

Natalia Maslii¹
Maryna Demianchuk²
Igor Britchenko³
Maksym Bezpartochnyi⁴

MODELING MIGRATION CHANGES ACCORDING TO ALTERNATIVE SCENARIOS IN THE CONTEXT OF THE GLOBAL COVID-19 PANDEMIC: THE EXAMPLE OF UKRAINE⁵

Global processes significantly affect the mobility of the population. In the context of geopolitical transformation, globalization and quarantine restrictions of Covid-19, it is important to predict the development of the migration movement of countries that are developing. Therefore, the article is aimed at modelling migration changes according to alternative scenarios using the example of Ukraine.

The theoretical and methodological basis of the research is formed by a number of scientific works of leading scientists from different countries, statistical information on migration processes and socio-economic indicators of Ukraine's development, economic, mathematical and scenario methods. In the course of the study, the main factors were identified that more affect the migration processes of Ukraine, taking into account the trends in the impact of Covid-19 on them. These include population size, life expectancy, GDP per capita, average monthly wages, and the volume of remittances from individuals to Ukraine.

With the help of correlation-regression analysis, a multivariate econometric model of migration growth (reduction) has been built. This made it possible to study the absolute and relative influence of factors on the magnitude of the migration increase (decrease), determine the potential reserves for its increase (decrease), evaluate them using a

¹ Natalia Maslii, Doctor of Economic Sciences, Professor, Odessa I.I. Mechnikov National University, Faculty of Economics and Law; Institute of Market Problems and Economic-Ecological Research of the National Academy of Sciences of Ukraine, Senior Scientific Associate, e-mail: masliy.natalia@gmail.com.

² Maryna Demianchuk, Doctor of Economic Sciences, Associate Professor, Odessa I.I. Mechnikov National University, Faculty of Economics and Law; Institute of Market Problems and Economic-Ecological Research of the National Academy of Sciences of Ukraine, Senior Scientific Associate, e-mail: ma-demyanchuk@ukr.net.

³ Igor Britchenko, Doctor of Economic Sciences, Professor, Department of Finance, VUZF University of Finance, Business and Entrepreneurship, e-mail: ibritchenko@gmail.com.

⁴ Maksym Bezpartochnyi, Doctor of Economic Sciences, Professor, National Aerospace University named after N. Zhukovskiy «Kharkiv Aviation Institute», Faculty of Software Engineering and Business, e-mail: m.bezpartochnyi@khai.edu.

⁵ This paper should be cited as: Maslii, N., Demianchuk, M., Britchenko, I., Bezpartochnyi, M. (2022). Modeling Migration Changes According To Alternative Scenarios in the Context of the Global COVID-19 Pandemic: The Example of Ukraine. – Economic Studies (Ikonomicheski Izsledvania), 31 (1), pp. 58-71.

comparative analysis and carry out predictive calculations of the volume of migration increase (decrease) in Ukraine.

Keywords: migration; migration movement; migration increase; emigrants; immigrants; multivariate econometric model; scenarios; Covid-19

JEL: C82; F22; F24; J11

1. Introduction

Changes in geopolitical globalization, production internationalization, international economic and political integration and world migration processes' intensification cause the international mobility increase of the Ukrainian population, including women and men, minors, and highly qualified specialists. Record migration flows with all countries taking imbalances of the labour force in various labour markets. However, with quarantine activities background triggered by the Covid-19 epidemic and the lockdown imposed by many countries (restrictions on movement and communication among countries) and a decline in economic activity worldwide, some migration processes connected mainly with the migrant workers inbound. The mentioned reasons enforce to regulate such processes and provide them with a well-maintained and non-conflict character. Therefore, state regulation on a favourable and sustainable social and economic development of the country, minimizing pandemic and economic crisis, is vital, especially at the national level. Hence, national job creation issues address time to prevent migrant workers from leaving, as the workforce is the propulsion behind that crisis. Ensuring state regulation of migration processes is a complex task that requires an integrated and systematic approach.

2. Literature Review

The World Bank Grope (World Bank Grope, 2020) appraised the economic crisis impact caused by Covid-19 through the migration perspective, namely global trends in international economic migration and remittances in 2020 and 2021. When considering migration processes, the economic crisis could extend, deepen, and get pervasive, as global economic activities almost got a standstill with imposed travel bans and social distortion. Host countries face challenges in many sectors, like health and agriculture, which depend on migrant workers. Migrants face the risk and possible loss of employment, wages, and health insurance. Therefore, relevant public authorities should address such processes at the national level.

Policy Strategy of Ukraine's State Migration up to 2025 (Verkhovna Rada of Ukraine, 2017) aims to direct state and society's efforts towards forming and implementing the state migration policy. Which on the one hand, positively affected Ukraine's consolidation and its state security, accelerated social and economic development, and, on the other hand, contributed to a slowdown in depopulation, becalming quantitative and qualitative population aspects, meeting the economy requirements in labour, corresponding both with international standards and obligations of Ukraine.

Furthermore, this strategy focuses on migration problems, direct society to tackle them, ensures the migration policy relationship with other areas of the country's activity, and shifts

from a response policy concerning internal and external migration factors to a more active and targeted policy.

Both local and international scientists study migration trends at the national and international levels, particularly the theory of global and regional migration processes, migration flows in OECD countries, aspects of asymmetry in migration processes, and economic research on immigration determinants. For instance, provided by an overview of existing economic theory and empirical data to assess the likelihood of migration flows from neighbouring countries to the EU states (Borjas, 1999), allowing to make recommendations on Migration policy to avoid serious problems arising in the migration in the European Union. Economists and economic historians (Hatton, Williamson, 2005) examined two centuries of global mobility, assessing its impact on migrants themselves, on sending and receiving countries, and also conducted a comprehensive economic assessment of mass migration from a long-term historical perspective, including migration from north to north, south to south and south to north. Other scientists (Karemera, et al., 2000), in their study, analyzed the influence of political, economic, and demographic effects on the size and structure of migration inflows to North America. Proved that an increase in migration with low ability than high capacity movement leads to a decrease in migrants' expected wages at the destination, hindering high capacity migration (Katz, Stark, 1984). Empirically investigated the determinants of migration flows in fourteen OECD states by the country of origin, analyzing the impact on the movement of average income and income dispersion in the countries of destination and origin, the influence of geographic, cultural, and demographic factors and the role that changes play in the migration policies of destination countries (Mayda, 2009). Based on the analysis, we presented forecast models of international migration.

Quite a few works are devoted to studying theoretical and applied aspects of migration processes in Ukraine. In particular, reviewed the challenges and threats that caused massive interregional and interstate population migration movements in some areas of Ukraine (Dacko, 2014), general methodological approaches to studying the risks of modern migration processes to the country's national security in theoretical and practical aspects, and implementation of the state migration policy measures to prevent them and the resolve them when they appear. Determined the labour migration impact on the development of Ukraine's labour market by assessing labour migrants' earnings and remittances (Maidanik, 2019), allowing to develop proposals for the migration policy formation and improving labour migration statistics. Substantiated and defined conceptual approaches, directions, and mechanisms for improving Ukraine's external migration management based on the migration analysis and the evolution of the management activities after generalizing international, mainly European, experience (Malinovskaya, 2013). Assessed the impact of modern trends in external labour migration on Ukraine's long-term social and economic development, particularly a quantitative estimation of the process's outcomes (Poznyak, 2016). By studying the development of global demographic processes (Sardak, et al., 2018), defined their appearance, manifestations, implications, and prospects for spreading in the first half of the 21st century. With worldwide Covid-19 and quarantine activities impose, several scientists devoted their work to study the impact of Covid-19 on migration and national economies. In particular, discusses the impact of activities related to curbing infection (Michie, 2020). Developed the migration model and intensity of travel based on human mobility analysis and

coronavirus infection (Sirkeci, Yucesahin, 2020). Carried out the risk management analysis (McAleer, 2020), of social and economic consequences of the pandemic (Nicola, et al., 2020), of the influence of Covid-19 on society and the world economy (Chakraborty, Maity, 2020). However, aspects of migration processes in Ukraine require additional research. It is necessary to study the impact of the demographic and socio-economic development of the country, living standards, education and employment of the population during the global Covid-19 pandemic on migration processes.

The article is aimed at modelling migration changes according to alternative scenarios, using the example of Ukraine. This makes it necessary to analyze the main factors affecting the migration processes of Ukraine: population size, life expectancy, GDP per capita, average monthly wages, and the volume of remittances of individuals to Ukraine.

3. Methodology Data description

For the study, the results of scientific works of leading scientists were studied and summarized in terms of the main factors affecting migration processes. Taking into account the constant decrease in the number of residents of Ukraine and the change in their life expectancy, the share of the economically active population (persons aged 15 and over) has decreased. This influenced the decrease in GDP per capita. The global Covid-19 pandemic has caused the need to introduce quarantine measures related to restricting movements. This led to the return of labour migrants to their homeland. Labour migration in Ukraine is mainly related to wages, which are significantly lower than the average level among European countries. This significantly affected the volume of remittances. This made it possible to identify a number of factors influencing migration processes and between which there is a correlation dependence. Using the statistical method of multiple regression, a multivariate econometric model of the dependence of migration growth (decline) on the selected indicators is calculated. This made it possible to simulate migration changes according to alternative scenarios.

4. Research Results

The methodology of theoretical justification and migration management in the current conditions requires a comprehensive approach to the analysis of the nature of migration being in its entirety and those economic, social, legal, and other factors inherent for this particular period, as well as its causes, and subjects of migration, and the methods of its regulation. The theory of controlling the population migration movement (Veselskaya, 2017) provides an understanding of migration as a specific way of being, functioning, and developing determinants and mechanisms of migration, types of migration needs and interests, and the features of their formation and achievement.

However, in reality, the main reasons for changing the migration process are Covid-19 and other global pandemics, as they directly impact restricting people's moving across borders. Besides, 179820 people have lost their jobs since introducing quarantine measures related to Covid-19, which is 1.73% of the officially employed people. Simultaneously, 122451 people

Maslii, N., Demianchuk, M., Britchenko, I., Bezpartochnyi, M. (2022). *Modeling Migration Changes According To Alternative Scenarios in the Context of the Global COVID-19 Pandemic: The Example of Ukraine*.

have formally been unemployed since the quarantine began, making 25.37% of the country's official unemployment. Since the beginning of 2020, the migration balance in Ukraine has remained positive. As of 14 May 2020, 135509 more foreigners left the country than entered, and 489153 more Ukrainians left the country than arrived due to the economic consequences of the Covid-19 quarantine. Quarantine measures have also affected remittances in Ukraine, namely, as of 31 March 2020, remittances to the country amounted to 921.9 million USD that individuals had transferred 504.7 million USD via international payment systems, which is 16.31% less than of 31 December 2019 (remittances via global payment systems decreased by 21.73%). Equal significance has had a negative difference between the amount of currency sold by the population and the amount bought by banks from the community since the country's epidemiological restrictions. That means that the population has sold more foreign currency than bought, i.e., the population spends the saved money on their priority security, leading to social tension and has to turn to borrowed funds. The attraction of credit funds by individuals has increased by 5.57% since the beginning of 2020, with 35.3% of non-performing loans.

Ukraine migration has different effects on its demographic development, participation in the international labour division, access to European and world markets, and social and national security. Hence, Ukraine's main strategic tasks are maintaining state sovereignty, territorial integrity, integration into the European economic and migration scope, ensuring close to world standards of quality and life expectancy, and realizing citizens' rights and freedoms (Table 1).

Table 1

Dynamics of structural indicators of migration processes in Ukraine

Indicators Years	Population (thousand people)	Births number per 1000 residents	Death number per 1000 residents	Average life expectancy and males at birth, years	Interstate migration		
					Emigrated people	Immigrated people	Migration growth, reduction (-)
2011	45778.5	11.0	14.5	71.02	14588	31684	17096
2012	45633.6	11.4	14.5	71.15	14517	76361	61844
2013	45553.0	11.1	14.6	71.37	22187	54100	31913
2014	45426.2	10.8	14.7	71.37	21599	42698	21099
2015	42759.7	10.7	14.9	71.38	21409	30659	9250
2016	42584.5	10.3	14.7	71.68	6465	14311	7846
2017	42386.5	9.4	14.5	71.98	20234	28360	8126
2018	42153.2	8.7	14.8	71.76	24252	39307	15055
2019	41902.4	8.1	14.7	72.01	26789	45011	18222

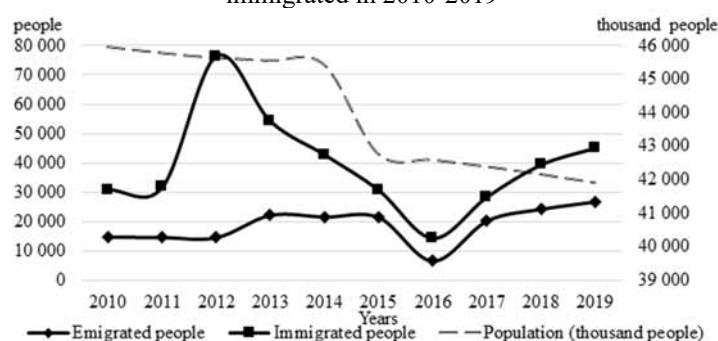
Source: authors' development based on (State Statistics Service of Ukraine, 2020a).

It should be noted that the average life expectancy in Ukraine in 1991 in Ukraine was 69 years, and already in 2019 - 72.01. At the same time, life expectancy for men increased from 64.6 years (in 1991) to 66.9 (in 2019). Life expectancy has increased from 74.2 years (in 1991) to 76.98 years (in 2019). The difference in life expectancy between women and men is observed throughout the territory of the former Soviet Union. In Europe, the difference in life expectancy between women and men is 4-5 years. So far, due to an ageing population and a low birth rate, Ukraine is rapidly approaching a demographic crisis, which will have

consequences in the economic sphere, due to a decrease in the volume of the domestic market and the number of the labour force.

According to (SMSU 2019), in 2018, Ukrainian citizens were issued 8551 permits to travel abroad for permanent residence, 1634 citizens returned to Ukraine. Immigration relations are an essential component of migration. Figure 1 shows the dynamics of the current population and the number of persons who emigrated and immigrated in 2010-2019.

Figure 1
Dynamics of the current population and the number of persons who emigrated and immigrated in 2010-2019



Source: constructed by the authors on the basis of the data (State Statistics Service of Ukraine, 2020a).

The dynamics of the available population has a steady downward trend and develops according to a linear relationship with an approximation level of 0.8687:

$$y = -543.81 \cdot x + 47005. \quad (1)$$

This allows us to make a forecast and assert that if we do not take measures to reduce the number of Ukrainian citizens travelling abroad, then by 2025, the population in the country will decrease by another 5 million and will amount to about 37 million people.

The dynamics of the number of persons who immigrated develops according to a polynomial dependence of the 5th degree with an approximation level of 0.8039. With the preservation of such dynamics in 2025, there will be about 19.5 thousand immigrants, which is explained by the possibility of employment with better wage conditions in other countries than in Ukraine.

$$y = -74.286 \cdot x^5 + 1977.1 \cdot x^4 - 18416 \cdot x^3 + 69940 \cdot x^2 - 94606 \cdot x + 69652. \quad (2)$$

The dynamics of emigrated persons develops according to a polynomial dependence of the 6th degree with an approximation level of 0.7268 and, according to forecasts, in 2025, this indicator will be 4 thousand people:

$$y = -8.8531 \cdot x^6 + 262.54 \cdot x^5 - 2908.6 \cdot x^4 + 14924 \cdot x^3 - 35942 \cdot x^2 - 38204 \cdot x + 337.67. \quad (3)$$

Such processes are demonstrating intensive growth rates and are becoming less and less predictable. There is an emigration of persons from developing countries to developed countries. In parallel, the immigration of unskilled labour from even poorer countries is taking place, which creates a number of additional problems. They must be tackled immediately, as this could lead to the collapse of Ukraine as a whole.

The most significant number of immigrants are citizens of the former Soviet Union countries and have preserved kinship and territorial relations with Ukrainian citizens. We should note that most migration declines (ingoing people more than outgoing) in the USA and Germany, while migration grows (outgoing people more than ingoing) is in African countries, Russian Federation, and Turkey.

Studies of interstate migrants by age groups and sex (Table 3) showed that most of all men aged 15 to 29 arrived in Ukraine – 18,598 people, which is 60.43% of the total number of male arrivals. The number of women leaving is two times less. Men between the ages of 20 and 29 are leaving the country en masse - 6937 people, which is 42.50% of the total number of men who left the country. At the same time, 3361 women of the same age dropped out (32.11% of the total number of women who dropped out).

According to research (International Organization for Migration, 2019), every second young Ukrainian aged 20 to 35 expresses a desire to emigrate from Ukraine, while the age structure of Ukrainian emigrants is divided into five age groups and has the following form: migrants aged 15-19 – 3%, 20-24 years old – 15%, 25-34 years old – 34%, 35-44 years old – 31%, 45 years old and older – 17%. Persons with complete secondary and secondary specialized education make up the largest number of migrants from Ukraine (48%), that is, graduates of secondary schools, gymnasiums, lyceums, colleges, technical schools and colleges; persons with basic higher education account for 24% (graduates of higher educational institutions with educational qualification level “bachelor”), as well as persons with complete higher education - 18% (graduates of higher educational institutions with educational qualification level “specialist” and “master”).

The most important macroeconomic indicator for any country is GDP (Table 3). It forms an idea of the general material well-being of the nation. Ukraine’s GDP is excessively consumer-oriented (growth from 85.6% in 2017 to 93.5% in 2020). A high level of consumption is accompanied by extremely small resources that were saved and could be used for gross capital formation (a decrease from 20.7% in 2017 to 7.5% in 2020). At the same time, per capita GDP is increasing, but the dynamics of positive change is less annually.

Small and medium-sized enterprises, which are able to quickly adapt to changes, have a significant impact on economic and social transformations in the country. But this segment is unstable and during the crisis, their activities are more susceptible to negative changes in the economic and political environment of the country than the activities of big business. In Ukraine, even before the start of quarantine, the conditions for the functioning of small and medium-sized enterprises (SMEs) had many disadvantages. And as a result of the quarantine, about half of the existing SMEs cut from 10 to 30% of the staff.

Table 2

Number of interstate migrants by age group and sex in 2019

	Arrivals			Dropouts			Migration growth, reduction (-)
	both genders	men	women	both genders	men	women	
Total	45011	30777	14234	26789	16324	10465	18222
including age, years							
0–4	1500	778	722	661	341	320	839
5–9	348	170	178	863	451	412	-515
10–14	361	189	172	754	395	359	-393
15–19	10678	6974	3704	1334	881	453	9344
20–24	10326	7355	2971	5670	3925	1745	4656
25–29	5818	4269	1549	4628	3012	1616	1190
30–34	3974	2906	1068	3054	1783	1271	920
35–39	2845	2093	752	2386	1353	1033	459
40–44	2059	1527	532	1878	1141	737	181
45–49	1928	1455	473	1442	928	514	486
50–54	1433	974	459	948	614	334	485
55–59	1369	837	532	827	482	345	542
60–64	940	593	347	755	375	380	185
65–69	611	344	267	549	261	288	62
70–74	356	171	185	431	178	253	-75
75–79	210	80	130	287	97	190	-77
80–84	180	45	135	235	79	156	-55
85 and older	75	17	58	87	28	59	-12

Source: authors' development based on (State Statistics Service of Ukraine, 2020a).

Table 3

Dynamics of Ukraine's GDP

Years	GDP at current prices, mln. USD	GDP per capita at current prices, USD	Final consumer spending		Gross capital formation		Export of goods and services, mln. USD	Import of goods and services, mln. USD
			mln. USD	% GDP	mln. USD	% GDP		
2017	106277,79	2502,32	90943,34	85,6	22051,15	20,7	50957,35	-57674,05
2018	128527,43	3042,26	115455,12	89,8	24124,02	18,8	58107,21	-69158,92
2019	167800,83	3996,46	159803,30	95,2	21135,26	12,6	69087,32	-82225,05
2020	148334,62	353,99	138753,62	93,5	11141,66	7,5	57910,60	-59471,26

Source: constructed by the authors on the basis of the data (State Statistics Service of Ukraine, 2020b).

As a result of the Covid-19 epidemic, the unemployment rate rose from 8.6% to 9.9% (Table 4).

Table 4

Unemployment rate in Ukraine

Years	Economically active population, thousand people	Employed population, thousand people	Unemployed population, thousand people	Unemployment rate, %
2017	17 854,40	16 156,40	1 698,00	9,9
2018	17 939,50	16 360,90	1 578,60	9,1
2019	18 155,70	16 668,00	1 487,70	8,6
2020	17669,80	15995,60	1674,20	9,5

Source: constructed by the authors on the basis of the data (State Statistics Service of Ukraine, 2020c).

Maslii, N., Demianchuk, M., Britchenko, I., Bezpartochnyi, M. (2022). *Modeling Migration Changes According To Alternative Scenarios in the Context of the Global COVID-19 Pandemic: The Example of Ukraine*.

Workers of small and medium-sized businesses suffered the most. According to the State Statistics Service of Ukraine, the number of unemployed has reached 1.6 million people.

In addition to the country's demographic situation, the size of wages in the country has an interstate migration growth (reduction). Since the main reason, for example, for Ukrainian labour migration abroad is a low average wage, which makes about 460 USD per month in the first quarter of 2021 (Table 5). Therefore, migrants move to the European countries in general, as in 14 countries, average wages are over 3 thousand USD. Ignoring the fact that Ukraine's average wage is continually growing, it is still far lower than Ukrainian citizens can make in other countries.

Table 5

Dynamics of average monthly wages in Ukraine

Year, January-December of the corresponding year	Average monthly salary		Real wage index, %	Consumer price index, %
	USD per one full-time employee	in% to the corresponding period of the previous year		
2017	253,11	137,1	119,1	114,4
2018	320,17	124,8	112,5	110,9
2019	443,17	118,4	109,8	107,9
2020	409,94	110,4	107,4	102,7
I quarter 2021	460,28	116,6	108,5	107,4

Source: constructed by the authors on the basis of the data (State Statistics Service of Ukraine, 2020c).

The disappointment with the country's economic situation mainly causes unsatisfactory demographic conditions and people moving to search for work abroad. Thus, Ukrainians went abroad in search of work, devoted their time to self-employment, and had less time to deal with the making and development of their own families, which hit the birth rate, and as a result, lead to Ukraine's low demographic status in general.

However, under Ukraine's negative economic situation, the results of Ukrainian migration abroad in search of work yielded positive results. For instance, for 2011-2018, Ukrainian employees' remittances to Ukraine (Table 6) in USD hit 70369 million (State migration service of Ukraine, 2019).

Table 6

Dynamics of private remittances to Ukraine by countries, mln. USD

Countries \ Years	2015	2016	2017	2018	2019	2020
EU Countries	3397	4254	5697	7150	7728	7596
In % to the total volume	48.8	56.5	61.5	64.4	64.8	63.9
CIS Countries	1992	1553	1515	1250	1397	1159
In % to the total volume	28.6	20.6	15.6	11.3	11.7	9.7

Source: authors' development based on (State migration service of Ukraine, 2020).

Between 2018, 2019 and 2020, there was a significant increase in Ukraine's remittances, hitting a record. We should note that the volume of remittances via informal channels increases annually, indicating mistrust for the country's banking system and employees' attempts to save on additional money on the transfer. The dynamics study of private

remittances to Ukraine by significant countries of origin showed that in 2020 the most substantial remittances were transferred from the EU countries – 63.9%, including 25.7% from Poland, 14/0% less than in 2019. However, in 2020 the migrant workers’ remittances to Ukraine tend to decrease due to about 20% of seasonal migrant workers leaving the country.

Empirical studies of analytical and statistical data (State migration service of Ukraine, 2020; International organization for migration, 2019; NGO “Public Audit”, 2019; State Statistics Service of Ukraine, 2020a,b,c) showed that between all the selected factors affecting the migration processes in the country, specifically the population, there is a correlation dependence of varying degrees in average life expectancy, average monthly wage, GDP per capita and private money remittances to Ukraine (Table 7).

Table 7

Correlation dependence of the leading structural indicators of migration processes in Ukraine

Indicators	Migration growth, reduction	Population	Average life expectancy	Average monthly wage	GDP per capita	Volumes of private money remittances to Ukraine
Migration growth, reduction	1.0000	0.5567	-0.2751	-0.3260	-0.3687	-0.4630
Population	0.5567	1.0000	-0.8375	-0.8009	-0.8369	-0.8923
Life expectancy	-0.2751	-0.8375	1.0000	0.8336	0.8569	0.8590
Mid-monthly wage	-0.3260	-0.8009	0.8336	1.0000	0.9959	0.9722
GDP per capita	-0.3687	-0.8369	0.8569	0.9959	1.0000	0.9883
Volumes of private money remittances to Ukraine	-0.4630	-0.8923	0.8590	0.9722	0.9883	1.0000

Source: author’s calculations.

Such indicators characterize the strongest positive correlation as average monthly wages, GDP per capita, and private remittances to Ukraine. A high positive correlation lies between the average life expectancy, the average monthly wage, GDP per capita, and private remittances to Ukraine. Furthermore, the weakest negative correlation is between migration growth (reduction) and average life expectancy. There are high negative relationships between the general population’s size and average life expectancy, an average monthly wage, GDP per capita, and private remittances to Ukraine. There is an average positive and negative correlation between migration growth (reduction) and the current population size and private remittances to Ukraine. Such indicators as migration growth (reduction) and average monthly wages and GDP per capita have a negatively correlated relationship, indicating a decrease in one variable with an increase in another.

The statistical method of multiple regressions allowed the authors developing a multivariate econometric model of the dependence of migration growth (reduction) ($M_{g(r)}$) on selected indicators, with 0.6173 reliability, and 14979.8995 standard error:

$$M_{g(r)} = -0.0035 \cdot P - 2437.3677 \cdot \bar{E}_l - 33.3650 \cdot \bar{W}_m + 8.8482 \cdot GDP_{1p} - 0.000012 \cdot PTV + 261077.0378, \quad (4)$$

where:

P is population;

\bar{E}_l – average life expectancy;

\bar{W}_m – average monthly wages;

$GDP_{1p.}$ – GDP per capita;

PTV – private remittances to Ukraine.

The developed model is applicable to upgrade the analysis and forecasting of migration processes in Ukraine to ensure a high life quality for current and future generations based on a balanced solution of available and rational use of the state's labour resource potential. The forecast should be dynamic and adaptive to changes, including the latest data, and the proposed model should further be integrated into the existing decision support system for migration processes in Ukraine.

Besides, correlation and regression analysis allow evaluating the current situation by the regression equation. Data on the analyzed factors of volume and movement direction allow obtaining funds for the assessment and appropriate adjustment of the state migration policy.

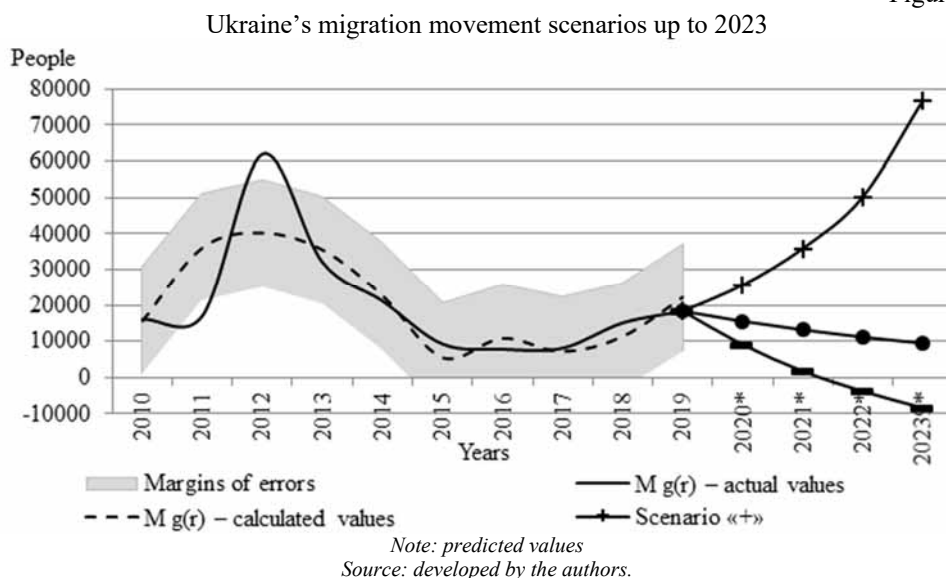
The multifactor econometric model of migration growth (reduction) is places on the production function. It allows studying the absolute and relative influence of factors on the volume of migration growth (reduction), determining the potential reserves of its increase (decrease), and evaluating them by a comparative analysis. That is, for example, if the volume of private remittances is staggered by 1% (that is, 9424.31 million USD), with other unchanged indicators, there will be a decrease in migrants by 148 people, which is 12.24%.

Thus, correlation and regression analysis provide a powerful and flexible tool for studying the relationship between migration growth (reduction) and many independent variables. Nevertheless, according to the authors, it is essential to carry out forecast computations of the migration growth (reduction) for the future according to three scenarios based on the developed econometric model (Figure 2).

The “+” scenario is that those who come to Ukraine are likely to leave the country (positive migration movement) – which is now Ukraine. That means, if the population continues to decrease over the next five years, it reaches 39522.4 thousand people (another 6% will decrease compared to 2019), the average monthly wage will increase by 27% with the rise of the gross domestic product only by 5.89%, private money remittances to Ukraine by 4%, and the average life expectancy by 1.2% (which is 0.83 years), the migration movement will be “plus” 76.5 thousand people. More than 19% of people are entering the country. Ukraine will experience an increase in unemployment inside the country under such circumstances when financial dependence on family members who have to go abroad for employment and get decent pay; with the growth of social tension; preventing a balance of payments deficit and reducing sufficient demand through remittances; reduced competitiveness of the workforce; growth of tax burdens by increasing deductions from the income of legal migrants; the influx of relatively cheap labour force, with mostly unskilled and therefore lower production costs; with the GDP growth for the maximum involvement of the working-age population; the

development of labour conflicts on political, religious, racial and other issues and, as a result, raising the crime level, and the like.

Figure 2



The “-” scenario is that more people are leaving Ukraine than those entering (negative migration movement). That is, for example, if the population increases within the next five years by at least 1%, with the average monthly wage by 20%, the gross domestic product by 40%, the volume of private remittances to Ukraine by 20%, and the average life expectancy increases by at least half a year, the migration movement will be decreased by 34 thousand people, almost 8% of people leaving the country. Under such circumstances, Ukraine will experience an increase in the country population’s average age and the ageing of the nation, a decrease in working population, and tax revenues. The quality of medical care and the provision of educational services shall decrease. That will harm the quality of the country’s labour potential as a result of the migration of its employees abroad; a decrease in demand for products (goods, services), primarily those business entities that are focused only on the national market, due to decline of the living population; the need to boost spending on social events and the like.

The “0” scenario is that the difference between those who leave and those entering the country tends to zero (the migration movement approaches zero). One can achieve this scenario by comparing some indicators with the minimum indicators of the European Union countries. That is, for instance, with an increase in average life expectancy by 2.36 years (i.e., by 3.3%) over the next five years, an average wage of 3.5 times and a gross domestic product of 5.5 times, a decline in private remittances to Ukraine by 70% and an increase in the population by 50%; the value of the migration movement is approaching zero 1.09 thousand

Maslii, N., Demianchuk, M., Britchenko, I., Bezpartochnyi, M. (2022). Modeling Migration Changes According To Alternative Scenarios in the Context of the Global COVID-19 Pandemic: The Example of Ukraine.

people (i.e., 0.2% of the population). There will be a relative balance among all processes related to interstate migration in Ukraine under such circumstances.

Due to the Covid-19 epidemic, mass labour migration has stopped. However, as soon as quarantine is over and regular international transport in Ukraine restores, a new wave of labour migration is expected to be much more potent than that in recent years, primarily due to high unemployment. That is since Ukraine is at the beginning of the economic crisis that will cause a drop in living standards and an increase in unemployment.

According to the authors, the unemployment rate after quarantine may reach 17% of the economically active population (about 3 million people remain unemployed). That is, people will have to go abroad to find employment and return to their own business, located in another country, because the governments of European countries support business and ordinary citizens, including foreigners doing business in their countries, by providing the loans' opportunities at 1-2% per year. Under the circumstances, Ukraine's labour market trends to suffer personnel shortages due to the demographic "pit" of the 1990s, the unstable political and economic situation in the country, and, above all, the migration processes.

Conclusions

Migration processes are a demographic and economical investment for the recipient countries, as they depend on international labour. For donor countries, migration processes cause a decline in the working population and labour and resource potential, as cheap labour and highly skilled employees leave the country. With the quarantine caused by the Covid-19 pandemic, migration has been halted worldwide due to lockdowns, with negative consequences both in recipient countries due to labour shortages and in donor countries with additional financial injections through workers' remittances, affecting the development level of their economies.

As a factor of urbanization and a social phenomenon, an indispensable source of quantitative and qualitative population growth, migration is incredibly essential and requires regulation by the state structures. Otherwise, it transforms into an unmanageable social system that is spontaneously born and developed, leading to negative consequences, undesirable stable parameters and trends, specific content, and a particular orientation. With the quarantine lifting, the regular operation of international transport resuming, leading to a new wave of labour migration, which will be incredibly more potent than that in recent years, due to the beginning of the economic crisis, an increase in the unemployment rate in the country and a decline in living standards. Therefore, the country's job creation factors must be addressed promptly to prevent labour migrants from leaving, as labour is the driving force to fight the crisis.

References

Borjas, G. J. (1999). Economic research on the determinants of immigration. – World Bank Technical Papers. doi: <https://doi.org/10.1596/0-8213-4504-4>.

- Chakraborty, I., Maity, P. (2020). COVID-19 outbreak: Migration, effects on society, bal environment, and prevention. – *Science of The Total Environment*, Vol. 728, No 138882. doi: <https://doi.org/10.1016/j.scitotenv.2020.138882>.
- Datsko, O. I. (2014). The impact of international migration on increasing threats to the country's economic security. *Problems of external migration of Ukraine and other post-Soviet states: materials of the round table meeting*. Lviv: Together. pp. 25–29.
- Hatton, T. J., Williamson, J. G. (2005). *Global Migration and the World Economy*. doi: <https://doi.org/10.7551/mitpress/3303.001.0001>.
- International organization for migration (2019). *Migration in Ukraine: Facts and figures (2019)*. http://iom.org.ua/sites/default/files/iom-ukraine_facts-eng_2019.pdf.
- Karemera, D., Oguledo, V. I., Davis, B. (2000). A gravity model analysis of international migration to North America. – *Applied Economics*, Vol. 32(13), pp. 1745–1755. doi: <https://doi.org/10.1080/000368400421093>.
- Katz, E., Stark, O. (1984). Migration and Asymmetric Information: Comment. – *American Economic Review*, Vol. 74, 533–534.
- Maidanik, I. P. (2019). Contextual parameters of return labor migration to Ukraine. – *Demography and Social Economy*, Vol. 2(36), pp. 81–95. doi: <https://doi.org/10.15407/dse2019.02.081>.
- Malinovskaya, O. A. (2015). On the need to develop and approve a new version of the Concept of State Migration Policy of Ukraine. Kyiv: National Institute for Strategic Studies under the President of Ukraine. <http://www.niss.gov.ua/articles/1762/>.
- Mayda, A. M. (2009). International migration: a panel data analysis of the determinants of bilateral flows. – *Journal of Population Economics*, Vol. 23(4), pp. 1249–1274. doi: <https://doi.org/10.1007/s00148-009-0251-x>.
- McAleer, M. (2020). Prevention Is Better Than the Cure: Risk Management of COVID-19. – *Journal of Risk and Financial Management*, Vol. 13(3), pp. 46. doi: <https://doi.org/10.3390/jrfm13030046>.
- Michie, J. (2020). The COVID-19 crisis – and the future of the economy and economics. – *International Review of Applied Economics*, Vol. 34(3), pp. 301–303. doi: <https://doi.org/10.1080/02692171.2020.1756040>.
- NGO “Public Audit” (2019). *Global analysis of basic macroeconomic indicators of Ukraine (2013-2018)*. <http://publicaudit.com.ua/reports-on-audit/globalnyj-analiz-bazovyh-makroekonomichnyh-pokaznykiv-ukrayiny-2013-2018-rr/>.
- Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., Agha, M., Agha, R. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. – *International Journal of Surgery*, Vol. 78, pp. 185–193. doi: <https://doi.org/10.1016/j.ijssu.2020.04.018>.
- Poznyak, O. (2016). Assessing the consequences of external labor migration in Ukraine. – *Demography and Social Economics*, Vol. 2 (27), pp. 169–182.
- Sardak, S., Korneyev, M., Dzhyndzhoian, V., Fedotova, T., Tryfonova, O. (2018). Current trends in global demographic processes. – *Problems and Perspectives in Management*, Vol. 16(1), pp. 48–57. doi: [https://doi.org/10.21511/ppm.16\(1\).2018.05](https://doi.org/10.21511/ppm.16(1).2018.05).
- Sirkeci, I., Yucesahin, M. M. (2020). Coronavirus and Migration: Analysis of Human Mobility and the Spread of Covid-19. – *Migration Letters*, Vol. 17(2), pp. 379–398. doi: <https://doi.org/10.33182/ml.v17i2.935>.
- State migration service of Ukraine (2020). *Migration profile of Ukraine for 2019*. https://dmsu.gov.ua/assets/files/mig_profil/migprofil_2019x.pdf.
- State Statistics Service of Ukraine (2020a). *The population of Ukraine 2019: Demographic Yearbook*. http://www.ukrstat.gov.ua/druk/publicat/kat_u/2020/zb/12/zb_ukr_2019.pdf.
- State Statistics Service of Ukraine (2020b). *Statistics information. Economic statistics. National accounts*. http://www.ukrstat.gov.ua/operativ/menu/menu_u/nac_r.htm.
- State Statistics Service of Ukraine (2020c). *Statistics information. Demographic and social statistics. Population and migration*. http://www.ukrstat.gov.ua/operativ/menu/menu_u/ds.htm.
- Veselskaya, L. A. (2017). Improvement of public administration of mass interstate and interregional migration processes. – *Public Administration: Improvement and Development*, Vol. 9. <http://www.dy.nayka.com.ua/?op=1&z=1123>.
- Verkhovna Rada of Ukraine (2017). *Ordinance of the Cabinet of Ministers of Ukraine On Approval of the Strategy for State Migration Policy of Ukraine for up to 2025 No. 482-p (2017, 12 July)*. <https://zakon.rada.gov.ua/laws/show/482-2017-%D1%80>.
- World Bank Grope (2020). *COVID-19 Crisis Through a Migration Lens. Migration and Development Brief 32*. <http://documents1.worldbank.org/curated/en/989721587512418006/pdf/COVID-19-Crisis-Through-a-Migration-Lens.pdf>.