









# “Causality of external population migration intensity and regional socio-economic development of Ukraine”

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# CAUSALITY OF EXTERNAL POPULATION MIGRATION INTENSITY AND REGIONAL SOCIO-ECONOMIC DEVELOPMENT OF UKRAINE

## Abstract

The Carpathian Region (Zakarpattia, Lviv, Chernivtsi, and Ivano-Frankivsk) is inferior to other regions in Ukraine regarding its economic development, which does not contribute to migration stability and, rather, serves as a factor motivating the active part of the population to emigrate. The problem of the labor market disproportions in the Carpathian Region is one of the significant causes of the formation and subsequent implementation of migration intentions, especially in rural areas, less economically developed areas, and district centers, where labor demand is much lower. The research aims to develop an innovative approach to calculating the intensity of the population's external migration based on the introduction of a correction coefficient, which enables to consider the scale of transit migration in the Carpathian Region. The data presented in the study were collected for the period 2005–2018. Granger causality analysis is used to assess the relationship between migration and socio-economic development of the region. The analysis reveals that in all regions of the Carpathian Region, there is a short-run causal relationship between the intensity of external migration and the share of total household expenditure on food; in the medium run, the real household income, the size of the average monthly wages, and the volume of foreign portfolio investment, the foreign economic activity and retail trade turnover in the region; in the long run, living standards and indicators of economic growth. Future studies may require a more diverse set of indicators to evaluate the causal relationship in other regions of Ukraine, which will provide the integrity of the results of Granger causality analysis.

## Keywords

migration intensity, socio-economic development,  
Granger causality, Carpathian Region, Ukraine

## JEL Classification

F22, O15, R11

## INTRODUCTION

Socio-economic development of the Carpathian Region is both a cause and a consequence of migration since the critical accumulation of disparities (compared to other regions, large cities, and industrial development centers), and the lag of the Region's regions in key social and macroeconomic parameters strengthen people's motivation for labor and further permanent migration. On the contrary, a significant increase in the intensity and scale of migration leads to the growing number of social problems, worsening of labor potential of the territories' development, decline in production, and GDP growth. The problem of labor market imbalance and lower wages and incomes is one factor determining the formation and subsequent implementation of attitudes towards migration, especially in rural areas, less economically developed territories, and district centers, where demand for labor is much lower.

The large-scale external migration of the population deteriorating human resource potential of the region has a significant negative effect

causing a decrease in certain parameters of social and economic development of the Regions' regions and, accordingly, needs to be regulated. At the same time, short-term migration usually leads to positive effects on the population's purchasing power, development of the domestic market, investment activity, etc.

To form a quality and effective state migration policy, it is necessary to understand the positive and negative effects of migration processes and identify areas (macroeconomic and social indicators) directly affected by migration and determine those of them, which, in turn, intensify migration themselves.

The search for relevant methods for analyzing the relationships between the external migration, on the one hand, and socio-economic development, on the other hand, is an important task in creating the information and analytical support for forecasting migration effects, and, consequently, developing efficient government decisions to regulate migration processes to minimize their negative impacts and using their capacity to strengthen the socio-economic growth of the regions.

## 1. LITERATURE REVIEW

While elaborating on the methodology, the results of research in the field of migration, socio-economic development of the territories have been considered. The mentioned studies relate to the analysis of the volume, rate, and intensity of external migration in European countries (Danzer & Dietz, 2014; Lücke & Saha, 2019; Malynovska, 2014; Okólski, 2007; Vollmer & Malynovska, 2016; Zimmermann, 1996). They substantiate the growing migration flows from the Eastern European countries, including Ukraine, to Western and Southern Europe. These trends are influenced by many endogenous and exogenous factors shaping the migration environment. With respect to the latter, there is an emerging number of works aimed at the identification of factors and consequences of external population migration at the micro, meso, and macro levels (Bauernschuster, Falck, Heblich, Suedekum, & Lameli, 2010; Dustmann, Frattini, & Preston, 2013; Hear, Bakewell, & Long, 2017; Katsarski, 2019; Mulka, Baraniak, Ivaniuk, & Kolosinska, 2019; Woo & Kim, 2020). Another relevant issue, which often recurs in discussions, is the development of approaches to the selection of indicators for the integral evaluation of migration activity and areas' socio-economic growth. Since in the current theory and practice of economic research there is little consensus about this, it is reasonable to use the authors' previous contributions and other scholars' studies (Levytska, Mulka, Ivaniuk, Kuniytska-Iliash, Vasylytsiv, & Lupak, 2020; Rahman, 2013; Vasylytsiv, Levytska, & Mulka, 2019).

The theoretical and empirical search for relationships and interactions between external migration and socio-economic development of the regions is thoroughly studied by Fisher (2013), Kravtsiv (2013), Levytska (2016), Sadova (2011), Vasylytsiv, Irtysheva, Lupak, Popadynets, Shyshkova, Boiko, and Ishchenko (2020). The causality analysis of economic growth and migration processes in different states and regions is presented in the works of Gómez and Giráldez (2017), Kangasniemi, Mas, Robinson, and Serrano (2012), Lewis (2004), Morley (2006) and etc., while social dimension as a potential determinant of migration and the pull and push effects of social institutions have been recently studied by Arif (2020).

Much of the literature is drawn from the experience of advanced economies, although developing economies are of a great scientific interest. Thus, the publication by Docquier, Peri and Ruysen (2014) reveals the effect of country-specific factors on the probability that individuals join the pool of potential migrants with the following consideration of the bilateral and destination country factors that affect the frequency at which potential migrants turn into actual migrants. Apart from the analysis of causality between external population migration intensity and regional socio-economic development, it is important to consider the demographic and migration modeling of perspective development of the regions based on regression analysis, gravity models, matrix models or multiregional population projections (Raymer & Rogers, 2007; Rogers, 2008; Wilson & Rees, 2005) for substantiated discussion and inter-

pretation of positive and negative impacts of external migration on socio-economic development in the short, medium, and long run (Gheitarani, El-Sayed, Cloutier, Budruk, Gibbons, & Khanian, 2020; Rosvall, 2020; Wenham, 2020).

These studies have formed the basis for the development of a methodological approach and further causality analysis of external migration intensity and social and economic development of the Carpathian Region. However, the complexity of migration processes in Ukraine and its regions is still insufficiently studied, which requires a deeper and more thorough analysis of these issues at the local and regional levels using new research methods and tools.

## 2. AIMS

The current research aims to evaluate the intensity of external migration of the population based on the introduction of a correction coefficient of transit migration in the Carpathian Region and assess the relationship between migration and socio-economic development of the region.

Summarizing the above considerations, the following hypothesis is put forward that there is a close causal relationship between the external migration growth and socio-economic development of the regions, which differs in a short-run, medium-run, and long-run perspective; thus, the scale of migration effects increases over time: in a short run, it mostly deals with the purchasing power and consumption expenditure of the population, and in the long run, it deals with the life quality and economic growth.

## 3. METHODS

### 3.1. Calculation of external population migration intensity in the Carpathian Region's regions

Calculating the level of external population migration in the regions of the region has information and analytical limitations associated with the incompleteness of hard statistical data on migration processes at the regional level and the lack of

such studies in domestic research. The availability of information and its quality led to the selection of a specific indicator of external migration, which is the intensity of migration processes and allowed to develop an algorithm for its evaluation by regions.

The level of external population migration intensity in the region is calculated as a ratio of the number of citizens who have left the region to the population in the mentioned region. The external movements through the Carpathian Region are performed not only by residents of the region but also by representatives of other regions in Ukraine (transit migrants). When calculating the level of external migration intensity, a correction coefficient should be considered (formula (1)):

$$MIGR_t^{reg} = \frac{DEP_t^{reg}}{NP_t^{reg}} \cdot k_t^{reg}, \quad (1)$$

where  $MIGR_t^{reg}$  is the level of external population migration intensity in a region in time interval  $t$ ;  $DEP_t^{reg}$  is the total number of Ukrainian citizens who have moved abroad from a region in time interval  $t$ ;  $NP_t^{reg}$  is the population size in a region in time interval  $t$ ;  $k_t^{reg}$  is a regional correction coefficient of migration in time interval  $t$ .

The regional correction coefficient of migration ( $k_t^{reg}$ ) is to be calculated by the following formula:

$$k_t^{reg} = \frac{DEP_t^{UA} - DEP_t^{reg}}{NP_t^{UA} - NP_t^{reg}}, \quad (2)$$

where  $DEP_t^{UA}$  is the total number of Ukrainian citizens who have moved abroad from the country in time interval  $t$ ;  $NP_t^{UA}$  is the population size in Ukraine in time interval  $t$ .

### 3.2. The causal analysis of population migration and socio-economic development of the Carpathian Region

For assessing the causality of external population migration in the Carpathian Region's regions and their social and economic development, some relevant indicators as ratios or percentages have been selected (Table 1). This ensures the indicator com-

**Table 1.** Indicators of socio-economic development of the Carpathian Region

Source: Compiled by the authors.

Abbreviation	Indicators	Explanation
<b>Social development of the region</b>		
UNEMPL	Unemployment rate for the population aged 15-70	Total population aged 15-70, %
EAR	Economic activity rate for the population aged 15-70	Total population aged 15-70, %
WAGE	Average monthly nominal wages	Per employee, EUR
INCOME	Household real income	Per capita, EUR
CPI	Consumer price index	Average percentage change over time (year) in the prices, %
EXPENS	Share of total household expenditure on food	Per household/month, %
<b>Economic development of the region</b>		
FDI	Foreign direct investment	Per capita, EUR
FPI	Foreign portfolio investment	Per capita, EUR
GVA	Gross value added	Per capita, EUR
UNITS	Number of small business units	Per 10,000 population
RETAIL	Retail trade turnover	Per capita, EUR
FEA	Volume of foreign economic activity	Per capita, EUR
GDP	GDP to gross employee wages ratio	Coefficient

parability in terms of the regions and allows following up the real trends.

The hypothesis of the existence of a causal relationship has been tested using Granger causality analysis (Granger, 1988), and its method involves three stages:

- 1) logarithm of the original data to bring the indicators to one logical series, including the reduction of statistical errors;
- 2) selection of the required number of time lags (there are three lags selected for the study, namely, the short-run (lag 1), medium-run (lag 2), and long-run (lag 3));
- 3) acceptance/rejection of the null hypothesis by the obtained values of the  $p$ -level.

## 4. RESULTS AND DISCUSSION

The level of economic development of the Carpathian Region is way behind the national average, which does not contribute to migration stability. Rather, it serves as a factor that motivates the active population to mobility, including migration abroad, in the case of affordable living and work alternatives.

The statistical basis for calculating the level of external population migration intensity in the

Carpathian Region is the data of territorial subdivisions of the Western Regional Directorate of the State Border Guard Service of Ukraine on the number of Ukrainian citizens who emigrated from the Carpathian Region during 2008–2018 (Table 2).

**Table 2.** Number of Ukrainian citizens who emigrated from the Carpathian Region in 2008–2018

Source: Based on the data from the Western Regional Directorate of the State Border Guard Service of Ukraine (2018).

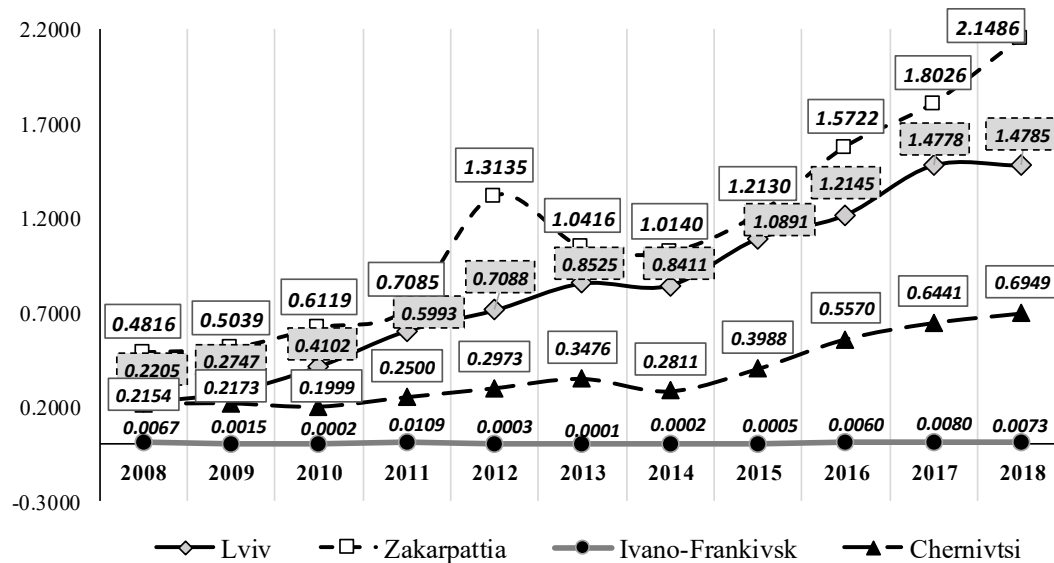
Year	Carpathian Region/regions			
	Lviv	Zakarpattia	Ivano-Frankivsk	Chernivtsi
2008	1,806,484	1,996,579	27,059	592,193
2009	2,355,780	2,126,649	6,163	601,224
2010	3,262,467	2,283,796	718	486,258
2011	4,246,726	2,242,850	33,857	525,562
2012	4,614,349	4,236,851	942	575,772
2013	4,953,623	2,751,412	316	606,421
2014	5,362,474	2,874,029	569	517,301
2015	6,854,217	3,182,344	1,231	676,578
2016	7,012,523	3,957,649	13,876	888,185
2017	8,243,577	4,208,026	17,315	952,601
2018	6,853,316	4,638,356	14,530	942,540

The results of calculations of the level of external population migration intensity in four regions of the Carpathian Region are presented in Figure 1.

The highest level of external population migration intensity during the study period is observed in the Zakarpattia region, in which the indicator in-



Source: Authors' calculations based on formulae (1) and (2) and statistical data (State Statistics Service of Ukraine, 2018).



**Figure 1.** External population migration intensity by regions in the Carpathian Region, 2008–2018

creased from 0.4816 to 2.1486 (migrants per capita). The lowest level of external population migration intensity is observed in the Ivano-Frankivsk region, in the territory with the lowest number of checkpoints across the state border among regions of the Carpathian Region. The external population migration intensity in the region ranged from 0.0001 to 0.0109 during the analyzed period.

According to the Granger test results on the causal relationship between migration and indicators of social and economic development presented in Tables A1 and A2 (see Appendix), the null hypotheses are rejected or accepted. When the variables are cointegrated, a statistical relationship over the sample period is present. Herein, it is important to determine the estimated coefficients' statistical significance to conclude if there is a relationship running from migration to social and economic indicators or the reverse. For example, in the Lviv region, it has been found that in the short run, the external population migration intensity affects the living standards of households, in particular, the share of total food expenditures (see Tables A1 and A2 in Appendix). It can be assumed that the increase in migration leads to an increase in household income, thus improving households' financial situation, including the structure of their expenditures. Simultaneously, the impact of mi-

gration on the economic development of the region is confirmed, represented by such indicators as the volume of foreign economic activity and labor productivity (GDP to gross employee wages ratio). Thus, external migration is the reason for the revival of international trade in goods and services and the growth of GDP in the region.

In the medium run, external migration has the greatest impact on economic indicators of the Lviv region's development – the volume of portfolio investment and foreign economic activity. The remittances of migrants, providing opportunities to obtain capital resources, contribute to increasing business and economy competitiveness.

These assumptions are confirmed in the long run because according to the Granger analysis, the Lviv region's economic growth is largely due to the level of external population migration intensity. In the first turn, migration affects the number of small units in the region, as migrant workers' financial potential contributes to the realization of business goals and, consequently, the creation of new jobs. At the same time, external migration in the Lviv region affects the unemployment rate (in the short run), the average monthly nominal wages, volume of portfolio investments, gross value added and productivity (in the short and medium

run), foreign economic activity (only in the medium run), real income and consumer price index (in the long run).

Migrants are an important source of economic growth not only for recipient countries but also for donor ones. In the regional context, the situation is similar. Thus, in the Ivano-Frankivsk region, the impact of external migration on the share of total household expenditure on food is revealed in the short run, as well as migration impact on GDP to gross employee wages ratio is found in the same period (see Tables A1 and A2 in Appendix).

Despite the low external population migration intensity in the Ivano-Frankivsk region in 2008–2018, compared to other regions in the region, this factor causes significant social and economic consequences in the medium run. There is a partial balancing of the local labor market due to the citizen's emigration (often unemployed), lower unemployment rate, and average wage changes in the region.

There is an impact of migration on investment development in the region due to the inflow of foreign portfolio investment in the long run. It should be added that feedback (conditionality of migration by indicators of socio-economic development) is present in almost all lags. Thus, in particular, the external population migration intensity of the Ivano-Frankivsk region is influenced by the average monthly wages in the region, disposable income, and per capita gross value added, retail trade, direct and portfolio investment, foreign economic activity in the region, and the level of GDP.

According to the results of the Granger causality analysis, it is found that the high level of migration intensity in the Zakarpattia region (see Tables A1 and A2 in Appendix) in the medium run causes changes in disposable incomes (strengthens the financial situation of residents in the region) and retail turnover of enterprises.

In the long run, migration is becoming a factor in changes in the average monthly nominal wages in the region and citizens' disposable income. This confirms the thesis that the local population's living standards are increasing because of increasing

migration processes, mainly labor ones. At the same time, migration volumes in the Zakarpattia region are influenced by such indicators of social and economic development as the level of economic activity of the population (including the unemployment rate), the disposable income of residents, the volume of direct and portfolio investment.

The Zakarpattia region's main migration outflow is related to the 'shuttle' movement to Hungary and labor migration to the Czech Republic, Poland, Germany, and other EU countries.

The research results on the causality of external migration and social and economic indicators in the Chernivtsi region (see Tables A1 and A2 in Appendix) revealed other correlative positions. In the short run, there is an impact of external migration on the structure of total household expenditures, particularly on the share of food expenditures. The impact on the volume of foreign direct investment and foreign economic activity in the region is also revealed. It can be assumed that external migration in the Chernivtsi region contributes to the growth of living standards and the region's economic development (improvement of the investment climate, the revival of international trade, etc.).

In the medium run, migration affects the volume of foreign economic activity due to the region's close trade ties with Romania and Moldova. Simultaneously, in the long run, external migration impacts the level of inflation, turnover of retail trade, and, thus, the overall macroeconomic stability in the region.

The causality of external migration processes in the Chernivtsi region is related to such factors as the population's economic activity, consumer price index, foreign direct and portfolio investment, retail trade, and foreign economic activity in the region. The predominance of the economic nature of external migration in the region is noticeable.

The research results of the causality of external migration and the Carpathian Region's social and economic development are presented in Table A3 (see Appendix). For all regions in the short run, a causal relationship between the level

of external population migration intensity (impact factor) and the share of total household expenditures on food can be traced. In the medium run, such social and economic effects as the population's disposable income, employee compensation, the volume of portfolio investment, foreign economic activity, and retail turnover of enterprises are added. In the long run, external migration in the Carpathian Region impacts living standards (average wages and disposable incomes, consumer price index) and indicators of region's economic development (number of small

business units and foreign economic activity). It is worth noting that most of the listed causal relationships are bilateral, in which migration is both a factor and a consequence in different periods. This confirms the ambiguity and complexity of the nature of external migration processes. On the one hand, the population's migration is a driver of economic growth in the region. On the other hand, it hinders its socio-economic development, violating demographic stability, reducing the labor potential and competitiveness of the economy as a whole.

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## CONCLUSION

The study intends to examine the effects of external migration on the socio-economic development of the Carpathian Region. Based on a new methodological approach, the level of external migration intensity in the region is determined, which allowed assessing the causality of migration and the selected indicators of the region's socio-economic development. It is established that the highest level of external population migration intensity is observed in the Zakarpattia region, and the lowest level is typical for the Ivano-Frankivsk region. The results of the analysis confirmed a significant causal relationship between the level of external population migration intensity in the Carpathian Region and the share of total households expenditures on food in the short run; disposable population's income, the average monthly nominal wages, the volume of portfolio investment, foreign economic activity and retail trade of enterprises in the medium run; the average monthly wages and disposable population's income, the consumer price index, the number of small business units and the volume of foreign economic activity in the long run. Prospects for further studies are related to such research areas as substantiation of the development divergence with the border areas or the EU countries, substantiation of the limit value, and a critical range of the level of external population migration intensity.

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## APPENDIX

**Table A1.** Granger causality interaction between population migration and social development of the Carpathian Region, 2008–2018

Source: Calculated based on the data from the State Statistics Service of Ukraine (2018) and the main statistical offices in Lviv, Zakarpattia, Ivano-Frankivsk, and Chernivtsi regions.

Null hypotheses ( $X - Y$ variables)	Lviv region			Ivano-Frankivsk region			Zakarpattia region			Chernivtsi region		
	Lag			Lag			Lag			Lag		
	1	2	3	1	2	3	1	2	3	1	2	3
UNEMPL – MIGR	6.80	2.95	3.11	0.289	2.354	4.423	3.931	2.417	1.392	2.301	0.628	5.736
	(0.04)**	(0.16)	(0.39)	(0.61)	(0.21)	(0.33)	(0.09)*	(0.21)	(0.54)	(0.17)	(0.58)	(0.30)
MIGR – UNEMPL	1.76	0.19	0.21	0.001	4.129	3.484	0.368	2.059	4.505	0.306	0.047	0.062
	(0.23)	(0.83)	(0.88)	(0.97)	(0.11)*	(0.37)	(0.56)	(0.24)	(0.33)	(0.60)	(0.95)	(0.97)
EAR – MIGR	0.95	1.96	39.87	0.652	0.342	0.265	3.981	1.828	4.987	5.204	2.431	3.262
	(0.36)	(0.26)	(0.12)*	(0.45)	(0.73)	(0.85)	(0.09)*	(0.27)	(0.32)	(0.06)*	(0.20)	(0.38)
MIGR – EAR	2.36	1.11	0.78	0.372	0.243	1.583	0.401	1.099	0.251	0.306	0.671	0.399
	(0.17)	(0.41)	(0.66)	(0.56)	(0.80)	(0.52)	(0.55)	(0.42)	(0.86)	(0.60)	(0.56)	(0.79)
WAGE – MIGR	4.42	3.90	9.78	1.992	10.246	24.860	1.496	0.644	3.221	1.680	0.549	0.378
	(0.07)*	(0.11)*	(0.23)	(0.20)	(0.03)**	(0.15)*	(0.26)	(0.57)	(0.38)	(0.24)	(0.62)	(0.80)
MIGR – WAGE	0.75	0.22	0.75	1.723	3.524	1.391	1.495	0.415	340.836	0.631	0.743	0.534
	(0.42)	(0.81)	(0.67)	(0.23)	(0.13)*	(0.54)	(0.26)	(0.69)	(0.04)**	(0.45)	(0.53)	(0.74)
INCOME – MIGR	1.68	1.64	55.62	4.363	34.015	10.625	1.146	0.613	1695.69	1.528	0.460	3.079
	(0.24)	(0.30)	(0.10)*	(0.08)*	(0.00)***	(0.22)	(0.32)	(0.59)	(0.02)**	(0.26)	(0.66)	(0.39)
MIGR – INCOME	0.00	0.56	2.79	0.561	2.817	2.896	0.013	9.643	112.427	0.005	1.684	0.754
	(0.97)	(0.61)	(0.41)	(0.48)	(0.17)	(0.40)	(0.91)	(0.03)**	(0.07)*	(0.95)	(0.29)	(0.67)
CPI – MIGR	0.13	1.31	36.77	2.186	1.107	14.221	0.646	0.461	0.186	2.941	1.321	1.050
	(0.73)	(0.37)	(0.12)*	(0.18)	(0.41)	(0.19)	(0.45)	(0.66)	(0.90)	(0.13)*	(0.36)	(0.60)
MIGR – CPI	0.29	2.89	0.92	1.599	0.654	1.600	0.217	2.439	6.418	0.072	1.030	254.174
	(0.61)	(0.17)	(0.63)	(0.25)	(0.57)	(0.51)	(0.66)	(0.20)	(0.28)	(0.80)	(0.44)	(0.05)*
EXPENS – MIGR	1.34	0.19	7.15	1.742	1.142	1.347	0.531	0.234	0.222	0.256	0.278	9.810
	(0.28)	(0.84)	(0.27)	(0.23)	(0.34)	(0.55)	(0.49)	(0.80)	(0.88)	(0.63)	(0.77)	(0.23)
MIGR – EXPENS	4.34	1.63	0.93	14.124	2.793	0.765	0.011	1.153	1.990	2.591	0.274	0.382
	(0.08)*	(0.30)	(0.62)	(0.01)**	(0.17)	(0.66)	(0.92)	(0.40)	(0.47)	(0.15)*	(0.77)	(0.80)

Note: Above values are statistics in short (lag 1), medium (lag 2) and long (lag 3) run; number in parentheses are values of probability; \*\*\*, \*\*, \* significant at 1%, 5%, 10% levels, respectively. Estimated using EVIEWS 11.

**Table A2.** Granger causality interaction between population migration and economic development of the Carpathian Region, 2008–2018

Source: Calculated based on the data from the State Statistics Service of Ukraine (2018) and the main statistical offices in Lviv, Zakarpattia, Ivano-Frankivsk, and Chernivtsi regions.

Null hypotheses (X – Y variables)	Lviv region			Ivano-Frankivsk region			Zakarpattia region			Chernivtsi region		
	Lag			Lag			Lag			Lag		
	1	2	3	1	2	3	1	2	3	1	2	3
FDI – MIGR	1.09	0.79	0.59	4.046	2.263	1.270	0.053	3.115	1.837	3.447	2.487	0.335
	(0.33)	(0.51)	(0.72)	(0.08)*	(0.22)	(0.56)	(0.83)	(0.15)*	(0.49)	(0.11)*	(0.20)	(0.82)
MIGR – FDI	1.34	2.12	0.07	0.241	0.202	15.303	0.146	0.484	3.465	3.211	1.673	1.098
	(0.29)	(0.24)	(0.97)	(0.64)	(0.82)	(0.19)	(0.71)	(0.65)	(0.37)	(0.12)*	(0.30)	(0.59)
FPI – MIGR	7.73	18.25	8.15	1.599	4.499	4.950	0.594	10.66	46.235	12.068	10.412	2.459
	(0.03)**	(0.01)**	(0.25)	(0.25)	(0.09)*	(0.32)	(0.47)	(0.03)**	(0.11)*	(0.10)*	(0.03)**	(0.43)
MIGR – FPI	0.00	3.21	2.33	0.670	0.686	18.882	0.003	1.738	0.813	0.971	0.971	1.357
	(0.97)	(0.15)*	(0.44)	(0.44)	(0.55)	(0.17)	(0.96)	(0.29)	(0.65)	(0.36)	(0.45)	(0.55)
GVA – MIGR	4.27	4.27	9.20	2.582	3.499	197.031	1.955	0.689	10.365	1.426	0.426	0.653
	(0.08)*	(0.10)*	(0.24)	(0.15)*	(0.13)*	(0.05)*	(0.20)	(0.55)	(0.22)	(0.27)	(0.68)	(0.70)
MIGR – GVA	1.06	0.12	0.51	0.192	1.502	12.985	0.069	1.559	10.842	0.016	1.242	1.233
	(0.34)	(0.89)	(0.74)	(0.67)	(0.33)	(0.20)	(0.80)	(0.32)	(0.22)	(0.90)	(0.38)	(0.57)
UNITS – MIGR	0.05	2.42	1.08	0.892	0.554	12.282	0.872	0.460	2.736	0.897	0.409	0.192
	(0.83)	(0.20)	(0.59)	(0.38)	(0.61)	(0.21)	(0.38)	(0.66)	(0.41)	(0.38)	(0.69)	(0.89)
MIGR – UNITS	1.61	2.92	197853.0	0.386	0.712	0.430	0.000	0.037	0.023	0.084	0.071	1.146
	(0.25)	(0.17)	(0.00)***	(0.55)	(0.54)	(0.78)	(1.00)	(0.96)	(0.99)	(0.78)	(0.933)	(0.58)
RETAIL – MIGR	2.26	3.06	5.78	4.76	10.416	85.080	1.000	0.569	1.348	0.329	0.147	992.787
	(0.18)	(0.16)	(0.29)	(0.07)*	(0.03)**	(0.08)*	(0.35)	(0.61)	(0.55)	(0.58)	(0.87)	(0.02)**
MIGR – RETAIL	0.28	0.47	0.98	0.092	0.745	2.264	0.326	7.329	0.529	1.791	3.212	0.577
	(0.61)	(0.65)	(0.61)	(0.77)	(0.53)	(0.45)	(0.59)	(0.05)*	(0.74)	(0.22)	(0.15)*	(0.72)
FEA – MIGR	2.21	9.29	4.39	2.422	1.481	323.469	0.000	0.564	0.380	0.053	3.789	0.528
	(0.18)	(0.03)**	(0.33)	(0.16)	(0.33)	(0.04)**	(0.98)	(0.61)	(0.80)	(0.82)	(0.12)*	(0.74)
MIGR – FEA	3.97	3.77	50.25	2.072	0.182	16.039	0.881	1.102	2.483	14.634	1.715	16.955
	(0.09)*	(0.12)*	(0.10)*	(0.19)	(0.84)	(0.18)	(0.38)	(0.42)	(0.43)	(0.01)**	(0.29)	(0.18)
GDP – MIGR	6.11	1.85	3.66	0.149	0.097	500.701	0.532	0.228	0.626	0.412	0.430	10.130
	(0.04)**	(0.27)	(0.36)	(0.71)	(0.91)	(0.03)**	(0.49)	(0.81)	(0.70)	(0.54)	(0.68)	(0.23)
MIGR – GDP	4.26	0.54	2.60	2.780	0.183	0.695	0.028	0.215	6.937	0.012	0.325	0.400
	(0.08)*	(0.62)	(0.42)	(0.14)*	(0.84)	(0.68)	(0.87)	(0.82)	(0.27)	(0.92)	(0.74)	(0.79)

Note: Above values are statistics in short (lag 1), medium (lag 2) and long (lag 3) run; number in parentheses are values of probability; \*\*\*, \*\*, \* significant at 1%, 5%, 10% levels, respectively. Estimated using EViews 11.

**Table A3.** The causal relationship between population migration and social and economic development of the Carpathian Region

Source: Based on data in Tables A1 and A2.

Short-run (lag 1)				Medium-run (lag 2)				Long-run (lag 3)			
Lviv region	Zakarpattia region	Iv.-Frankivsk region	Chernivtsi region	Lviv region	Zakarpattia region	Iv.-Frankivsk region	Chernivtsi region	Lviv region	Zakarpattia region	Iv.-Frankivsk region	Chernivtsi region
Social development											
UNEMPL → MIGR	UNEMPL → MIGR					MIGR → UNEMPL					
	EAR → MIGR		EAR → MIGR					EAR → MIGR			
WAGE → MIGR				WAGE → MIGR		WAGE ↔ MIGR			MIGR → WAGE	WAGE → MIGR	
		INCOME → MIGR			MIGR → INCOME	INCOME → MIGR		INCOME → MIGR	INCOME ↔ MIGR		
			CPI → MIGR					CPI → MIGR			MIGR → CPI
MIGR → EXPENS		MIGR → EXPENS	MIGR → EXPENS								
Economic development											
		FDI → MIGR	FDI ↔ MIGR		FDI → MIGR						
FPI → MIGR			FPI → MIGR	FPI ↔ MIGR	FPI → MIGR	FPI → MIGR	FPI → MIGR		FPI → MIGR		
GVA → MIGR		GVA → MIGR		GVA → MIGR		GVA → MIGR				GVA → MIGR	
								MIGR → UNITS			
		RETAIL → MIGR			MIGR → RETAIL	RETAIL → MIGR	MIGR → RETAIL			RETAIL → MIGR	RETAIL → MIGR
MIGR → FEA			MIGR → FEA	FEA ↔ MIGR			FEA → MIGR	MIGR → FEA		FEA → MIGR	
GDP ↔ MIGR		MIGR → GDP								GDP → MIGR	

Note: → shows one-way causality; ↔ shows two-way causality.