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The influence of the internally displaced persons forced migration on the dynamics of regional social and economic security indicators

Abstract. The processes of forced internal migration, which became significant in 2014 as a result of the armed conflict in the east of the country, caused significant demographic and social changes in the regions performance. Particularly large changes have been taken place in the areas directly adjacent to the joint forces operation zone. The study is devoted to the research of the impact of the described processes on certain aspects of social and economic security of the regions. Impact assessment was performed on the basis of cluster analysis. In particular, the author constructed a neural network such as the Kohonen map. The model divided the neural sample from 25 regions (24 regions and the city of Kyiv) into six clusters according to the level of four indicators of social and economic security. This allowed assessing the impact of forced internal migration on some aspects of social and economic security of the regions. Based on the obtained map, it has been depicted that Donetsk and Luhansk regions, which directly border the joint forces operation zone, had a dramatic increase in the demographic burden and unemployment rate during the study period. The obtained results allowed assessing the impact of forced internal migration on the dynamics of certain indicators of social and economic security of the territories.

Keywords: Internally Displaced Person (IDP); Social and Economic Security; Forced Internal Migration; Cluster Analysis; Kohonen Map

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Вплив вимушеної міграції внутрішньо переміщених осіб

на динаміку окремих показників соціально-економічної безпеки регіонів

Анотація. Процеси вимушеної внутрішньої міграції, що набули значних масштабів в 2014 році в результаті збройного конфлікту на сході країни, спричинили суттєві демографічні та соціальні зміни в житті регіонів. Особливо великі зміни відбулись в областях, що безпосередньо межують із зоною ООС. Дослідження присвячене вивченню впливу описаних процесів на окремі аспекти соціально-економічної безпеки регіонів. Оцінка впливу виконана на основі кластерного аналізу. Зокрема, автором побудовано нейронну мережу типу карти Кохонена.

Модель розподілила навчальну вибірку з 25 регіонів (24 області та м. Київ) на шість кластерів за рівнем чотирьох показників соціально-економічної безпеки. На основі отриманої карти показано, що Донецька та Луганська області, які безпосередньо межують із зоною ООС, мали катастрофічне зростання демографічного навантаження та рівня безробіття протягом досліджуваного періоду.

Отримані результати дозволили оцінити вплив процесів вимушеної внутрішньої міграції на динаміку окремих показників соціально-економічної безпеки територій.

Ключові слова: внутрішньо переміщених особа; соціально-економічна безпека; вимушена внутрішня міграція; кластерний аналіз; карта Кохонена.

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Влияние вынужденной миграции внутренне перемещенных лиц на динамику отдельных показателей социально-экономической безопасности регионов

Аннотация. Процессы вынужденной внутренней миграции, получили значительные масштабы в 2014 году в результате вооруженного конфликта на востоке страны, вызвали существенные демографические и социальные изменения в жизни регионов. Особенно большие изменения произошли в областях, непосредственно граничащих с зоной ООС. Исследование посвящено изучению влияния описанных процессов на отдельные аспекты социально-экономической безопасности регионов. Оценка влияния выполнена на основе кластерного анализа. В частности, автор построила нейронную сеть типа карты Кохонена.

Модель распределила обучающую выборку из 25 регионов (24 области и г. Киев) на шесть кластеров по уровню четырех показателей социально-экономической безопасности. На основе полученной карты показано, что Донецкая и Луганская области, которые непосредственно граничат с зоной ООС, имели катастрофический рост демографической нагрузки и уровня безработицы в течение исследуемого периода.

Полученные результаты позволили оценить влияние процессов вынужденной внутренней миграции на динамику отдельных показателей социально-экономической безопасности территорий.

Ключевые слова: внутренне перемещенное лицо; социально-экономическая безопасность; вынужденная внутренняя миграция; кластерный анализ; карта Кохонена.

1. Introduction

The annexation of Crimea and the deployment of armed conflict in the east of Ukraine in 2014 led to a significant undermining of industrial, transport and social infrastructure, increased environmental risks, and a sharp deterioration in the social and economic situation in Luhansk and Donetsk regions. These processes have negatively affected the overall situation and safety of millions of people. There have been dramatic changes in the state of the economy of these regions, which accounted for about a quarter of industrial production and a large share of Ukraine's exports. The decline in production and the massive closure of small and medium-sized businesses resulted in large-scale job reduction. In Ukraine, the processes of internal forced migration have begun (I. Arakelova, 2018).

The processes of forced migration of internally displaced persons (IDPs) have an impact on almost all spheres of society, and most of all on the demographic, social, economic, labour and financial markets. It leads to the fact that these processes affect the level of social and economic security of the country and regions. However, despite the significant amount of research to study the social or demographic structure of IDPs, the issue of quantifying the impact of forced migration on the level of social and economic security in the regional context remains beyond the attention of scientists.

2. Brief Literature Review

O. Khomra (2005) argued that migration is a natural manifestation of human mobility, motivated by the desire to improve the conditions of their existence, more complete and more reliable satisfaction of their needs.

National scientists as O. Gladuna, T. Hnatyuk, T. Dragunova, O. Ivankova-Stetsyuk, O. Piskun, I. Prybytkova, Y. Rymarenko, U. Sadova, P. Shushpanova, and E. Libanova studied human development, first of all, its social and demographic issues.

Among the foreign scientists who have made a significant contribution to the study of the theory of regional migration processes the following ought to be mentioned: W. Beck, W. Sombart, E. Lee, N. Luhmann, P. Pedersen, J. Raven, O. Stark, and A. Schutz.

F. Castelli (2018) considered factors that trigger migration at the macro (the political, demographic, socio-economic and environmental situations), meso (communication technology, land grabbing and diaspora links) and micro (education, religion, marital status and personal attitude to migration) levels.

H. Haas et al. (2019) in «International Migration: Trends, Determinants, and Policy Effects» synthesizes insights from new global data on the effectiveness of migration policies. They show, that effectiveness of migration policies can limit by «substitution effects», and depend of geographically diverting migration, interrupting circulation, encouraging unauthorized migration, or prompting «now or never» migration surges.

Also H. Haas (2010) is considering migration as a diffusion process. He made a distinction between endogenous and contextual feedback mechanisms and outlined the various ways in which these internal dynamics can give migration processes their own momentum.

Mathematical models that formalize the relationship between migration processes and the factors provoking them are presented in the works: J. Poot, O. Alimi, M. P. Cameron, & D. C. Maré (2016); G. Fagiolo & M. Mastrolillo (2013); M. Czaika & Ch. Parsons (2017); S. Fransen & H. de Haas (2019).

Among the periodic international analytical documents that reveal the problem of internally displaced persons in the world, as well as the problem of refugees, the following should be singled out: World Migration Report (2018), Working Paper of United Nations, Department of Economic and Social Affairs, Population Division (UN-DESA) (2017), Health indicators by World Bank (2019), UNDP Human Development Report (2016).

The scale of migration flows in the world is quantified by specialized organizations, including the United Nations Department of Economic and Social Affairs (New York, USA) (2020) and the Institute for Migration Policy (Washington, USA) (2020). In Ukraine, these issues are dealt with by State Statistics Service of Ukraine (2020).

3. The purpose

The above-mentioned information provides for the conclusion that currently the issue of assessing the relationship between the level of social and economic security of the region and the risks that arise during the forced internal migration of citizens remains.

Aspects of the impact of forced internal migration processes on the level of social and economic security of regions remain insufficiently studied. In the context of a long unresolved conflict in parts of Donetsk and Luhansk regions, this issue primarily concerns regions that share their borders (parts of Donetsk and Luhansk regions controlled by Ukraine, Kharkiv, Zaporizhzhia regions), and Kyiv, where IDPs have more prospects for employment and the level of social protection is higher. To confirm this thesis, the author presents the structure of the distribution of IDPs between the regions of Ukraine as of April 13th, 2020 (Figure 1).

4. Results

The purpose of this study is to analyze the factors associated with the processes of forced migration of IDPs and quantify their impact on the dynamics of social and economic security of the regions. In particular, it is necessary to divide the regions of Ukraine into clusters in accordance with the level of social and economic security before the armed conflict in the East and to follow the dynamics of changes in this distribution over time. Factors that have an impact on the integrated assessment of social and economic security of territories are directly related to the processes of internal forced migration and need to be identified separately.

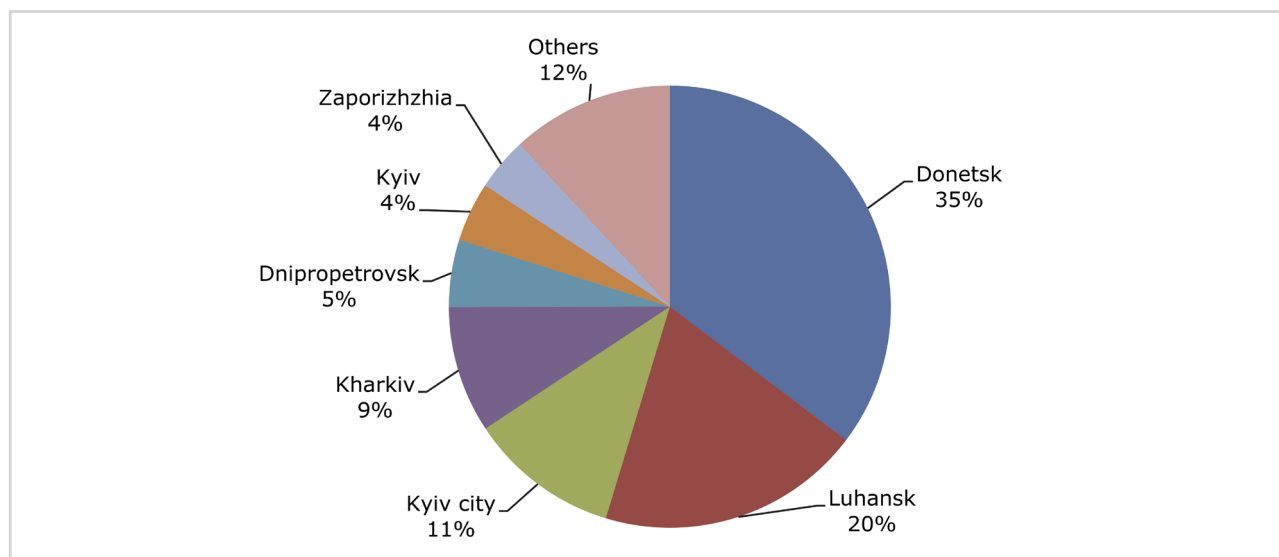


Figure 1:
Distribution of IDPs by regions in Ukraine as of April 13th, 2020
 Source: Created by the author according to UNHCR in Ukraine, 2020

An indicative approach to assessing the national economy vulnerability involves the calculation of a single aggregate index of economic security and a system of sub-indices that characterize the balance of the main sectors of the economy. Periodic calculation of this system of indicators and further comparison of the obtained quantitative estimates with the scale of normative values is the essence of methods of assessing economic security. It is assumed that beyond these values, the economic system becomes vulnerable to internal and external factors and is not capable of self-development, competitiveness, accumulation of national wealth (O. Koristin, O. Baranovsky, & L. Gerasimenko, 2008).

The level of country economic security is characterized by many indicators. Therefore, in practice, integrated assessments are used, which would describe the change in the level of economic security of the country in the dynamics in comparison with the threshold values. It is the comparison of the quantified level of economic security of the country with the threshold values which is the main task of the analysis of economic security.

The threshold value is a limit value; non-compliance with its values leads to the beginning of destructive actions and unregulated processes in various sectors of the country and its territories, to the formation of destabilizing tendencies, and provides for the crisis within the system.

In order to determine the threshold values of indicators, the following methods are used (Yu. Kharazishvili & T. Krupelnytska, 2013; M. Intriligator, 1975; I. Strelchenko, 2015):

- functional dependencies (macro / microeconomic analytical or statistical equations, Akhiezer-Goltz methods, information theory);
- macroeconomic models that adequately reflect the effects of destabilizing factors for a particular country in the current period;
- methods of expert assessments; taking into account the assessments of international organizations (comparison of the main macroeconomic indicators with the threshold values, which are accepted as values not lower than the world average);
- assessment of the increase of economic growth of the country according to the main macroeconomic indicators and the dynamics of their change;
- methods of expert assessment and heuristic methods («snowball»; analogue approach; calibration; scoring of the level of economic security and ranking of areas according to the degree of threats based on the analysis of actual indicators of economic security);
- method of analysis and processing of scenarios;
- nonlinear dynamics (Wavelet analysis);
- stochastic (diagnosis: cluster analysis, fuzzy sets; *t*-criterion; logistic regression, multidimensional statistical analysis);
- theoretical methods and gamification;
- methods of utility theory;
- methods of pattern recognition;
- legislative approach (setting thresholds at the legislative level).

The first two methods are used more often, the others - only in case of impossibility of their application.

Currently, in Ukraine at the legislative level, there are methodological recommendations for calculating the level of economic security of the country, which essentially implements an indicative approach in assessing the vulnerability of the national economy and ultimately provide for the calculation of integrated assessment. Compared to the abolished methodology in 2007, the new development has a number of advantages, namely (Yu. Kharazishvili & T. Krupelnytska, 2013):

- determination of the vector of limit values of integrated indicators;
- setting weighting factors to calculate the contribution of each sub-index to the integrated indicator by the method of principal components;
- substantiation of the method of rotation of factor axes.

This technique has several known methodological and technical drawbacks in determining the integrated indicator of economic security (Yu. Kharazishvili & T. Krupelnytska, 2013).

The classical indicative method is based on a comprehensive analysis of economic security indicators and consists of the following stages:

- formation of a set of indicators;
- determination of characteristic (optimal, threshold and limit) values of indicators;
- normalization of indicators;
- determination of weighting factors;
- calculation of the integrated index.

In order to adequately describe the dynamics and assess the social and economic security of the region in view of the ongoing military conflict in the East, it is necessary to expand the relevant system of basic indicators. It is essential to define a set of indicators that will allow quantifying the impact of forced internal migration on the state of social and economic security of the region. In addition to the generally accepted quantitative characteristics of assessing the effectiveness of the region's economy, the author proposes to use definite criteria, namely:

- the growth rate of demographic load since the beginning of environmental protection;
- the growth rate of unemployment since the beginning of the joint forces operation;
- the proximity of the region location to the joint forces operation zone;
- the growth rate of remittances from abroad since the beginning of the joint forces operation.

It is necessary to analyze separately the impact of selected indicators on the level of social and economic security of the region and their dynamics under the influence of forced internal migration.

In terms of the impact on the region economy, the growing burden of the elderly population on the working population leads to a decrease in the natural recovery of labour resources and is a problem for the social production development. If the share of retirees in the total population increases, it creates the need for additional care for the elderly, leads to an increase in the economic cost of providing services to support this category. In order to maintain and serve the elderly, it is important to increase non-production expenses (N. Stativka & A. Smaglyuk, 2011).

According to UNHCR in Ukraine (2020), the age structure of IDPs varies greatly by region, for example, the proportion of older people varies from 15% (Lviv region) to 72% (Luhansk region). The highest number of people with special needs in the structure of IDPs falls on the regions directly bordering the joint forces operation zone and neighbouring regions. This significantly affects the level of demographic burden on the economically active population and the level of social and economic security of these regions.

The State Statistics Committee defines demographic burden (DB) as a generalized quantitative characteristic of the age structure of the population, which shows the burden on society of the unproductive population. DB is given per thousand of population, i.e. in permille (‰). Accordingly, the DB is calculated by the formula:

$$DB = \frac{\text{number of people aged 60 and over}}{\text{population aged 16–59}} . \quad (1)$$

In order to confirm the assumption of a significant impact of forced internal migration processes after 2014 on the level of social and economic security of individual regions, the author created a comparative table of the total DB and compare the dynamics of its change during the period of the joint forces operation zone (Table 1).

According to Table 1, it can be concluded that the areas that are territorially located in the close proximity to the joint forces operation zone during the period under review had a rapid dynamics to the growth of DB. In particular, the maximum growth rate is observed in Luhansk (+32.2%) and Donetsk (+25%) regions, which account for more than 50% of the total number of IDPs. In comparison: the average growth rate of DB within the country during that period was - 11.7%.

The growth of the demographic burden has adverse consequences, which, in particular, leads to a scattering of investment as a result of their redistribution from manufacturing to social infrastructure, a decrease in savings as a result of increased consumption by households.

The next factor to be considered is the unemployment rate (UR) among IDPs. It is quite natural that a significant increase in the number of IDPs leads to a proportional increase in the unemployment rate in the region. The author presents the data on the unemployment rate according to the methodology of the International Labor Organization (defines the unemployment rate as the ratio (percentage) of the number of unemployed aged 15 and older to the labour force of the specified age or social and demographic group) by region in the form of a comparison table during the period of the joint forces operation (Table 2).

According to the results of the data given in Table 2, significant growth of UR in the regions bordering the joint forces operation zone can be observed. In particular, the unprecedented growth of the indicator during the period under review is noticed in Luhansk (202%) and Donetsk regions (59.5%), with the average growth rate of UR at 9.5%, and half of the regions had a reduction of UR.

The third indicator that needs to be taken into account in order to assess the impact of forced internal migration processes on the level of social and economic security of the region is the close proximity (CP) to the demarcation line, to the joint forces operation zone. The objectivity and the need to take this indicator into account is unquestionable. However, the quantitative assessment of territories by distance from the line of demarcation is complicated by the lack of a clear methodology in international law for determining areas of armed tension in countries with military conflict (R. Barttels, 2009). Therefore, in the framework of this study, the author offers an expert assessment of this indicator, which will be determined in points. The scale of the UR indicator varies from 1 to 4 and is adjusted according to the regions correspondingly to the geographical

Table 1:
Comparison of regions in Ukraine by the level of DB
in the period from 1.01.2014 to 1.01.2019

Region, in descending order of DB (1.01.2014)	DB (1.01.2014)	DB (1.01.2019)	Region, in descending order of DB (1.01.2019)
Chernihiv	421	489	Luhansk
Cherkasy	393	480	Donetsk
Kirovograd	385	459	Chernihiv
Donetsk	384	425	Cherkasy
Vinnytsia	378	421	Sumy
Poltava	376	416	Kirovograd
Sumy	375	415	Zaporizhzhia
Luhansk	370	403	Poltava
Khmelnitsky	365	402	Vinnytsia
Zaporizhzhia	364	399	Khmelnitsky
Zhytomyr	355	396	Dnipropetrovsk
Dnipropetrovsk	354	385	Kharkiv
Kharkiv	346	384	Mykolayiv
Mykolayiv	338	383	Zhytomyr
Kyiv	337	380	Kherson
Kherson	334	361	Odesa
Ternopil	331	357	Kyiv
Odesa	326	357	Ternopil
Lviv	306	344	Kyiv city
Chernivtsi	302	343	Lviv
Ivano-Frankivsk	299	330	Ivano-Frankivsk
Kyiv city	295	327	Chernivtsi
Volyn	285	314	Volyn
Rivne	273	303	Rivne
Transcarpathian	258	286	Transcarpathian

Source: Created by the author on the basis of State Statistics Service of Ukraine (2020)

Table 2:
Comparison of regions in Ukraine by the UR
in the period from 1.01.2014 to 1.01.2019

Region, in descending order of UR (1.01.2014)	UR, % (1.01.2014)	UR, % (1.01.2019)	Region, in descending order of UR (1.01.2019)
Zhytomyr	12.1	17.8	Luhansk
Chernihiv	11.9	15	Donetsk
Ternopil	11.8	13.3	Volyn
Rivne	11.7	13	Kirovograd
Vinnytsia	11.6	13	Ternopil
Khmelnitsky	11.2	12.5	Poltava
Poltava	10.8	11.9	Kherson
Transcarpathian	10.7	11.7	Chernihiv
Chernivtsi	10.7	11.6	Zhytomyr
Kirovograd	10.5	11.5	Rivne
Volyn	10.4	11.4	Vinnytsia
Sumy	10.4	1	Zaporizhzhia
Cherkasy	10.4	10.9	Khmelnitsky
Kherson	10.2	10.7	Mykolayiv
Mykolayiv	10	10.4	Cherkasy
Lviv	9.6	10.2	Transcarpathian
Ivano-Frankivsk	9.5	10.2	Sumy
Donetsk	9.4	9.9	Chernivtsi
Luhansk	8.8	9.1	Ivano-Frankivsk
Zaporizhzhia	8.1	8.5	Dnipropetrovsk
Kyiv	8.1	7.9	Lviv
Kharkiv	8	7.7	Kyiv city
Dnipropetrovsk	7.7	7.6	Odesa
Odesa	7.2	6.6	Kyiv
Kyiv city	7.1	6.2	Kharkiv

Source: Created by the author on the basis of State Statistics Service of Ukraine (2020)

distance from the demarcation line from the maximum value - for regions directly bordering the joint forces operation zone (Donetsk and Luhansk regions) to the minimum - regions far from the joint forces operation zone. The level of UR is equal to three in the regions bordering with regions with the level of UR equal to 4 (Dnipropetrovsk, Zaporizhzhia, Kharkiv). UR = 2 for the territories adjacent to Kirovohrad, Mykolaiv, Poltava, Sumy, Kherson and BR = 1 for all others.

The last indicator that the author proposes to take into account in the process of cluster analysis of the dynamics of individual indicators of social and economic security of regions under the influence of forced IDP migration is the growth rate of remittance flows from abroad (RF). This is the only one of the selected indicators that reflects the positive impact of IDP migration on regional security.

The current realities demonstrate that in conditions of declining investment attractiveness, as well as military-political conflict, growing remittances and investments of IDPs forced to work abroad can become a stable and long-term resource for regional economic development (A. Gaidutsky, 2015).

The available data of the National Bank of Ukraine allows investigating the regional distribution of only part of remittances to Ukraine that come through international payment systems (Western Union, «Golden Crown», MoneyGram, etc.). Therefore, this study is limited to official statistics and will not make assumptions about the amount of remittances through other revenue channels. This approach will allow forming a statistical sample to build a mathematical model that meets the principles of comparability (Table 3).

Based on the statistical information in Table 3, one can observe a growing trend of the RF in the regions that account for the majority of IDPs. An important exception is Donetsk and Luhansk regions. They show a decrease in RF revenues, and therefore no positive effect from the processes of forced internal migration on this indicator. This is due to the highest levels of IDPs in regions where more than half of IDPs are retired ones. Conversely, the majority of the economically active IDP population was registered in Kyiv, where the RF grew by 309% during the period under review.

Based on statistical information on the dynamics of selected indicators, the author will conduct a cluster analysis of their impact on the level of social and economic security of the regions on the basis of a neural network such as the Kohonen map.

The Kohonen map implements one of the methods of cluster analysis. This neural network is a single layer of neurons organized in the form of a two-dimensional matrix. It makes it possible to obtain a visual image of multidimensional input data. The Kohonen map allows clustering of objects of study and further analysis of neuronal weights and distribution of examples by clusters.

Table 3:
Comparison of regions in Ukraine by the level of RF
in the period from 1.01.2014 to 1.01.2019

Region, in descending order of RF (1.01.2014)	RF, USD million (1.01.2014)	RF, USD million (1.01.2019)	Region, in descending order of RF (1.01.2019)
Lviv	790	1845	Odesa
Ternopil	612	1765	Kyiv city
Ivano-Frankivsk	595	757	Kyiv
Donetsk	595	612	Dnipropetrovsk
Kyiv city	571	517	Kharkiv
Chernivtsi	527	433	Lviv
Dnipropetrovsk	416	417	Kherson
Luhansk	349	290	Zaporizhzhia
Kharkiv	348	257	Ivano-Frankivsk
Odesa	348	243	Mykolaiv
Khmelnitsky	332	237	Chernivtsi
Sumy	289	212	Ternopil
Zaporizhzhia	272	188	Vinnitsia
Transcarpathian	255	167	Poltava
Kyiv	245	153	Khmelnitsky
Cherkasy	229	147	Cherkasy
Mykolaiv	187	137	Transcarpathian
Vinnitsia	170	124	Donetsk
Poltava	146	112	Zhytomyr
Zhytomyr	136	112	Sumy
Rivne	136	93	Rivne
Volyn	128	92	Kirovohrad
Kherson	93	82	Chernihiv
Chernihiv	85	80	Volyn
Kirovohrad	68	53	Luhansk

Source: Created by the author on the basis of expert data and official information by State Statistics Service of Ukraine (2020) and A. Gaidutsky (2015)

According to the simulation results, the author obtained a Kohonen map, which divides the sample of 25 elements (24 regions and the city of Kyiv) into clusters according to the level of selected indicators that characterize certain aspects of the impact of forced internal migration on the level of social and economic security of regions (Figures 2 and 3).

The regions in Ukraine were distributed by clusters according to the values of the selected indicators as of January 1, 2014, as follows:

- Cluster No. 1: Transcarpathian, Zaporizhzhia, Ivano-Frankivsk, Kyiv, Mykolaiv, Sumy, Ternopil;
- Cluster No. 2: Volyn, Rivne, Kherson, Khmelnytsky, Cherkasy, Chernivtsi;
- Cluster No. 3: Dnipropetrovsk, Donetsk, Lviv, Luhansk, Odesa, Kharkiv;
- Cluster No. 4: Kirovohrad, Chernihiv;
- Cluster No. 5: Kyiv;
- Cluster No. 6: Vinnytsia, Zhytomyr, Poltava.

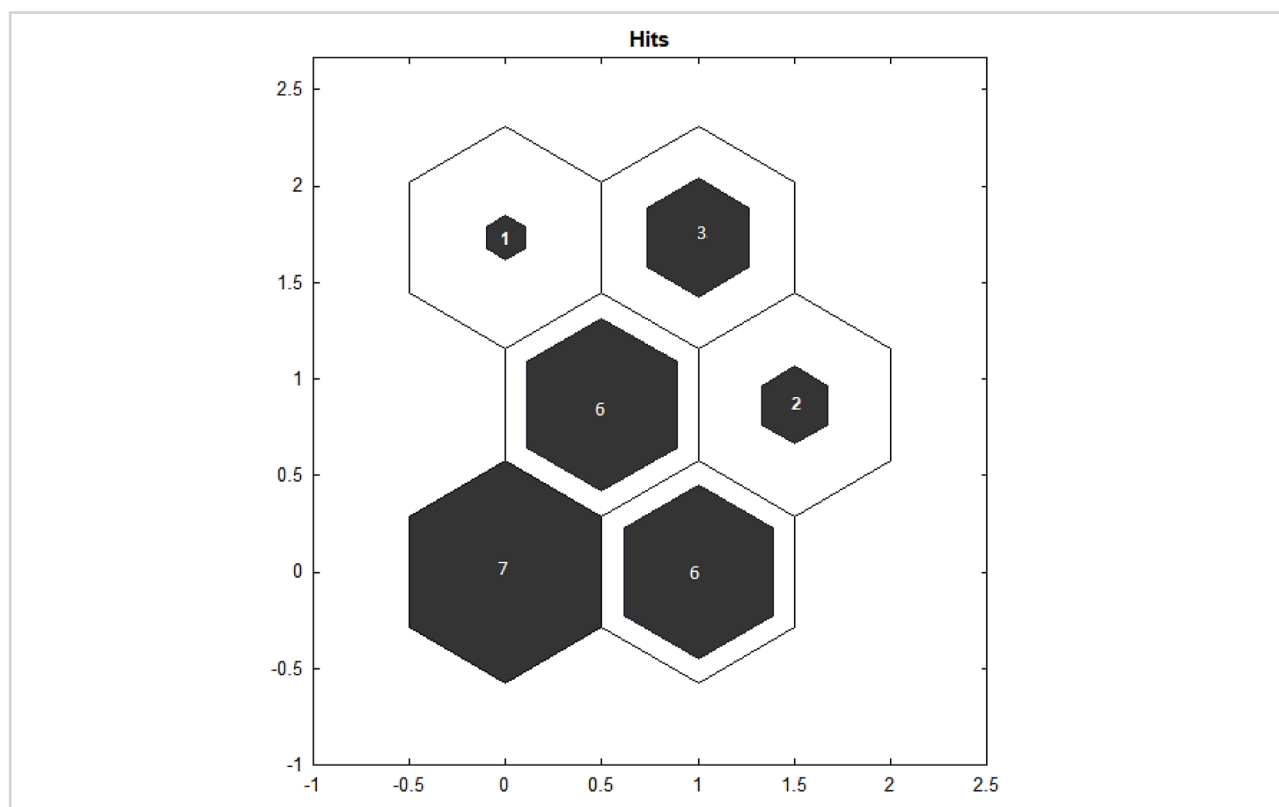


Figure 2:

Kohonen map, obtained as a result of modelling the distribution of regions of Ukraine by individual indicators of social and economic security according to data as of 1.01.2014

Source: Created by the author

It is necessary to consider the obtained clusters in accordance with the selected indicators of social and economic security and compare the change in the cluster structure of the training sample under the influence of forced internal migration (Figure 3).

The highest level of security according to the selected indicators as of January 1, 2014, was observed in Kyiv (cluster No. 1), Dnipropetrovsk, Donetsk, Lviv, Luhansk, Odesa and Kharkiv regions (cluster No. 3). They were characterized by a combination of the lowest and average values of demographic burden, unemployment and remittances. This result is quite justified - the core of the third cluster consists of historically formed industrial regions of Ukraine, and Kyiv as the financial and administrative centre of the country with all the relevant advantages and opportunities.

The cluster No. 1 is characterized by a stable level of security as it is the largest and includes areas with low unemployment, the demographic burden on the economically active population and high values of RF, which significantly exceed the corresponding flows of foreign investment in the regions. Slightly inferior to values of the studied indicators correspond to cluster number two. The level of security of the areas included in it, according to the selected indicators, is defined by the author as below average.

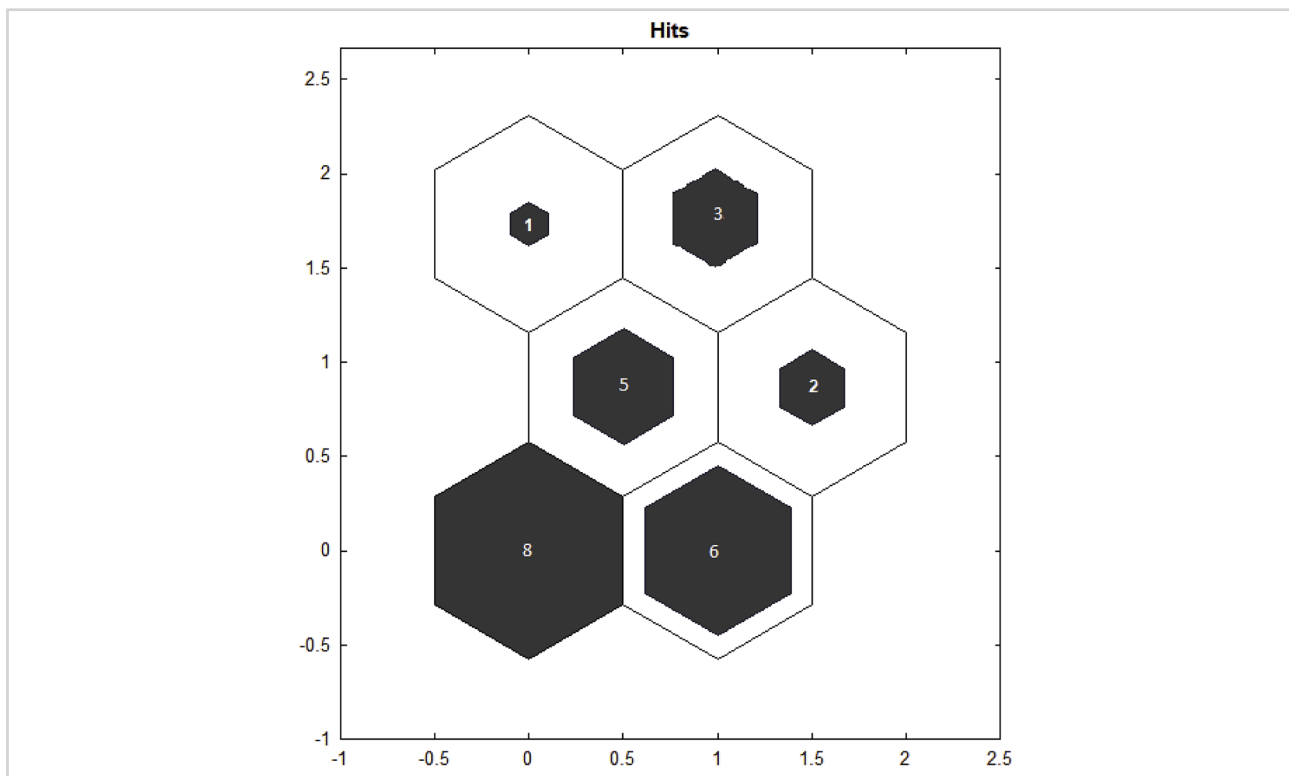


Figure 3:

Kohonen map, obtained as a result of modelling the distribution of regions in Ukraine by individual indicators of social and economic security according to data as of January 1, 2019

Source: Created by the author

The worst situation in terms of UR, DB and RF parameters was peculiar, as for 01.01.2014, to Vinnytsia, Zhytomyr, Poltava (cluster No. 6), Kirovohrad and Chernihiv regions (cluster No. 4). The latter two have the worst values of indicators, and therefore the level of social and economic security is defined by the author as «dangerous». The level of social and economic security in the regions of the sixth cluster was threatening.

Under the influence of the processes of forced internal migration in the cluster structure of the educational sample, there were changes. Therefore, the regions of Ukraine were distributed by clusters according to the values of the selected indicators on January 1, 2019, as follows:

- Cluster No. 1: Vinnytsia, Zhytomyr, Transcarpathian, Rivne, Ternopil, Khmelnytsky, Cherkasy, Chernivtsi;
- Cluster No. 2: Ivano-Frankivsk, Kyiv, Lviv, Mykolaiv, Odesa, Kherson;
- Cluster No. 3: Volyn, Kirovohrad, Poltava, Sumy, Chernihiv;
- Cluster No. 4: Donetsk, Luhansk;
- Cluster No. 5: Kyiv;
- Cluster No. 6: Zaporizhzhia, Dnipropetrovsk, Kharkiv.

According to the selected set of indicators, Donetsk and Luhansk regions have a dangerous level of social and economic security - cluster No. 4. Since the beginning of the military conflict in the east, which has led to a significant influx of IDPs to these regions, their status has changed from «the highest level of security» to «dangerous» one. The high share of IDPs in the structure of IDPs has led to a catastrophic increase in the demographic burden and unemployment rate in the regions. Instead, there was no increase in remittances, the positive dynamics of which also directly depends on the number of the economically active population in the region. In addition, the regions directly border to the joint forces operation zone, which, according to the proposed algorithm, gives the territories the highest values of the UR indicator and reflects the additional risks associated with it.

According to the distribution, the level of security in Volyn, Kirovohrad, Poltava, Sumy and Chernihiv regions remains threatening. Under the influence of forced internal migration, the indicators of demographic burden and unemployment have increased significantly in Zaporizhzhia, Dnipropetrovsk and Kharkiv regions. In addition, UR = 3 for these areas. Because of this, the

trained neural network assigned them to first cluster. However, the level of social and economic security of these regions remains above average, in particular, due to the growth of remittance flows and low unemployment. The results suggest that, despite the proximity of the location to the demarcation line, a significant number of IDPs did not cause a catastrophic decline in social and economic security. One reason is the difference in the demographic structure of IDPs. Compared to Donetsk and Luhansk regions, the regions of the sixth cluster have a ratio between people of working age and a retirement age of 80-90% (8-9 people of working age per 10 pensioners), while in the fourth cluster the same figure is 24% (Donetsk region) and 17 % (Luhansk region).

The fifth cluster has the highest level of security. It consists of one element of the training sample - Kyiv city. Although the status of the safest region according to the chosen system of indicators has not formally changed, the positive effect of the flow of IDPs since 2014 can be observed on the example of Kyiv. The reason for this is the demographic structure: the previously mentioned ratio between people of working age and pensioners among IDPs is 231%. This means that one pensioner has two people of working age. As a result, cash flows from IDPs, low unemployment and the demographic burden have more than tripled.

The first and second clusters are characterized by a medium and high level of social and economic security according to selected indicators. Generalized simulation results are given in Table 4.

Table 4:
Generalized characteristics of individual indicators of social and economic security of regions by clusters of the Kohonen map

Indicator	The average value per cluster					
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
DB, %	11.11	8.97	12.14	16.4	7.7	8.57
UR, %	360.25	359.17	402.6	484.5	344	398.67
RF, USD millions	159.88	664.17	106.6	88.5	1765	473
CP, rank	1	1.4	1.60	4	1	3

Source: Created by the author

The obtained average values of indicators of unemployment, demographic burden, remittances and proximity to the line of demarcation confirm the conclusions obtained by the author on the impact of forced internal migration on certain aspects of social and economic security of regions.

5. Conclusions

Events in the east of the country require additional studies of a conceptual approach to assessing the level of economic security of regions. In the light of these events, it becomes clear that adequate management of the security of the regional economy is impossible without taking into account the risks of significant fluctuations in its individual indicators under the influence of the processes of forced internal migration.

As a result of the study, the author constructed a neural network such as the Kohonen map. The model divided the neural sample from 25 regions (24 regions and the city of Kyiv) into six clusters according to the level of four indicators of social and economic security. This allowed assessing the impact of forced internal migration on some aspects of social and economic security of the regions. In particular, based on the obtained map, it has been depicted that Donetsk and Luhansk regions, which directly border the joint forces operation zone, had a dramatic increase in the demographic burden and unemployment rate during the study period. IDPs remittances have also declined several times. The level of social and economic security of the regions of the sixth cluster was selected as dangerous according to the selected indicators. In contrast, in Kyiv city, which has a significant influx of IDPs, there has been an increase in the level of social and economic security according to selected indicators. This is due to the demographic structure of the regions with IDPs. The ratio between people of working age and pensioners among IDPs is 231%. As a result, cash flows from IDPs, low unemployment and the demographic burden have more than tripled.

The level of security of the regions bordering Donetsk and Luhansk ones remains consistently high during the period under review. They did not record the dramatic impact of forced internal migration, but there was an increase in the demographic burden.

The obtained results can be used for the formation of regional social and economic policy and the corresponding national demographic and migration policy. The process of cluster analysis and the proposed system of indicators allow for constant monitoring and assessment of the impact of forced internal migration processes on certain aspects of social and economic security of the regions.

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