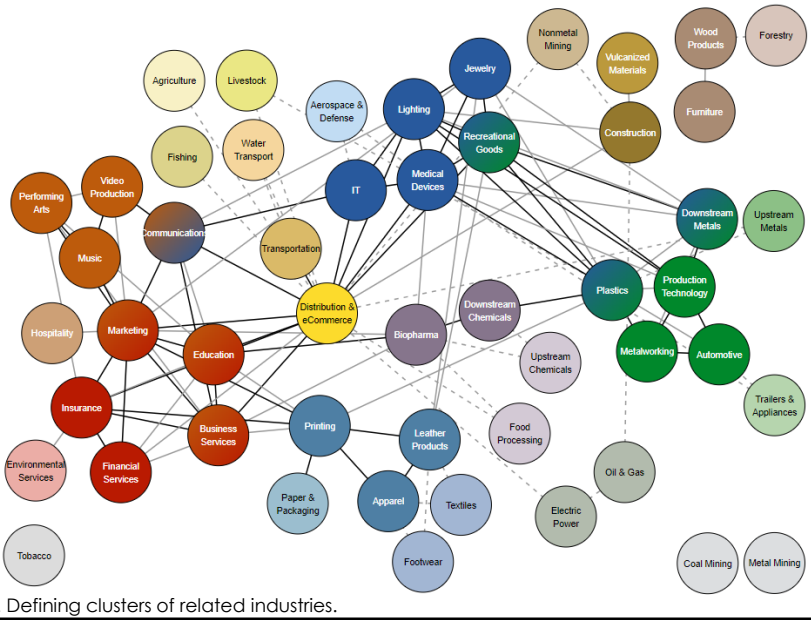
own region

neighboring regions

Map of Related Industries

Identified 51 industries, consisting of related economic activities

In addition, the links between the industries themselves are identified



Delgado, M., Porter, M. E., Stern, S. (2016). Defining clusters of related industries.

Methodology for identifying specialization industries

1 Data collection

Statistics on employment and wages for 2005-2015 in all Russian regions (detailed up to the fourth digit of the Russian National Classifier of Economic Activities)

2 Identifying specialisation industries

Meeting at least one criteria

Concentration
TOP-20% of regions by the share of employed in the industry

Localisation
TOP-20% of regions by the share of the industry in regional employment to the share of the same industry in national employment

Productivity
TOP-20% of regions by average wage

Dynamism
TOP-20% of regions by employment growth rates

3 Passing additional criteria

Compliance with the conditions

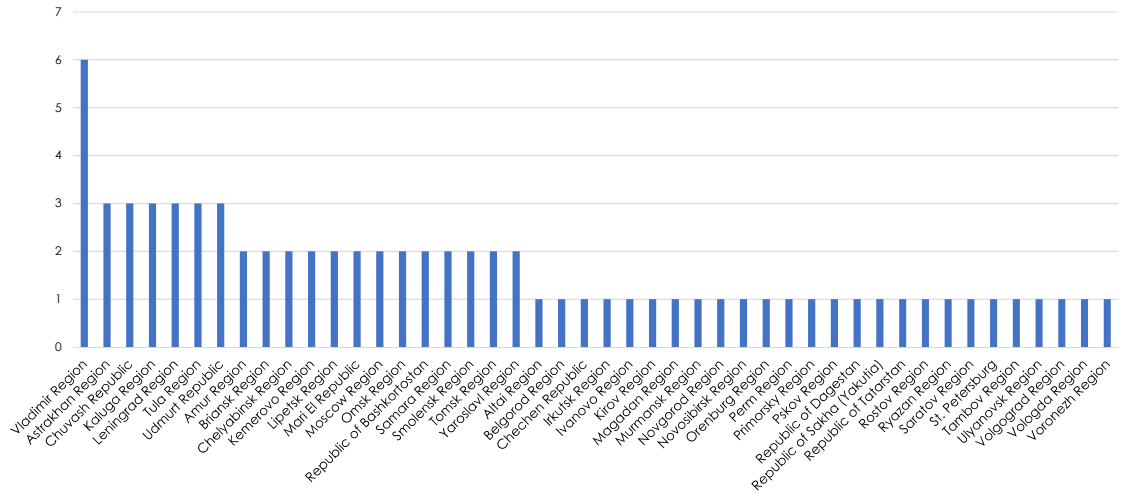
Concentration
Joining the list of the first regions that form 80% of the country-wide employment in this industry

Localisation
Being in the top 20% of regions by this indicator

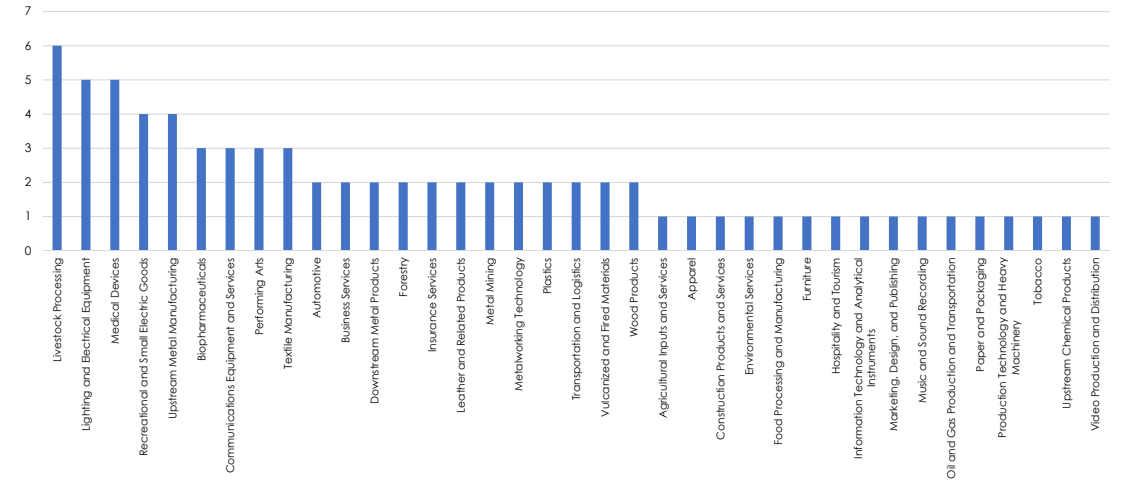
76 new specialization industries emerged in the Russian regions in 2005-2015

An industry of specialization is considered new if in none of the years of the period 2005-2007 it was a specialization industry of the region, and in each year of the 2013-2015 period it became such

Most of the new specialization industries emerged in the European part of Russia



Livestock Processing, Lighting and Electrical Equipment and Medical Devices - most frequently emerging new specialization industries



The Model

To test the hypothesis of the study, we used the following ordinary least square (OLS) econometric model:

$$NSA_i = \alpha_0 + \sum_{j=1}^{12} \alpha_i \boldsymbol{X}_i + e_i$$

Where **NSA** stands for new specialization industries
i indicates the region
j indicates the variable
X indicates a set of variables
A0 is constant
e represents well-behaved error term

HUMAN CAPITAL MULTIDISCIPLINARY RESEARCH CENTRE

Variable	Source
Dependent variable	
Number of new specialisation industries	Calculated by the authors
Independent variables	
Effect of complementary specialisation industries	
Share of new specialization industries related to existing specialization industries in the region	Calculated by the authors based on US Cluster Mapping
Share of new specialization industries related to existing specialization industries in the neighboring region	Calculated by the authors based on US Cluster Mapping
Control variables	
Impact of region size	
Number of specialization industries	Calculated by the authors
Number of employees	Rosstat
Market potential of the region	Calculated by the authors
Impact of existing skills	
Share of the working population with higher education	Rosstat
Influence of innovation activity	
Gross domestic expenditure on R&D (GERD) as a percentage of GRP	Rosstat
Number of domestic patent applications per 1 million labor force aged 15-72	Rospatent
Impact of wealth	
GRP per worker employed in the region	Rosstat
Infrastructure effect	
Existence of special economic zones (SEZs)	Russian Special Economic Zones
Effect of large cities	
Distance from the administrative center of the region to the nearest million-plus city	Google Maps
Square distance from the administrative center of the region to the nearest million-plus city	Google Maps

Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	C.V.
Dependent variables					
Number of new specialization industries (v1)	0.95	1.101208	0	6	115.9
Dummy of new specialization industries (1/0)	0.575	0.497462	0	1	86.5
Measurement of complementary specialization industries					
Dummy of the share of new specialization industries related to existing specialization industries in the region (1 indicates if more than 50%, otherwise 0)	0.36	0.483755	0	1	133.4
Dummy of the share of new specialization industries related to existing specialization industries in neighboring region (1 indicates if more than 50%, otherwise 0)	0.51	0.502997	0	1	98.1
Control variables					
Number of specialization industries	7.025	4.574904	0	15.7	65.1
Log of the total number of employees (2005-2007 average)	13.38	0.903286	10.44	15.62406	6.8
Log of differences in market potential (2005-2007 average)	13.31	1.005028	10.72	17.27148	7.5
Log of the share of working population with higher education (2005-2007 average)	3.13	0.17675	2.8	3.9	5.6
Log of gross domestic expenditure on R&D (GERD) as a percentage of GRP (2005-2007 average)	-0.76	1.119175	-3.53	1.521865	-147.0
Log of number of domestic patent applications per 1 million labor force aged 15-72 (2005-2007 average)	4.93	1.29375	-0.37	7.7	26.3
Log of GRP per worker employed in the region (2005-2007 average)	5.3	0.505516	4.28	7.22	9.5
Dummy of Special Economic Zones (industrial and logistics) (v8)	0.09	0.284349	0	1	325.0
Distance from the administrative center of the region to the nearest million-plus city (by road)	852.6	1503.931	0	6000	176.4
Square distance from the administrative center of the region to the nearest million-plus city (by road)	2960506	8265566	0	3.60E+07	279.2

12

OLS Results

Dependent variable:
Number of new specialization industries

What is needed to increase the number of new specialization industries?

- The complementarity of new specialisations with the industry profile of the region and neighboring regions turned out to be statistically significant and positive
- In a pairwise comparison, it showed that complementarity with neighboring regions is more important

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Dummy of the share of new specialization industries related to existing specialization industries in the region	0.251 (0.250)	1.051*** (0.265)			
Dummy of the share of new specialization industries related to existing specialization industries in the neighboring region	1.279*** (0.203)		1.453*** (0.178)		
Number of specialization industries	0.0330 (0.0351)		0.088*** (0.0258)		
Log of the total number of employees	-0.168 (0.115)			0.291** (0.122)	
Log of differences in market potential	0.245** (0.122)				0.311** (0.130)
Log of the share of working population with higher education	-0.399 (0.453)	-0.765* (0.446)	-1.011* (0.552)		-1.609** (0.724)
Log of Gross domestic expenditure on R&D (GERD) as a percentage of GRP	0.0513 (0.112)	0.0802 (0.127)			0.197* (0.118)
Log of number of domestic patent applications per 1 million labor force aged 15-72	-0.00396 (0.0911)	0.0858 (0.0793)			
Log of GRP per worker employed in the region	-0.0147 (0.145)			-0.276 (0.238)	
Dummy of Special Economic Zones	0.0830 (0.325)		0.00993 (0.413)		0.219 (0.453)
Distance from the administrative center of the region to the nearest million-plus city	0.000128 (0.000227)			-0.000442* (0.000262)	
Square distance from the administrative center of the region to the nearest million-plus city	-1.50e-08 (3.81e-08)			7.56e-08* (4.37e-08)	
Constant	0.274 (2.459)	2.601* (1.530)	3.493** (1.742)	-1.316 (1.649)	1.980 (2.698)
F stat	9.12***	10.24***	4.81***	3.46**	3.05**
Mean VIF	5.97	1.32	1.01	9.47	1.10

HUMAN CAPITAL MULTIDISCIPLINARY RESEARCH CENTRE

Probit Results

Dependent variable:
dummy of new specialization industries

What influences the process of launching the process of diversification of the regional economy?

- initial related diversified set of specialization industries have an important role in the emergence of new specialization industries
- the impact of demands and wealth do not show a statistically significant effect on the emergence of new specialization industries

VARIABLES	Model 7	Model 8	Model 9	Model 10
Number of specialization industries	0.0606 (0.0660)	0.131*** (0.0444)		
Log of the total number of employees	0.314 (0.311)		0.577*** (0.206)	
Log of differences in market potential	-0.00300 (0.223)			
Log of the share of the working population with higher education	-1.986* (1.078)			-1.779* (0.930)
Log of gross domestic expenditure on R&D (GERD) as a percentage of GRP	-0.110 (0.215)	-0.0965 (0.171)	0.0658 (0.144)	0.253* (0.150)
Log of number of domestic patent applications per 1 million labor force	0.306* (0.182)			
Log of GRP per worker employed in the region	-0.649 (0.405)	-0.407 (0.320)	-0.472 (0.325)	-0.00793 (0.308)
Dummy of Special Economic Zones	0.635 (0.674)	0.475 (0.536)	0.416 (0.532)	
Distance from the administrative center of the region to the nearest million-plus city	-0.000248 (0.000513)			-0.000508 (0.000426)
Square distance from the administrative center of the region to the nearest million-plus city	7.70e-08			7.02e-08
Constant	3.619 (5.223)	1.326 (1.662)	-5.012* (2.684)	6.227* (3.328)
LR chi2	21.28**	12.88**	12.18**	9.20*
Log likelihood	-42.5003	-48.1103	-48.456	-49.948
Pseudo R2	0.2002	0.1180	0.1117	0.0843

HUMAN CAPITAL MULTIDISCIPLINARY RESEARCH CENTRE

OLS Results

Dependent variable:
Modified number of new specialization industries

- The results show a similar effect of related industries on the emergence of new specialization industries

VARIABLES	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Dummy of the share of new specialization industries related to existing specialization industries in the region	0.0522 (0.228)		0.643*** (0.220)			
Dummy of the share of new specialization industries related to existing specialization industries in the neighboring region	1.080*** (0.165)					
Number of specialization industries	0.0172 (0.0250)		0.0167 (0.0243)	0.059*** (0.0211)		
Log of the total number of employees	-0.260** (0.114)	0.179** (0.0799)				
Log of differences in market potential	0.218** (0.107)					
Log of the share of working population with higher education	-0.0118 (0.393)	-0.410 (0.439)		-0.381 (0.424)		-0.411 (0.437)
Log of Gross domestic expenditure on R&D (GERD) as a percentage of GRP	0.103 (0.101)		0.0305 (0.115)			
Log of number of domestic patent applications per 1 million labor force	-0.0182 (0.0546)		0.0201 (0.0823)		0.124* (0.0666)	
Log of GRP per worker employed in the region	0.118 (0.128)	-0.145 (0.143)		-0.187 (0.142)		
Dummy of Special Economic Zones	0.328 (0.307)	0.227 (0.299)		0.222 (0.326)		
Distance from the administrative center of the region to the nearest million-plus city	0.000322* (0.000181)				-0.000234 (0.000177)	-0.000352* (0.000200)
Square distance from the administrative center of the region to the nearest million-plus city	-6.18e-08* (3.23e-08)				3.21e-08 (3.02e-08)	4.63e-08 (3.50e-08)
Constant	0.00380 (2.164)	0.300 (1.474)	0.236 (0.372)	2.416 (1.544)	0.156 (0.363)	2.113 (1.408)
R-squared	0.501	0.045	0.291	0.108	0.075	0.053

Why modified variable?

- some regions received new specialization industries not because they added the number of employees, but because it fell very much in this industry in other regions
- Additional criterion - an increase in the number of employees in this industry in the region by at least 20% from 2005 to 2015

OLS Results

Dependent variable:
Modified number of new specialization industries

- The results show a similar effect of related industries on the emergence of new specialization industries

1. **Complementarity matters for emerging of new specializations**
2. **It is more important to be included in inter-regional relations than in intra-regional**

VARIABLES	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Dummy of the share of new specialization industries related to existing specialization industries in the region	0.0522 (0.228)		0.643*** (0.220)			
Dummy of the share of new specialization industries related to existing specialization industries in the neighboring region	1.080*** (0.165)					
Number of specialization industries	0.0172 (0.0250)		0.0167 (0.0243)	0.059*** (0.0211)		
Log of the total number of employees	-0.260** (0.114)	0.179** (0.0799)				
Log of differences in market potential	0.218** (0.107)					
Log of the share of working population with higher education	-0.0118 (0.393)	-0.410 (0.439)		-0.381 (0.424)		-0.411 (0.437)
Log of Gross domestic expenditure on R&D (GERD) as a percentage of GRP	0.103 (0.101)		0.0305 (0.115)			
Log of number of domestic patent applications per 1 million labor force	-0.0182 (0.0546)		0.0201 (0.0823)		0.124* (0.0666)	
Log of GRP per worker employed in the region	0.118 (0.128)	-0.145 (0.143)		-0.187 (0.142)		
Dummy of Special Economic Zones	0.328 (0.307)	0.227 (0.299)		0.222 (0.326)		
Distance from the administrative center of the region to the nearest million-plus city	0.000322* (0.000181)				-0.000234 (0.000177)	-0.000352* (0.000200)
Square distance from the administrative center of the region to the nearest million-plus city	-6.18e-08* (3.23e-08)				3.21e-08 (3.02e-08)	4.63e-08 (3.50e-08)
Constant	0.00380 (2.164)	0.300 (1.474)	0.236 (0.372)	2.416 (1.544)	0.156 (0.363)	2.113 (1.408)
R-squared	0.501	0.045	0.291	0.108	0.075	0.053

Main results

- the most important are the variables associated with intra- and interregional complementarity of specialization industries
- Regression estimations show that regional size and innovation activities of the region are the second most important factors for the creation of new specialization industries

VARIABLES	Launch of economic diversification process	An increase in the number of new specialization industries	An increase in the number of new specialization industries (tightening of the criterion)
Dummy of the share of new specialization industries related to existing specialization industries in the region	++	++	++
Dummy of the share of new specialization industries related to existing specialization industries in the neighboring region	+++	+++	+++
Number of specialization industries	++	++	++
Log of the total number of employees	+++	++	++
Log of differences in market potential	-	++	++
Log of the share of working population with higher education	+ (negative)	+ (negative)	-
Log of Gross domestic expenditure on R&D (GERD) as a percentage of GRP	+	+	-
Log of number of domestic patent applications per 1 million labor force	+	-	+
Log of GRP per worker employed in the region	-	-	-
Dummy of Special Economic Zones	-	-	--
Distance from the administrative center of the region to the nearest million-plus city	-	+	+
Square distance from the administrative center of the region to the nearest million-plus city	-	+ (negative)	+ (negative)

Does complementarity matter for the emergence of new specialization industries in the regions of Russia?

Human Capital Multidisciplinary Research Centre

Kirill Tyurchev, Sabysachi Tripathi, Evgeniy Kutsenko

ktyurchev@hse.ru