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

AUTHORS
Olha Mulska [ORCID: 0000-0002-1666-3971] https://orcid.org/0000-0002-1666-3971
Olha Levytska [ORCID: 0000-0001-8174-9918] https://orcid.org/0000-0001-8174-9918
Volodymyr Panchenko [ORCID: 0000-0002-4927-0330] https://orcid.org/0000-0002-4927-0330
Maryana Kohut [ORCID: 0000-0001-8275-134X] https://orcid.org/0000-0001-8275-134X
Taras Vasyltsiv [ORCID: 0000-0002-2889-6924] https://orcid.org/0000-0002-2889-6924

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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; Mulksa, Baranik, 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, Mulksa, Ivaniuk, Kunytska-Iliash, Vasytsiv, & Lupak, 2020; Rahman, 2013; Vasytsiv, Levytska, & Mulksa, 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), Vasytsiv, Iryshcheva, 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 Ruysse (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-
interpretation 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)):

\[
MIGR_{reg}^t = \frac{DEP_{reg}^t}{NP_{reg}^t} \cdot k_{reg}^t,
\]

where \(MIGR_{reg}^t\) is the level of external population migration intensity in a region in time interval \(t\); \(DEP_{reg}^t\) is the total number of Ukrainian citizens who have moved abroad from a region in time interval \(t\); \(NP_{reg}^t\) is the population size in a region in time interval \(t\); \(k_{reg}^t\) is a regional correction coefficient of migration in time interval \(t\).

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

\[
k_{reg}^t = \frac{DEP_{UA}^t - DEP_{reg}^t}{NP_{UA}^t - NP_{reg}^t},
\]

where \(DEP_{UA}^t\) is the total number of Ukrainian citizens who have moved abroad from the country in time interval \(t\); \(NP_{UA}^t\) 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-
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 1. Indicators of socio-economic development of the Carpathian Region

| Abbreviation | Indicators | Explanation |
|--------------|------------|-------------|
| 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, % |

| Economic development of the region |
|------------------------------------|
| 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 |

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-
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 migration 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

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

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

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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.

**AUTHOR CONTRIBUTIONS**

Conceptualization: Olha Mulska, Volodymyr Panchenko, Taras Vasyltsiv.
Data curation: Olha Mulska, Olha Levytska, Volodymyr Panchenko, Maryana Kohut.
Formal analysis: Olha Mulska, Olha Levytska.
Investigation: Olha Mulska, Olha Levytska, Volodymyr Panchenko, Maryana Kohut, Taras Vasyltsiv.
Methodology: Olha Mulska, Olha Levytska.
Supervision: Taras Vasyltsiv.
Visualization: Olha Mulska, Olha Levytska, Maryana Kohut.
Writing – original draft: Olha Mulska, Olha Levytska, Taras Vasyltsiv.
Writing – review & editing: Olha Mulska, Olha Levytska.

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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 1       | Lag 2                   | Lag 3             | Lag 1            |
|                                   | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|                                   | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|                                   | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged UNEMPL – MIGR**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged MIGR – UNEMPL**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged EAR – MIGR**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged MIGR – EAR**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged WAGE – MIGR**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged MIGR – WAGE**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged INCOME – MIGR**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged MIGR – INCOME**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged CPI – MIGR**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged MIGR – CPI**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged EXPENS – MIGR**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

**Lagged MIGR – EXPENS**

|           | Lviv region | Ivano-Frankivsk region | Zakarpattia region | Chernivtsi region |
|-----------|-------------|------------------------|-------------------|------------------|
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |
|           | Lag 1       | Lag 2                   | Lag 3             | Lag 1            |

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 |
| FDI – MIGR                        | 1.09       | 0.79                   | 0.59               | 4.046             | 2.623             | 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)             | (0.09)**          | (0.32)            | *(0.87)**       | (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)            | (0.58)            | (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)**               | (0.010)            | (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

| 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 |
| UNEMPL → MIGR | UNEMPL → MIGR | MIGR → UNEMPL | MIGR → UNEMPL | MIGR → UNEMPL | MIGR → UNEMPL |
| EAR → MIGR | EAR → MIGR | MIGR → WAGE | MIGR → WAGE | MIGR → WAGE | MIGR → WAGE |
| WAGE → MIGR | WAGE ↔ MIGR | WAGE ↔ MIGR | WAGE ↔ MIGR | WAGE ↔ MIGR | WAGE ↔ MIGR |
| INCOME → MIGR | INCOME → MIGR | INCOME → MIGR | INCOME ↔ MIGR | INCOME ↔ MIGR | INCOME ↔ MIGR |
| MIGR → EXPENS | MIGR → EXPENS | MIGR → EXPENS | MIGR → EXPENS | MIGR → EXPENS | MIGR → EXPENS |

Social development

Economic development

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

Source: Based on data in Tables A1 and A2.