2. THE DEVELOPMENT OF TERRITORIAL ADMINISTRATION: CLUSTERS, REGIONS, CROSS-BORDER COOPERATION

Lukianenko I. G.

Doctor of Sciences (Economics), Professor,
Head of the Department of Finance
National University of «Kyiv-Mohyla Academy»

Oliskevych M. O.

Doctor of Sciences (Economics), Associate Professor,
Professor at the Department of
Mathematical Economics and Econometrics
Ivan Franko National University of Lviv

REGIONAL INEQUALITIES, ECONOMIC INTEGRATION AND STRUCTURAL CHANGE IN UKRAINE

Summary

The article presents an empirical research of the regional inequalities and impact of changes in economic integration on regional employment for different regions of Ukraine. We conducted a comparative analysis of the dynamic changes in the employment level and sectoral diversification. Based on empirical studies of the structure of regional employment by various economic activities we evaluated a number of indices, including sectoral diversification indices of employment for each region, indices regional diversification of employment for each sector, regional indices of economic integration with different groups of countries, attractiveness geographical regions indices. Based on regional data employment structure we estimated a series of econometric models that allow to evaluate the impact of the employment sectoral diversification index of the region, the index of geographic attractiveness of the region as well as the initial level of economic integration of the region with Europe and the CIS and their change over the six years on changes in regional employment in general, as well as in the sectors of agriculture and industry in particular.

Introduction

The spatial structure of each country are inherited the different forms of development asymmetry. Inconsistencies in the implementation of economic interests are due from many external and internal factors, including the fact of adapting the institutions to change in economic conditions and disturbance of market environment. Regional disparities cause the deepening inequality in social structure of the national economy: prevent the effective integration of Ukrainian labor market and convergence.

Analysis of disparities and asymmetric regional development is the subject of many Ukrainian research scientists. An important contribution in the study of regional disparities in Ukraine make T. Klebanova, L. Guryanova, T. Trunova and A. Smyrnova (2009), who proposed the author's estimation algorithm and analysis uneven regional development and implemented it for the regions of Ukraine.

O. Rayevneva and O. Bobkova (2012) examined the regional unevenness in Ukraine by Theil index decomposition; V. Oglih and T. Efanova (2014) estimated the economic system asymmetry at the level of individual regions. Many works devoted to the distribution regions of Ukraine into clusters. Scientists offer different schemes of analysis of spatial clustering of socio-economic development rates on the basis of cluster analysis. The theoretical clustering basis is described by I. Markovskyy (2011); T. Pushkar and V. Fedorova (2011) analyzed the formation of clusters in the world. The presence of heterogeneity in the development of regional labor markets certified O. Nikiforova and L. Chagovets (2011), which shared regions of Ukraine into two clusters using the method of K-means. Many Ukrainian scientists to study regional differentiation processes and spatial structures used mathematical and econometric modeling. In particular, L. Chagovets (2011) proposed space-dynamic differentiation model of social-economic regional development; Ya. Prytula and V. Kuzenko (2013) calculated the Theil index and structural changes in the regions of Ukraine and built an econometric model of regional convergence that includes three structural reforms, WTO accession, exchange rate policy and inflation.

The country integration into the global economy is an economic phenomenon covering different spheres of society and occupies an important place in economic world. Globalization of the world economy causes the increase of international cooperation, scientific and technological advances, and change the nature of human labor. Many Ukrainian scientists examine the problems of integration of Ukrainian economy into the world economy and the European Union. In particular G. Ortina (2014) emphasized the problems and opportunities of integration of the real economy, described the impact of integration on the relations development strategy of the real sector of the economy; A. Zhuravliov (2013) identified factors of Ukrainian integration development under global economy transformation conditions.

Domestic researchers note that one of the obstacles in achieving a high degree of integration of Ukraine is uneven and disparities in socio-economic development of the country. Regional development of asymmetry gives to raise the gape among the rich and poor regions and breaks the uniformity of the national economy. Scientists confirm the presence of inter-regional inequality and emphasize structural reforms to increase economic development of Ukraine in the future. They say that eliminating depression and establish the stable homogeneous regions are a priority policy for integration [O. Shevchenko, 2011].

Research of uneven regional development and integration problems is important in the world scientific literature. S. Obradovic (2008), L. Caceres (2014), S. Barrios and E. Strobl (2009), L. Sawers (2006), C. Savva and C. Aslanidis (2010), showed that each country adapt the integration processes in economic activity in different ways. L. Andrei (2014) focused on economic convergence and analyzed the current research integration within the European Union. G. Petrakos and L. Topaloglou (2008) analyzed the impact of integration dynamics on the development of external border regions of the EU. X. Huang, R. Leon-Gonzalez and S. Yupho (2013) applied the cointegration dynamic model to study regional financial integration.

The study of economic integration and uneven development has special importance in the labor market. B. Batavia and P. Nandakumar (2002) studied the impact of economic integration basing on utility maximization problem of trade union and determined the impact of external labor markets to the national wage. D. Kallioras and G. Petrakos (2010) examined the impact of economic integration on the growth of industrial employment in the EU new member states of the European Union by analyzing assessment results econometric models and built the relationship between

their structural characteristics and attractive geographic regions. H. Johansson (2001) found that regional integration contributes to productivity growth in the European Union.

At the current stage of globalization and European integration direction of the national economy are important the identification and modeling of economic integration of the regional labor markets in Ukraine. Despite considerable progress in research of economic instability in Ukraine are not sufficiently developed econometric methods for analysis and modeling of regional spatial non-uniformity, and its relationship with the processes of economic integration.

Part 1. Empirical analysis of regional inequalities

The identifying of unevenness factors in the spatial structure of labor markets in the regions of Ukraine needs assessments of the characteristics and spatial distribution of employment. The differences in the spatial distribution of employment can be one of the factors contributing to the differentiation of regional productivity growth over the last decades. Regional production structure of the regions in terms of employment can be described by comparing the proportion of the employed population in each region according to different economic activities, which include: 1) agriculture, forestry and fishery; 2) industry; 3) construction; 4) trade; hotels and restaurants; 5) transport and communications; 6) financial activities; 7) real estate, renting and business activities; 8) public administration; 9) education; 10) health care and social assistance; 11) other economic activities. Fig. 1 shows the share of employment in different sectors for 27 regions of Ukraine in 2013 and 25 regions (excluding the Crimea) in 2016.

Statistical data shows that the economic structure of employment in various fields differ for the share of employment in agriculture and industry, while the shares of other sectors for various regions are about the same.
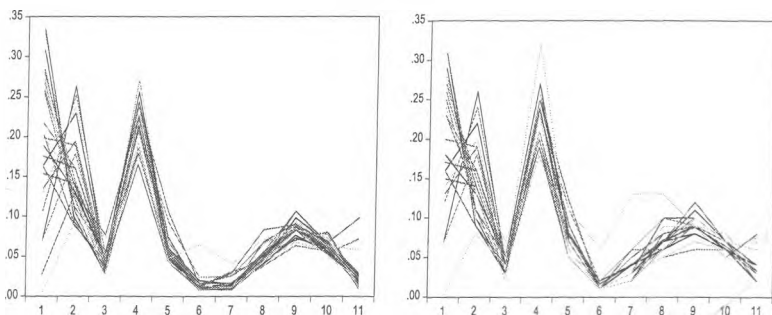
Fig. 1. The share of employment of different sectors in the regions of Ukraine
Source: data of the State Statistics Service of Ukraine, evaluation of authors

To measure the diversification of employment in different labor market sectors in regions of Ukraine we use the Theil index that characterizes the entropy measure of regional disparities in terms of employment sectors and is given by [G. Petrakos, L. Topaloglou, 2008]

$$T_r = \sum_{i=1}^{m} \frac{e_{ri}}{e_r} \ln \frac{e_r}{e_{ri}}, \qquad (1)$$

where $e_{ri} = \dfrac{EMPL_{ri}}{\sum_r \sum_i EMPL_{ri}}$ – the share of employment in the i-th sector of r-th region; $e_r = \sum_i e_{ri}$ – the overall proportion of employment in the r-th region. Note that $\dfrac{e_{ri}}{e_r} = \left(\dfrac{EMPL_{ri}}{\sum_r \sum_i EMPL_{ri}} \right) / \left(\dfrac{\sum_i EMPL_{ri}}{\sum_r \sum_i EMPL_{ri}} \right) = \dfrac{EMPL_{ri}}{\sum_i EMPL_{ri}}$ – the share of i-th sector in r-th region, $\sum_r \sum_i e_{ri} = 1$. Due to the division of T_r to the theoretical maximum ln (m), where m – the number of sectors, we get the normalized index of sectoral diversification in each region, which includes the value in the interval [0, 1]. In particular, the normalized index for the region r takes the value 0 if only one sector exist in this region and 1 if all m sectors conclude the same number of people. At the national level using the average Theil index

$$\overline{T}_r = \sum_{r=1}^{n} e_r \ln \frac{1}{e_r},$$

wheree n – the number of regions.

Table 1

Sectoral Diversification Indexes of Employment in Different Regions of Ukraine

Region	2004	2009	2014
Crimea	0,8811	0,8944	—
Vinnytsia	0,8237	0,8640	0,8399
Volyn	0,8366	0,8575	0,8652
Dnipropetrovsk	0,8496	0,8606	0,8596
Donetsk	0,8411	0,8609	0,8563
Zhytomyr	0,8483	0,8946	0,8960
Zakarpattia	0,8710	0,8929	0,8781
Zaporizhia	0,8490	0,8757	0,8705
Ivano-Frankivsk	0,8743	0,8882	0,8607
Kiev Obl.	0,9003	0,9254	0,9171
Kirovohrad	0.8390	0,8732	0,8640
Luhansk	0,8414	0,8539	0,8369
Lviv	0,9076	0,9193	0,9081
Mykolaiv	0,8822	0,8692	0,8566
Odessa	0,8943	0,9121	0,9058
Poltava	0,8575	0,8827	0,8729
Rivne	0,8881	0,8883	0,8743
Sumy	0,8642	0,8984	0,8897
Ternopil	0,8486	0,8798	0,8501
Kharkiv	0,8860	0,8871	0,8936
Kherson	0,8357	0,8546	0,8476
Cherkasy	0,8467	0,8750	0,8676
Chernivtsi	0,8606	0,8683	0,8676
Chernihiv	0,8487	0,8705	0,8687
Kyiv	0,9040	0,8987	0,8927
Sevastopol	0,9296	0,9244	—

Source: evaluation of authors

The calculated value of regional Theil index show that different regions of Ukraine have different degrees of specialization in sectors which also shows different trends over time. In particular, in 2004 the index of sectors diversification for different regions ranged from 0.821 to 0.907 (with an average of 0.859); in 2008 it increased and was in the range of 0.852 to 0.925 (with a mean value of 0.880), whereas in 2014 it slightly decreased again and was in the range from 0.836 to 0.918 (mean value of 0.872). Note that in most regions (18 regions) over time throughout the period from 2004 to 2014 industrial diversification increased. Moreover, comparing the degree of specialization sectors in regions we see that during this time period there was some alignment of regions in terms of employment in different sectors, as evidenced by decreasing the slope coefficient regression (Fig. 2). In particular for the regions with higher in 2004 than the average in Ukraine Theil the index it decreased slightly, while those regions witch were characterized at the beginning rather low index Theil and higher degree of sectoral specialization, on the contrary we observe the increase its relative diversification.
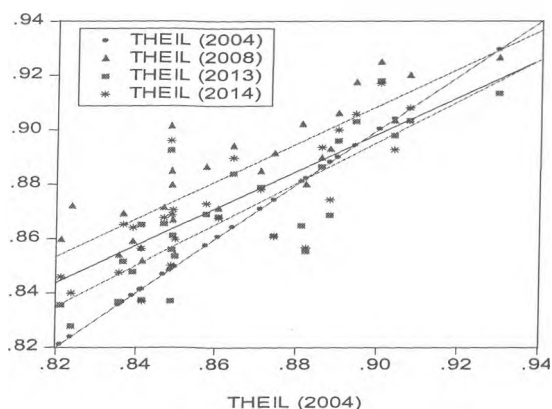
Fig. 2. Change in sector diversification indices

Source: evaluation of authors

Khmelnytsky, Chernivtsi, Kherson, Volyn, Kirovograd, Ternopil regions (dominated by agriculture sector, which employs about a third of employees (28-33%)) and Luhansk region (36% of employment in trade, the largest share of the trade sector in Ukraine) are the most specialized among the regions of Ukraine. For the entire period the most diversified by sector regions are Kiev, Lviv, Odessa and Kharkiv regions. Note also that the Zhytomyr region, which in 2004 showed the average index of diversification by reducing the share of employment in agriculture from 28% to 15% now is the most diversified region.

The main difference between Ukrainian economy compared to countries of the European Union is a significant excess shares in agriculture and trading, but shares of construction, industry, transport, finance, real estate sector and healthcare are low. Comparing the level of specialization in employment in Ukraine and other European countries (Table 2) we see that the national economy is somewhat lower degree of diversification.

Table 2

Sectoral Diversification Index of Employment in Ukraine and Europe

Year	Ukraine	EU15	Czech	Hungary	Latvia	Estonia	Bulgaria	Romania	Poland
2000	0,881	0,927	0,885	0,906	0,915	0,901	0,880	0,752	0,902
2004	0,890	0,929	0,884	0,915	0,929	0,899	0,882	0,816	0,903
2007	0,903	0,930	0,881	0,913	0,933	0,915	0,884	0,838	0,912
2008	0,906	0,935	0,888	0,920	0,935	0,909	0,892	0,853	0,918
2009	0,905	0,937	0,898	0,927	0,947	0,923	0,897	0,858	0,926
2010	0,905	0,937	0,900	0,927	0,944	0,923	0,897	0,859	0,929
2011	0,902	0,937	0,894	0,925	0,947	0,923	0,899	0,866	0,929
2012	0,900	0,936	0,897	0,931	0,954	0,927	0,898	0,861	0,931
2013	0,896	0,935	0,900	0,931	0,949	0,929	0,905	0,863	0,931
2014	0,898	0,944	0,897	0,928	0,948	0,926	0,911	0,869	0,933

Source: evaluation of authors

More specialized are only Romania and Bulgaria. Furthermore, in all EU countries over the past decade the level of diversification increased, while in Ukraine it has not changed. Note also that despite the different level of sectoral diversification in the regions of Ukraine none of the regions showed the level that is inherent for countries EU15.

To measure of economic integration degree of Ukraine's regions with different world area we determine the regional economic integration indices RIEI. The calculation we based on the volume of trade in goods and services. The index of economic integration with European countries at the national level for each sector (i) and given year (t) is

$$\text{IEI}(\text{EUR})_{i,t} = \frac{\text{TRADE}(\text{EUR})_{i,t}}{\text{TOTALTRADE}_{i,t}} \quad (2)$$

where $\text{TRADE}(\text{EUR})_{i,t}$ – the trade volume (import and export) with European country for i-th sector in year t; $\text{TOTALTRADE}_{i,t}$ – the total trade of i-th sector in year t. IEI is in [0,1], and is equal 0 if there is no economic integration and 1 if there is full economic integration. Statistics shows that exports and imports in the sectors of agriculture and industry have different distribution in different years. Comparing the 2006, 2008 and 2013, we see that the dynamics of trade in agricultural products is characterized by a growing trend, and industrial trade volume in 2013 compared to 2008 decreased contrast. In addition, in 2013 in respect to previous years the share of trade in Ukraine agricultural production with Europe, America and CIS was the lowest, while with the countries of Asia and Africa the highest. In 2014 we see a decrease in trade for sector of agriculture with all countries (mainly due to the decrease in imports) and reducing the export and import industry with the CIS countries. The share of trade volumes with different groups of countries in 2014 compared to 2013, excluding the share of industry trade with the CIS countries, which fell significantly, almost unchanged.

In the absence of statistics for the trade with various countries at the regional level in order to determine the regional economic integration indices we calculate regional-sectoral location quotient [G. Petrakos, L. Topaloglou, 2008]

$$LQ_{ri} = (EMPL_{ri} / EMPL_r) / (EMPL_i / EMPL), \quad (3)$$

where $EMPL_{ri}$ – the number of employees for i-th sector in r-th region; $EMPL_r$ – the total number of employees in r-th region; $EMPL_i$ – the total number of employees in i-th sector; EMPL – the total number of employees in Ukraine. Values of LQ_{ri} are

greater than 0. Values greater than 1 indicate that the part of i-th sector in the region is higher than in the country as a whole (Table 3).

Analysis of calculated quotients for different sectors in different regions of Ukraine shows that in each direction of economic activity there are several areas where LQ greater than 1. The largest contribution to employment in the agricultural sector belongs to Ternopil, Vinnytsia and Kherson regions for which the ratio LQ greater than 1.7 and Kirovograd, Khmelnitsky, Volyn, Zakarpattia, Ivano-Frankivsk, Mykolayiv, Cherkasy, Chernivtsi and Chernihiv regions, the rate of which fluctuate from 1.37 to 1.66. The least agriculture LQ are in Dnipropetrovsk and Kyiv region with factor of 0.4. Dnipropetrovsk, Donetsk, Luhansk, Zaporizhia, Kharkiv and Poltava regions (LQ from 1.2 to 1.6) dominate in industry employment, while in Zakarpattya, Odesa, Ternopil and Kherson regions LQ factor for the industry does not reach the value 0.7. The construction sector dominates in Lviv region (LQ = 1.58), and the transport sector – in Odessa and Kiev. The financial sector is concentrated in the Kiev city with LQ = 4.03 and in Dnipropetrovsk. Note that after 2014 regional sectoral allocation didn't change.

Table 3

Regional-Sectoral Location Quotiens of Ukrainian Regions

Region	Agri-culture	Industry	Const-ruction	Trade	Trans-port	Finance	Edu-cation	Health
Vinnytsia	1,81	0,71	0,61	0,81	0,88	0,66	1,10	1,14
Volyn	1,37	0,80	0,68	0,97	0,80	0,74	1,33	1,10
Dnipropetrovsk	0,42	1,62	0,89	1,11	1,02	1,25	0,91	0,92
Donetsk	0,69	1,50	1,24	1,13	1,03	0,59	0,69	0,87
Zhytomyr	0,87	0,87	0,96	1,04	1,14	0,62	1,12	1,10
Zakarpattia	1,45	0,71	1,32	0,90	0,77	0,47	1,06	0,86
Zaporizhia	0,92	1,39	0,96	1,00	0,80	0,75	0,87	1,01
Ivano-Frankivsk	1,66	0,78	1,12	0,83	0,64	0,56	1,16	1,10
Kiev Obl.	0,39	1,12	0,87	0,96	1,39	1,48	0,99	1,28
Kirovohrad	1,62	0,83	0,77	0,78	1,01	0,44	1,08	1,13
Luhansk	0,80	1,22	1,10	1,34	0,93	0,57	0,74	0,92
Lviv	1,07	0,93	1.58	0.87	1,03	0,77	1,13	1,18
Mykolaiv	1.57	0,85	0,85	0,90	0,88	0,54	0,97	0,87
Odessa	0,95	0,56	0,99	1,06	1.58	0,92	1,07	0,96
Poltava	1,17	1,20	0,76	0,90	0,96	0,68	0,98	1,09
Rivne	1,04	0,83	1,13	1,16	0,86	0,60	1,15	1,09
Sumy	1,32	0,99	1,21	0,82	0,86	0,63	1,04	1,04
Ternopil	1,83	0,58	0,78	0,78	0,70	0,53	1,27	1,14
Kharkiv	0,78	1,19	1,10	1,02	0,99	0,76	1,06	0,93
Kherson	1,71	0,62	0,68	0,96	0,72	0,60	1,06	0,95
Cherkasy	1,56	0,91	0,99	0,82	0,87	0,78	1,00	1,11
Chernivtsi	1,63	0,62	1,11	0,89	0,70	0,53	1,09	1,03
Chernihiv	1,41	0,79	0,56	0,95	0,74	0,93	1,00	1,22
Kyiv	0,02	0,52	0,98	1,11	1,40	4,03	1,00	0,76

Source: evaluation of authors

Regional economic integration indices we calculate by the formula

$$RIEI_{r,t} = \sum_{i=1}^{m} (IEI_{i,t} \times LQ_{ri,t}).$$

(4)

Analysis of regional integration index (Table 4) shows that compared to 2008 in all regions of Ukraine the degree of integration of agriculture sector with Europe and the CIS weakened, while significantly increased with the countries of Asia and Africa. However the industry sector during 2008-2013 demonstrates the significant temporal changes in regional indices RIEI. In 2014 the level of regional agriculture integration with Asia reached the respective levels of integration with Europe and Africa RIEI, and in some areas even exceeded the values with CIS countries. Also in 2014 there was a change in the regional economic integration indices of industry. In particular, the highest index value is obtained in this year for Europe.

Table 4

Regional Economic Integration Indices

Region	Agriculture					Industry				
	Europe	SIC	Asia	Africa	America	Europe	SIC	Asia	Africa	America
Vinnytsia	0,636	0,218	0,670	0,223	0,058	0,258	0,243	0,150	0,000	0,030
Volyn	0,480	0,164	0,506	0,168	0,043	0,291	0,273	0,169	0,000	0,034
Dnipropetrovsk	0,148	0,051	0,156	0,052	0,013	0,592	0,556	0,344	0,000	0,069
Donetsk	0,244	0,084	0,257	0,086	0,022	0,548	0,514	0,318	0,000	0,064
Zhytomyr	0,307	0,105	0,323	0,108	0,028	0,317	0,298	0,184	0,000	0,037
Zakarpattia	0,510	0,175	0,538	0,179	0,046	0,259	0,244	0,151	0,000	0,030
Zaporizhia	0,324	0,111	0,342	0,114	0,029	0,508	0,477	0,295	0,000	0,059
Ivano-Frankivsk	0,583	0,199	0,614	0,204	0,053	0,285	0,268	0,166	0,000	0,033
Kiev Obl.	0,137	0,047	0,145	0,048	0,012	0,410	0,385	0,238	0,000	0,048
Kirovohrad	0,571	0,195	0,602	0,200	0,052	0,304	0,286	0,177	0,000	0,035
Luhansk	0,280	0,096	0,295	0,098	0,025	0,446	0,419	0,259	0,000	0,052
Lviv	0,375	0,128	0,395	0,131	0,034	0,338	0,317	0,196	0,000	0,039
Mykolaiv	0,551	0,188	0,580	0,193	0,050	0,311	0,292	0,181	0,000	0,036
Odessa	0,333	0,114	0,351	0,117	0,030	0,204	0,191	0,118	0,000	0,024
Poltava	0,411	0,141	0,433	0,144	0,037	0,437	0,410	0,254	0,000	0,051
Rivne	0,366	0,125	0,386	0,128	0,033	0,304	0,285	0,176	0,000	0,035
Sumy	0,464	0,159	0,489	0,163	0,042	0,360	0,339	0,209	0,000	0,042
Ternopil	0,643	0,220	0,677	0,225	0,058	0,212	0,199	0,123	0,000	0,025
Kharkiv	0,274	0,094	0,288	0,096	0,025	0,435	0,409	0,253	0,000	0,051
Kherson	0,601	0,205	0,633	0,211	0,054	0,224	0,211	0,130	0,000	0,026
Cherkasy	0,549	0,188	0,578	0,192	0,050	0,332	0,312	0,193	0,000	0,039
Chernivtsi	0,572	0,196	0,603	0,201	0,052	0,224	0,211	0,130	0,000	0,026
Chernihiv	0,496	0,170	0,523	0,174	0,045	0,289	0,271	0,168	0,000	0,034

Source: evaluation of authors

Comparing the integration levels of agriculture sector and industry in terms of employment shows that most regions of Ukraine, except six industrial regions (Dnipropetrovsk, Donetsk. Zaporizhia, Kyiv, Luhansk, Kharkiv regions) are more integrated with Europe for agriculture sector. At the same time exploring the integration degree of the Ukrainian regions with the CIS countries we get the opposite result – for most regions index integration of industry with these countries is much greater than the corresponding index of agriculture integration. Note also that in 4 regions (Chernovtsy, Vinnitsa, Kherson and Ternopil) the total RIEI for agriculture is almost three times higher than RIEI for industry, and for another 10 areas RIEI are twice. Overall analysis of regional integration index found that agriculture regions of Ukraine are more integrated with Europe, while industry – with CIS countries.

Index geographical attractiveness of region we define under gravity index formula [D. Kallioras, G. Petrakos, 2010]

$$GRAVITY_r = \sum_j \left(POP_r \times POP_j / d_{rj} \right), \qquad (5)$$

where POP_r – population in r-th region, for with we calculate GRAVITY index; POP_j – population in j-th region ($j=1,...,25$, $j \neq r$); d_{rj} – the distance between the centers of the r-th and j-th regions. Analysis of regional GRAVITY index showed the most accessible and geographically attractive the Dnipropetrovsk, Donetsk, Kharkiv, Zaporizhia, Lviv and Odessa, Luhansk, Kyiv region in relation to other regions of Ukraine, while Chernivtsi, Sumy, Chernivtsi and Chernihiv regions have the lowest indices

Part 2. Econometric modeling and results

We conducted also the features research and econometric modeling of dynamic changes in regional employment and productivity. Empirical research of nominal employment in different regions of Ukraine for the past 10 years reveals significant regional differences in the dynamics of changes in interest total employment and the number of employees in various sectors. In particular, during 2004-2013 in half of the regions, despite falling population, we saw an increase in the nominal employment (among others, in the Ternopil region by 14.2%, Rivne – 13.1%, Chernivtsi – 10.8%, Ivano-Frankivsk – 9.6%, Volyn – 5.1%, Lviv – 4.5%, Odessa – 2.4%), although in some regions the total employment decreased (most in Chernihiv (-6.5%) and Donetsk (-5.7%) regions). However, the dynamics of the number of employees in the industry is caused by negative growth rate, which is an average of -7.5% in all regions of Ukraine. The percentage change in employment in regional agriculture is characterized by greater compared to total employment and employment in the industry, and a large variation of left-sided asymmetry. Increasing the number of people employed in the agricultural sector (about 9%) occurred only in third regions of Ukraine (Lviv, Rivne, Kharkiv, Chernivtsi, Donetsk, Mykolaiv, Ivano-Frankivsk and Ternopil), has undergone significant agriculture changes in Kyiv (-59, 7%), Zhytomyr (-45.5%) and Dnipropetrovsk (-37.4%) regions, whereas other regions falling in agriculture employment rate ranged from -3% to -27%. In 2014 we saw a drop in total employment and the number of people employed in agriculture and industry for all regions of Ukraine.

Table 5

Characteristics of the percentage change in employment in the regions of Ukraine, 2004-2016pp.

Characteristics	Percentage change in total employment	Percentage change in agriculture employment	Percentage change in industry employment
Mean	-0,055217	-0,216251	-0,259587
Median	-0,061592	-0,168564	-0,243927
Maximum	0,084570	0,163315	-0,003802
Minimum	-0,174262	-1,003302	-0,605819
Std. Dev.	0,068575	0,262620	0,130197
Skewness	0,507263	-1,151290	-0,471559
Kurtosis	2,735898	4,760967	3,707068
Jarque-Bera	1,099011	8,402882	1,389417
Probability	0,577235	0,014974	0,499220
Sum	-1,325196	-5,190035	-6,230079
Sum Sq. Dev.	0,108159	1,586289	0,389881

Source: evaluation of authors

To model the changes in regional employment in general, as well as in the sectors of agriculture and industry in particular we use econometric models. Based on the economic and mathematical analysis, evaluating and comparing the various econometric models we chose such specifications:

$$\Delta \ln \text{EMPL}_r = \alpha_1 + \alpha_2 \text{E04\_agr}_r + \alpha_3 \text{EMPL04\_agr}_r / \text{POP04}_r + \alpha_4 \Delta \text{RIEI(EUR)\_ind}_r +$$
$$+ \alpha_5 \Delta \text{RIEI(CIS)\_ind}_r + \alpha_6 (\Delta \text{RIEI(EUR)\_agr}_r + \Delta \text{RIEI(CIS)\_agr}_r) +$$
$$+ \alpha_7 (\Delta \text{RIEI(ASIA)\_agr}_r + \Delta \text{RIEI(AFR)\_agr}_r) + \alpha_8 \ln \text{GRAVITY04}_r + \alpha_9 \text{THEIL}_r + \varepsilon_{1r},$$
$$\Delta \ln \text{EMPL\_agr}_r = \beta_1 + \beta_2 \text{E04\_agr}_r + \beta_3 \text{E04\_serv}_r + \beta_4 \text{EMPL04\_agr}_r / \text{POP04}_r + + \beta_5$$
$$(\Delta \text{RIEI(EUR)\_agr}_r + \Delta \text{RIEI(CIS)\_agr}_r) + \beta_6 (\Delta \text{RIEI(ASIA)\_agr}_r +$$
$$+ \Delta \text{RIEI(AFR)\_agr}_r) + \beta_7 \ln \text{GRAVITY04}_r + \beta_8 \Delta \text{THEIL}_r + \varepsilon_{2r},$$
$$\ln \text{EMPL\_ind}_r = \gamma_1 + \gamma_2 \text{E04\_ind}_r + \gamma_3 \text{E04\_serv}_r + \gamma_4 \text{EMPL04\_ind}_r / \text{POP04}_r +$$
$$+ \gamma_5 \Delta \text{RIEI(EUR)\_ind}_r + \gamma_6 \text{RIEI08(CIS)}_r + \gamma_7 \text{RIEI08(ASIA)}_r +$$
$$+ \gamma_8 \ln \text{GRAVITY04}_r + \gamma_9 \Delta \text{THEIL}_r + \varepsilon_{3r}.$$

Here EMPL04_r define the total employment in r-th region in initial 2004; POP04_r – population of r-th region in 2004; E04_agr_r – the agriculture share in r-th region in 2004; E04_ind_r – the industry share in r-th region in 2004; E04_serv_r – the service sector share in r-th region. Variable RIEI(EUR)_r, RIEI(CIS)_r, RIEI(ASIA)_r, RIEI(AFR)_r denote economic integration indices of r-th region with Europe, CIS, Asia and Africa countries respectively. ΔRIEI_r – change in the index of economic integration in the r-th region for the period 2008 to 2013. Variable ΔTHEIL_r characterizes the change in the index of diversification (specialization) employment in various sectors of r-th region during 2004-2013 years and GRAVITY04_r variable indicates the geographical attractiveness index r-th region in 2004.

The estimates of the models parameters determine the impact of differences in geographical location of the region, the initial level of employment, the share of individual sectors, the degree of economic integration and diversification index of economic sectors in the region to the change in nominal employment in the region and also in regional employment in agriculture and industry.

Analyzing the impact of exogenous variables on regional employment change, we found that the initial share of the region in the agricultural sector of Ukraine is a significant factor that has influence to the future dynamics of the number of employees in the region. Regions that are characterized by higher initial (2004) share of agriculture sector, showed during the years 2004-2013 total employment growth, but that was accompanied by decreasing the number of employees in agriculture. Instead, the initial share of industry in the region had no significant effect on change in total employment and agriculture employment, but the negative impact on employment change in the industry. The results indicate that the industrial sector in the regions in which its share in terms of lower can better withstand external and internal instability of the economic environment and structural changes in the economy. However, higher initial share of employment in services in the region provided the other conditions of equality and promotes agriculture and industry growth rate and the growth of employment and development of these sectors.

The increase in employment in the region depends inversely on the proportion of employment in agriculture sector the region in the structure of the region's population, and its increase of 1% causes the decrease in growth rate of total employment by 0.06%.

The modeling results also showed that a higher index of regional industry integration with Europe will help increase employment in the region, while higher levels of industrial integration with the CIS region opposite the deteriorating situation

on the regional labor market. The level of integration of the agricultural sector doesn't change the employment in general, but is a significant factor in changing agriculture employment. Note that the agriculture which intensified trade relations with Asia and Africa tend to employment growth, while expanding integration with Europe and the CIS makes its decline. In addition, a significant factor influencing the growth of regional employment in the industry is the initial index level of economic integration in the CIS industry, before the crisis set in 2008.

Growth in factor diversification Theil index is a significant factor in the changes in employment, confirming the importance of regional specialization in employment growth in the region. The negative estimated value revealed that regional diversification in Ukraine does not allow muffle inherent in every industry shocks arising from integration processes, crisis and instability of the situation, but rather increase the impact of storms and weaken the economy in general.

Meanwhile, the index of gravity is not a statistically significant factor in any of the models suggests not that the geographical location of the region has no influence on the dynamic changes in regional employment.

We explored also the relationship between productivity in the regions of Ukraine, uneven regional development and integration processes. Statistical data show that the highest productivity was observed in Dnipropetrovsk, Kyiv and Poltava regions exceeding three times the values in these unproductive regions: Zakarpattia, Ternopil and Chernivtsi.

Empirical study of the relationship between productivity in the regions of Ukraine, uneven regional development and the level of integration processes we conduct based on econometric models

$$\ln PROD_{rt} = \alpha_{1i} + \alpha_{2t} E\_serv_{rt} + \alpha_{3t} RIEI(EUR)_{rt} + \alpha_{4t} RIEI(CIS)_{rt} + \\ + \alpha_{5t} \ln GRAVITY_r + \alpha_{6t} \ln THEIL_r + \varepsilon_{rt},$$

where $PROD_{rt}$ denote labor productivity in r-th region in year t, E_serv_{rt} – employment share in r-th region in service sector in year t. We estimate model parameters for two different years, namely 2008, preceding the beginning of the economic crisis, and 2013.

Table 6

The Results of Evaluation of Labor Productivity Models

	The Equation for			
	ln PROD (2008)		ln PROD (2013)	
Variable	Coefficient	t-Statistic	Coefficient	t-Statistic
Const	-8.9602	-2.231**	-16.2174	-3.894***
E_serv	3.3615	0.857	0.1188	3.468***
ln THEIL	3.0137	1.397	7.2349	3.678***
ln GRAVITY	0.3567	3.27***	0.3547	3.668***
RIEI(EUR)	-0.0028	-0.429	0.0574	3.209***
RIEI(CIS)	0.0318	1.841*	0.0174	3.473***
R-squared	0.8206		0.8264	
Adjusted R-squared	0.7734		0.7807	
F – Statistic	17.3829 (0.0000)		18.0887 (0.0000)	
White Statistic	1.6866 (0.1862)		0.8011 (0.5626)	
BPG Statistic	1.8032 (0.1604)		1.1278 (0.3794)	

Source: evaluation of authors

Analyzing the results of the model evaluation we obtain the following: in 2008 productivity statistically significant only depend on the geographical location of the region, whereas in 2013 this we had the effect of economic integration indices, Theil index and uneven share of employment in services. The estimated elasticity in productivity by Theil index found that increasing the diversification of the regional index by 1% causes productivity growth in 7.2%.

GRAVITY index is a statistically significant factor of influence in both models, indicating that the geographical location has significant impact on productivity in the region. The positive and stable over time coefficient α_5 shows that remote (peripheral) areas have less potential for productivity growth and require to increase attention to the development and implementation of innovative regional development strategies.

Conclusions

The current experience of formation and development of market economy in Ukraine demonstrates the relevance of studying regional characteristics of domestic labor sector, defining features of social and economic phenomena in the regions of our country. As a result of analysis of employment diversification indices for different regions of Ukraine showed different degree of regional specialization in sectors which, moreover, show different trends over time. We showed that the most diversified regions of Ukraine are Kiev, Lviv, Odessa and Kharkiv regions, while the Khmelnytsky, Chernivtsi, Kherson, Luhansk and Volyn – by contrast have a high degree of specialization of employees. However none of the regions of Ukraine is demonstrate the diversification level which is inherent for the EU.

Modeling demonstrates a convergence of regions in terms of the share of employment in agriculture and industry. Also found significant positive effects on employment change in the initial index of economic integration with Europe and the negative impact index of integration with CIS countries. Specifically the model results indicate that the higher index of integrating the region with European countries contributes to employment in the region, while higher levels of integration with the CIS region opposite the deteriorating situation on the regional labor market. This result is obtained for the sector of agriculture and industry, demonstrates the benefits of European economic integration direction Ukraine.

The results of modeling also show that a higher degree of diversification of industries in the economic structure of the region leads to much better opportunities for reallocation of the available manpower and existing alternative safer economic activities, resulting in decline in some sectors does not lead to decline in the regional economy as a whole. Also acquired new skills and work experience diversity workers extend business activity, especially in areas where movement of workers observed not only between companies but also between different sectors.

Econometric analysis and modeling of changes in labor productivity in regions of Ukraine proves the significance of geographical location of the region, which is determined based on the evaluation of regional gravity index, which indicates that the geographical location of production resources significantly affects productivity in Ukraine. Modeling also proves that the increase in the indices of regional economic integration with Europe and the CIS stimulate productivity growth. However elasticities for Europe and the CIS are different and, therefore, are 5.7 and 1.7, confirming the benefits, feasibility and prospects of Ukraine's integration with the European Union.

References:

1. Andrei, L. C., (2014), Economic Convergence, Part of Advanced European Integration. Internal Auditing and Risk Management, 2(34), 13–21.

2. Artelaris, P., Kallioras, D., Petrakos, G. (2010), Regional Inequalities and Convergence Clubs in the European Union New Member-states. Eastern Journal of European Studies, 1(1), 113–133.

3. Barrios, S., Strobl E. (2009), The Dynamics of Regional Inequalities. Regional Science and Urban Economics, 39(5), 575–591.

4. Bartz, K.and Fuchs-Schündeln, N., (2012), The role of borders, languages, and currencies as obstacles to labor market integration. European Economic Review, 56(6), 1148–1163.

5. Batavia, B., Nandakumar, P. (2002), Economic Integration and Union Power. Open Economies Review, 13(2), 175–182.

6. Caceres, L. R. (2014). Economic integration and unemployment in Central America. Journal of Developing Areas, 48(1), 43–60.

7. Chagovets, L. A. (2011), Prostorovo-dynamichna model dyferenciaciji socialno-ekonomichnogo rozvytku regioniv (Space-dynamic Differentiation Model of Social-economic Regional Development). Business Inform, 9, 26–29.

8. Huang, X., Leon-Gonzalez, R. and Yupho, S. (2013). Financial Integration from a Time-Varying Cointegration Perspective. .Asian Journal of Empirical Research, 3(12), 1473–1487.

9. Johansson, H. (2001), Regional Integration and Productivity Growth: The Case of EU. Journal of Economic Integration, 16, 1–20.

10. Kallioras, D., Petrakos, G. (2010), Industrial Growth, Economic Integration and Structural Change, Evidence from the EU New Member-states Regions. The Annals of Regional Science, 45(3), 667–680.

11. Klebanova, T. S., Guryanova, L. S., Trunova, T. M., Smyrnova, A. Y. (2009), Ocenka y analyz neravnomernosty razvytyja regyonov Ukrayny (Estimation and Analysis of Unbalanced Regional Development in Ukraine). Actual Problems of Economics, 8(98), 162–167.

12. Markovskyy, I. O. (2011). Klasteryzacija innovacijnoji aktyvnosti krajin-chleniv ES [Clustering of Innovation Activity in the EU Member States]. Ekonomichnyi Chasopys-XXI (EconomicAnnals-XXI), 11-12, 16–19.

13. Nikiforova, O. V. and Chagovets L. A. (2011). Ocenka neodnorodnosty razvytyja systemy regyonalnyh rynkov truda Ukrajiny [Assessment of Heterogeneity of Development of the System of Regional Markets of Labor of Ukraine]. Bisnes Inform (Business Inform), 5, 41–44.

14. Obradovic, S. (2008) «European Integration and Balkan Countries», Revista Economica, 40(3), pp. 119–124.

15. Oglih, V. V. and Efanova, T. I. (2014). Analiz socialno-ekonomichnogo rozvytku ekonomichnoji systemy Dnipropetrovskoji oblasti [Analysis of Socio-Economic Development of the Economic System of Dnipropetrovsk Region]. Economichnyi Prostir (Economic space), 87, 91–99.

16. Ortina, G. V. (2014), Vplyv integracijnyh vidnosyn na formuvannja strategiji rozvytku realnogo sectora ekonomiky (Effect relationship with integration strategy formation economics development). European vector of economic development, 1(16), 129–134.

17. Petrakos, G. and Topaloglou, L. (2008). Economic geography and European integration: the effects on the EU's external border regions. Int. J. of Public Policy, 3(3/4), 146–162.

18. Prytula, Ya. Ya., Kuzenko, V. (2013), Structural Reforms and Regional Convergencein Ukraine. Regional Economy, 1, 7–16.

19. Pushkar, T. A. and Fedorova, V. G., 2011. Svitovyj dosvid formuvannja j rozvytku merezevyh i klasternyh objednan [International Experience the Formation and Development of Network and Associations Klasternih]. Ekonomichnyi Chasopys-XXI (EconomicAnnals-XXI), 11-12, 68–71.

20. Rayevneva, O. V. and Bobkova, O. Y., 2012. Vyznachennja dzerel nerivnomirnosti rozvytku regioniv Ukrajiny na pidstavi rozkladannja indeksu Tejla [Identifying Sources of Development Disparities of Ukraine's Regions Basing on Decomposition of Theil Index]. Actualni Problemy Economiky (Actual Problems of Economics), 2(128), 200–210.

21. Savva, C., Aslanidis, C. (2010), Stock Market Integration between New EU Member States and the Euro-zone. Empirical Economics, 39(2), 337–351.

22. Sawers, L. (2006). Inequality and the Transition: Regional Development in Lithuania. Baltic Journal of Economics, 6(1), 37–51.

23. Shevchenko, O. (2011), Depression of regions in Ukraine and possibilities of its overcoming. Business Inform, 7, 66–68.

24. Zhuravliov, A. V. (2013), Mizhnarodni integracijni procesy Ukrajiny v umovach transformacij I globalnoji ekonomiky (International Integration Processes of Ukraine under Global Economy Transformation Conditions). Business Inform, 7, 43–47.