NATIONAL RESEARCH UNIVERSITY

Marshallian vs Jacobs effects: which one is stronger? Evidence for Russia unemployment dynamics

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Motivation

- The purpose of the work is to find out which effects dominate in the Russian regions, Marshallian or Jacobs, and whether this predominance is stable for different time intervals
- The Jacobs' theory (Jacobs, 1969) posits that due to the higher diversification level urban territories better absorb unemployment shocks: in fact, it's easier to find job in another sector of the economy in case of job loss, which leads to a lower unemployment rate.
- Marshall's theory, by contrast, suggests that regions with a high level of specialization have better economic indicators and have a lower unemployment rate due to agglomeration economies (Marshall, 1993).

Why Russian case is interesting?

- The vast territories of the country provide evidence of very different and varied experiences of both agglomeration and diversification
- Historical stratification of industry localization makes several regions of the country traditionally strongly specialized in specific types of industries as a consequence of the past forced industrialization.
- Agglomeration economies are linked, at least initially, to the localization of natural resources, especially gas and oil, and the relative mining industry.
- The “disorganization” of central planning has changed over the last three decades the past specialization pattern of several regions of the country, breaking down old linkages between industries and, therefore, generating a higher degree of diversification of productions.

Literature

Beaudry C., Schiffauerova A. (2009), Who's right, Marshall or Jacobs? The localizationversus urbanization debate, Research Policy, 38, 318–337.

Results	Number of articles			
	Marshallian		Jacobs	
Positive	23	34%	26	39%
Positive and negative	24	36%	24	36%
Not significant	2	3%	15	22%
Negative	18	27%	2	3%
Total	67	100%	67	100%

Literature

Beaudry C., Schiffauerova A. (2009), Who's right, Marshall or Jacobs? The localizationversus urbanization debate, Research Policy, 38, 318–337.

Geographical region	*Number of dependent variables with positive results*				
	MAR only	*Jacobs only*	*Both*[a]	*None*[b]	*Total*
United States	*7*	*8*	*6*	*1*	*22*
United Kingdom	*7*	*1*	*3*		*11*
Italy	2	3	6	2	13
Germany	0	0	2		2
Spain	2	1	4		7
Netherlands	3	6	2	1	12
France	0	3	1	1	5
Finland	1	0	1		2
Sweden	1	0			1
Portugal	2	1			3
Europe	1	1	1		3
Continental Europe total	*12*	*15*	*17*	*4*	*48*
Japan	1	1	2		4
China	0	1		1	2
Mexico	0	0	1	1	2
Korea	0	1	1		2
Brazil	1	0			1
Israel	0	0	1		1
Other total	*2*	*3*	*5*	*2*	*12*

Literature

Dependent variable[c]	Number of dependent variables with positive results				
	MAR only	Jacobs only	Both[a]	None[b]	Total
Economic growth					
Employment	4	13	12	3	32
New firms	1	2	5		8
Wage growth	2	1		1	4
Other economic growth		2			2
Economic growth sub-total	*7*	*18*	*17*	*4*	*46*

Dependent variable[c]	Number of dependent variables with positive results				
	MAR only	Jacobs only	Both[a]	None[b]	Total
Productivity					
Output and TFP	9	2	1	2	14
Valued added		1	2		3
Other productivity	1		1		2
Productivity sub-total	*10*	*3*	*4*	*2*	*19*
Innovation					
Patents	4		7	1	12
Inventions	2	2			4
Innovation adoption			2		2
R&D intensity		2			2
Other innovations	2	1	1		4
Innovation sub-total	*8*	*5*	*10*	*1*	*24*
Total	*25*	*26*	*31*	*7*	*89*

[a] Number of dependent variables for which both MAR and Jacobs externalities are found.

[b] Number of dependent variables for which neither MAR nor Jacobs externalities are found.

Literature

Authors	Main conclusions
Simon, 1988; Simon, Nardinelli 1992 Elhorst, 2003 Ferragina, Pastore, 2008 Viladecans-Marsal, 2004	In diversified regions, unemployment levels are lower (confirming Jacobs effects). But there are periods (for example, the Great Depression) when the unemployment rate was higher in diversified regions.
Basile et al., 2012	The sectoral shifts and the degree of specialization exert a negative role on unemployment dynamics. By contrast, highly diversified areas turn out to be characterized by better labour market performances.

Main hypotheses

Hypothesis 1: The dependence of the unemployment rate on the degree of concentration or diversification is non-monotonic due to the possible overlapping effects of urbanization (Jacobs effects) and localization (Marshallian effects).

Hypothesis 2: The direction of influence of the degree of concentration or diversification on the unemployment level depends on the chosen time interval.

Data

80 Russian regions, period 2007 – 2016

Data source: Federal State Statistics Service of the Russian Federation, www.gks.ru

The company's revenue was obtained using the Ruslana database (Bureau Van Dijk). There is information on 12116 companies, 24 industries related to “Manufacturing industries” (code C) in accordance with the accepted classification OKVED 2.

Indexes of spatial diversification

P.Vorobyov (2014) proposed modified diversification index

$$ihh_t^i = \frac{\sum_{j=1}^{S}\left[\frac{pq_t^{ji}}{pq_t^i}\right]^{\frac{1}{S}} - 1}{\left(S^{1-\frac{1}{S}}\right) - 1}, \quad ihh_t^i \in [0;1]$$

i- number of a region; j – number of industries in the economy;
pq^{ij} – revenue (or gross value added) in industry j in region i;
pq^i - revenue (or gross value added) in all industries in region i.

ihh^i = 1 – equal distribution of firms' turnover between industries (diversification);

ihh^i = 0 – uneven distribution of firms' turnover in industries (lack of diversification).

Indexes of spatial diversification based on firms data

$$ihhmn_i^t = \frac{\sum_{j=1}^{24}\left[\frac{pq_{ij}^t}{pq_i^t}\right]^{\frac{1}{24}} - 1}{\left(24^{1-\frac{1}{24}}\right) - 1},$$

i- number of a region;

j = {1, …,24} – number of the manufacturing industry;

pq_{ij} – revenue of all firms in industry j in region i;

pq_i - revenue of all firms in region i;

$ihhmn_i$ = 1 – equal distribution of firms' turnover between industries (diversification);

$ihhmn_i$ = 0 – uneven distribution of firms' turnover in industries (lack of diversification).

Indexes of spatial diversification based on VA data

$$ihhva_i^t = \frac{\sum_{j=1}^{15} \left[sh_{ij}^t\right]^{\frac{1}{15}} - 1}{\left(15^{1-\frac{1}{15}}\right) - 1},$$

i- number of a region;
j = {1, …,15} – number of the type of economic activity (agriculture, forestry, fishing; mining and quarrying; manufacturing; production and distribution of electricity, gas and water; construction; wholesale and retail trade; repair of motor vehicles and motorcycles; accommodation and food service activities; information and communication; financial and insurance activities; real estate, rent and services activities; public administration and defense; compulsory social security; education; human health and social work activities; provision of other communal, social and personal services);
sh_{ij} is the share of j-th type of economic activity in region i;
$ihhva_i$ = 1 – equal distribution of economic activity (diversification);
$ihhva_i$ = 0 – uneven distribution of economic activity (lack of diversification).

Index of spatial concentration based on firm data

Ellison-Glazer index (J.Vernon Henderson, 2003).

$$iegmn_i^t = \sum_{j=1}^{24} \left(\frac{pq_{ij}^t}{pq_j^t} - \frac{pq_j^t}{pq^t} \right)^2,$$

i - number of a region;
j = {1, …,24} – number of the manufacturing industry;
pq_{ij} – revenue of all firms in industry j in region i,
pq_i - revenue of all firms in region i;
pq_j - revenue of all firms in industry j;
pq – revenue of all firms

$iegmn_j$ = 2 – specialization of the region on one industry is observed,

$iegmn_j$ = 0 – the region does not specialize in one industry.

Index of spatial concentration based on VA data

Ellison-Glazer index (J.Vernon Henderson, 2003).

$$iegva_i^t = \sum_{j=1}^{15} \left(sh_{ij}^t - sh_j^t \right)^2,$$

i - number of a region;

j = {1, …,15} – number of the type of economic activity

sh_{ij} – share of j-th type of economic activity in region i,

sh_j – share of j-th type of economic activity in Russia,

$iegva_j$ = 2 – specialization of the region on one type of economic activity is observed,

$iegva_j$ = 0 – the region does not specialize in one one type of economic activity.

Minimum, maximum and average values of concentration and diversification indices

Index	Minimum		Maximum		Average value	
	2007	2016	2007	2016	2007	2016
Diversification (GVA)	0.772	0.797	0.977	0.974	0.88	0.908
Diversification (revenue)	0.084	0.082	0.978	0.973	0.715	0.705
Concentration (GVA)	0.007	0.009	0.506	0.402	0.057	0.052
Concentration (revenue)	0.035	0.02	0.834	0.906	0.218	0.229

Dependent variable

The dependent variable is average increase in unemployment over the period [t_1 , t_2] (in log):

$$Y_i^{[t_1,t_2]} = \frac{\ln U_i^{t_2} - \ln U_i^{t_1}}{t_2 - t_1}$$

The following periods were considered :

2007-2016 (general period),

2007-2008 (the period before economic crisis),

2008-2010 (crisis period),

2010-2013 (recovery period),

and 2013-2016 (slowdown in economic growth).

Independent Variables

Explanatory variables	Previous articles
GRP per cap PPP (in 2000 basic price)	(Elhorst, 2003).
Share of urban population	(Molho, 1995).
Share of population with high education in labour force	(Aragon et al., 2003).
Net migration rate	(Andrienko and Guriev, 2004)
Lilien index of sectoral shifts by economic activity	(Samson, 1985), Krajnya`k and Sommer (Krajnya`k, Sommer, 2004), Newell and Pastore (Newell, Pastore, 2006) and Robson (Robson, 2009).

Lilien index

Lilien index – index of variation in the growth of employment in specific industries, which measures sectoral shifts by economic activity. Lilien index is calculated by the following formula

$$lil_i = \left(\sum_{s=1}^{S} \left[\frac{x_{si}}{x_i} \right] \cdot (\Delta \ln x_{si} - \Delta \ln x_i)^2 \right)^{1/2}$$

Where x_{si} is regional employment in industry s, X_i - total regional employment.

Independent Variables

Explanatory variables	Previous articles
Share of people below working age (< 16 лет)	(Hofler, Murphy, 1989), (Elhorst, 1995, 2013), (Kapelushnikov, 2014).
Share of people above working age(> 55 for women/> 60 for men)	(Sonina, Kolosnitsyna, 2015), (Sinyavskaya, 2017), (Partridge, Rickman, 1995).
Population density	(Elhorst, 2003), (Niebuhr, 2003), (Basile, 2012).
Logarithm of the unemployment rate at the beginning of the period	(Overman, Puga, 2002), (Basile, 2012), Oschepkov and Kapelyushnikov, 2015) .
Average neighboring unemployment rate growth (spatial lag)	Mussida C. and Pastore F. (2015)

Descriptive statistics

Variable	Min	Max	Average
GRP per cap PPP (in 2000 basic price)	7.789	13.851	11.03689
Share of urban population	0.262	1	0.6894
Share of population with high education in labour force	0.174	0.465	0.2422
Net migration rate	-139	81	0
Share of people below working age (< 16)	12.3	29.9	16.754
Share of people above working age(> 55 for women/> 60 for men)	7.3	26.9	19.72
Population density	0.0693	3262.86	70.505
Lilien index of sectoral shifts by economic activity	0.094	0.463	0.205839
Initial level of unemployment	1.3	47.3	7.434
Average neighboring unemployment rate growth	-0.097	0.116	-0.004

Model

The semiparametric additive model with spatial lag

$$Y_i = \alpha_0 + \alpha_1 X_{1i}^* + \alpha_2 X_{2i}^* + \ldots + f_1(X_{1i}) + f_2(X_{2i}) + \ldots + f_w(Y_i^o) + \varepsilon_i$$

$$W_{lj} = \begin{pmatrix} 0 & w_{12}^{ij} & \ldots & w_{1n}^{ij} \\ w_{21}^{ij} & 0 & \ldots & w_{2n}^{ij} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1}^{ij} & w_{n2}^{ij} & \ldots & 0 \end{pmatrix}$$

- weighting binary matrix of dimension 80*80

$$Y_i^o = \sum_{j \neq i} w_{ij} Y_j$$ **- spatial lag (endogenous variable)**

Methodology of estimation

Basile R., Girardi A., Mantuano M., Pastore F. (2012), Sectoral shift, diversification and regional unemployment: evidence from local labour systems, Empirica, 39, 525-544.

1 step: The following auxiliary semiparametric regression is considered

$$Y_i^o = f_1^*(X_{1i}^*) + f_2^*(X_{2i}^*) + \ldots + f_1(X_{1i}) + f_2(X_{2i}) + \ldots$$
$$+ h_1^*(WX_{1i}^*) + h_2^*(WX_{2i}^*) + \ldots + h_1(WX_{1i}) + h_2(WX_{2i}) + \ldots + \nu_i$$

Instruments for spatial lag:

$$X_1^*, X_2^*, \ldots, X_1, X_2, \ldots, \; WX_1^*, WX_2^*, \ldots, WX_1, WX_2, \ldots$$

Methodology of estimation

2 step: The estimation of the additive model in the following form

$$Y_i = f_1^*(X_{1i}^*) + f_2^*(X_{2i}^*) + \ldots + f_1(X_{1i}) + f_2(X_{2i}) + \ldots + f_w(Y_i^o) + f_v(\hat{v}_i) + \varepsilon_i$$

This model includes the same explanatory variables as the original model and additionally a nonparametric function that depends on the model residuals obtained in the first step.
Penalized smoothing splines were used for each function f.

Methodology of estimation

For each explanatory we choose between linear and nonparametric dependence: the null hypothesis is that the dependence is linear, and the alternative hypothesis is that the dependence is nonparametric.

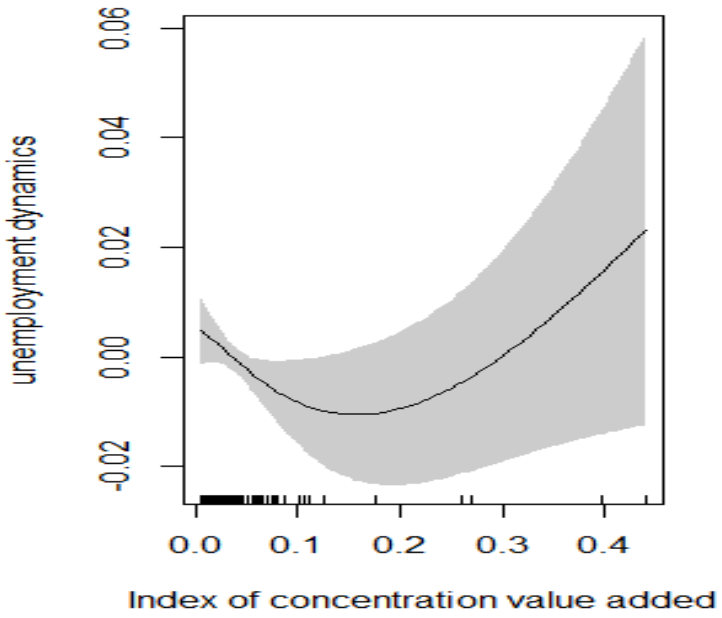
In the absence of a significant difference, a linear form of the dependence was chosen.

It was found out that linear dependence took place only for the variables share of people below working age (up to 16 years) and Lilien index

Results of estimation (example)

Parametric terms (beta and p-values)	Model 1		Model 2		Model 3		Model 4	
time period	2007-2016		2007-2016		2007-2016		2007-2016	
intercept	-0.227***		-0.230***		-0.235***		-0.256***	
	0.000		0.000		0.000		0.000	
lilien	0.047		0.061		0.052		0.072	
	0.322		0.199		0.248		0.117	
young	0.013***		0.013***		0.013***		0.014***	
	0.000		0.000		0.000		0.000	
Nonparametric terms								
F test and p-values		edf						
f(ihhva)	1.225	1.949						
	0.273							
f(ihhmn)			0.360	1.000				
			0.551					
f(egva)					2.665*	1.935		
					0.070			
f(egmn)							0.022	1.000
							0.883	

Testing of main hypotheses, 2007-2016



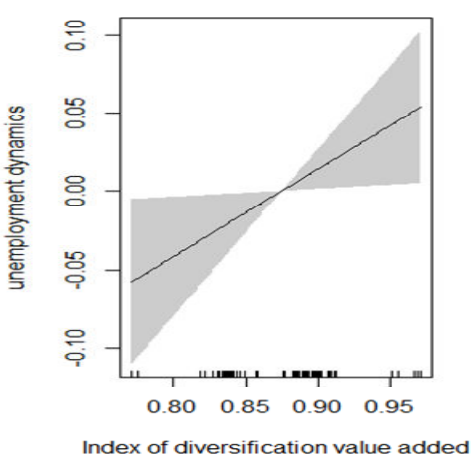
Throughout the period 2007 to 2016, only the dependence of Ellison-Glaser index, calculated on the gross value added, was significant.

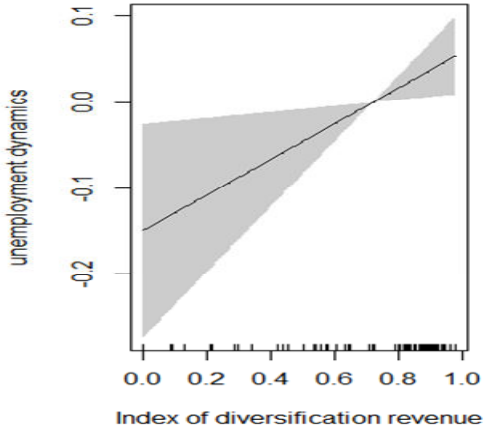
The dependence in whole period is non-linear: at low levels of concentration in the region, unemployment decreases with increasing concentration (thus, the localization effect predominates), but when the concentration exceeds a certain threshold value (ca 0.15), its further increase leads to a rise in unemployment (Jacobs externalities dominate).

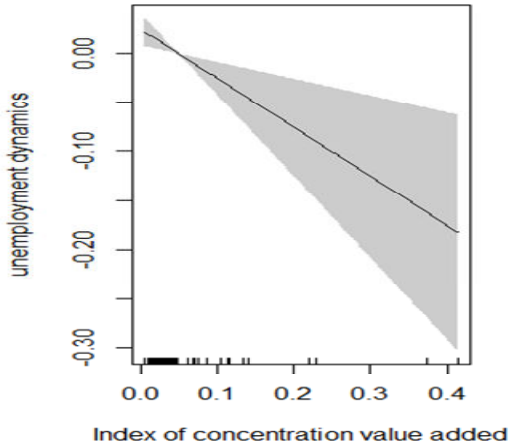
Testing of main hypotheses, 2007-2008

For the period 2007-2008, the significant impact of the diversification and concentration indexes on the growth of unemployment was not confirmed

Testing of main hypotheses, 2008-2010

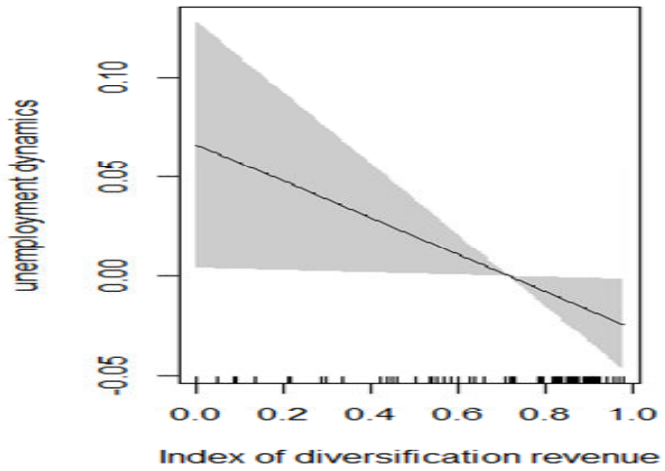


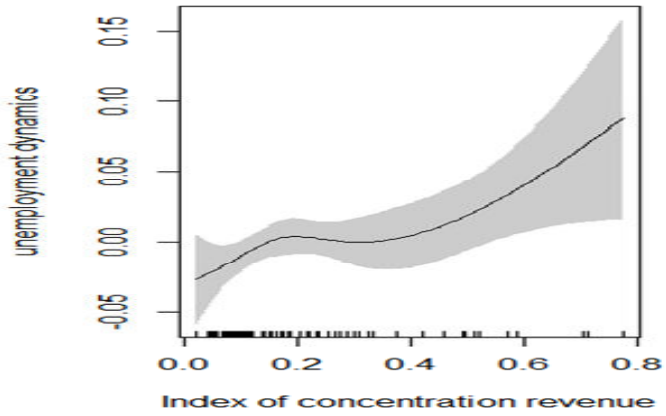




In the crisis period 2008-2010 the significant influence on the dependent variable was proved by both diversification indexes and concentration index calculated on the basis of GVA. Along with the diversification growth in the crisis, the unemployment rate increases, indicating the predominance of the Marshallian effects in the crisis period. Therefore, in 2008-2010 specialization effects prevailed.

Testing of main hypotheses, 2010-2013

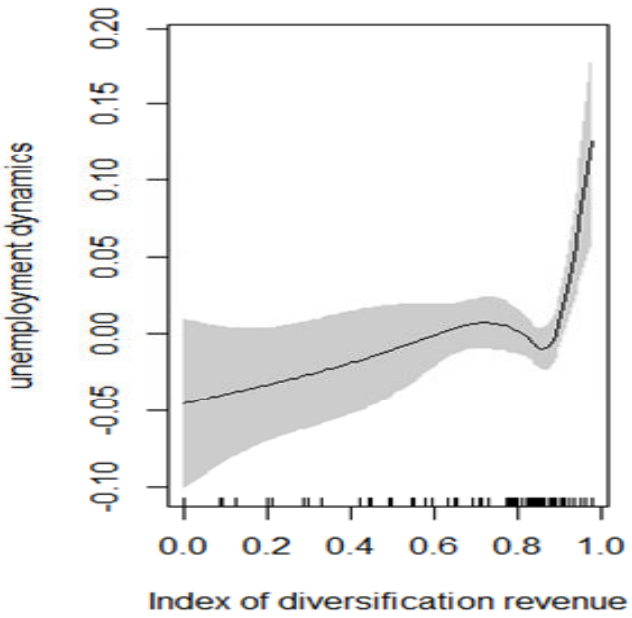




The time period 2010-2013 is considered as an "exit from the crisis" and an economic upsurge. In these years, the significance of unemployment growth's dependence on the diversification and concentration indices, calculated on revenue, was confirmed.

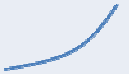
With the increase in the diversification in the region, the unemployment rate is decreasing, and as concentration increases, unemployment grows, too (Jacobs effects were confirmed).

Testing of main hypotheses, 2013-2016



In 2013-2016, when the economic situation in the country began to deteriorate again, a significant influence was confirmed for the diversification index calculated on revenue: an increase in diversification leads to an upsurge in unemployment (the Marshallian effect predominates). On the level of diversification from 0.7 to 0.9, a small increase in the index leads to a decrease in unemployment (Jacobs effect for fairly diversified regions), but an increase in the index value exceeding 0.9 rapidly increases unemployment. This is true for such regions as St. Petersburg, Yaroslavl Region, Leningrad Region, Moscow and Moscow Region, Krasnodar Territory.

Influence of other explanatory variables

Variable	Sign of the coefficient or graph of functional dependence				
	2007-2008	2008-2010	2010-2013	2013-2016	2007-2016
Lilien index	+	insignificant	insignificant	insignificant	insignificant
Share of people below working age	insignificant	+	+	+	+
Index of diversification/concentration	-				
GRP per cap PPP (in 2000 basic price)			-		-
Share of urban population	-	-			
Share of population with high education in labour force			-	-	
Net migration rate	-			-	-
Share of people above working age	-	-			
Population density					
Initial level of unemployment					

Conclusions

- For Russia, it is impossible to draw unambiguous conclusions regarding which externalities predominate due to the great heterogeneity of the regions, as well as the imposition of urbanization (Jacobs) and localization (Marshallian) effects.
- During the period of economic growth (such as 2010-2013), people move between sectors and can easily find work, so the urbanization effects prevail,
- In the difficult periods for the country (for example, 2008-2010 and 2013-2016), the localization effects dominate: local agglomeration of firms from one industry creates a labour market with a limited set of skills that are in demand for a particular industry, and it is easier for people to find a job in industries of specialization.

Policy implications

- Understanding the key differences between the regions of the Russian Federation will allow the state to conduct a competent structured socio-economic policy that will help to eliminate the negative social and economic consequences from the high concentration in some regions.

- In the crisis period the state should support enterprises whose specialization does not coincide with the main specialization of the region through tax benefits and special subsidies

- In the period of growth the state should develop the most promising sectors in each region. In addition, special attention should be paid to youth policy aimed at lowering unemployment in certain regions.

Thank you!
Merci!

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