Mulska, Olga; Baranyak, Ihor

Article

Formation of the forecasting model for Ukrainian : German migration system

Reference: Mulska, Olga/Baranyak, Ihor (2019). Formation of the forecasting model for Ukrainian : German migration system. In: Economy and forecasting (2), S. 119 - 136. https://journals.indexcopernicus.com/api/file/viewByFileId/1240239.pdf. doi:10.15407/econforecast2019.02.119.

***Olga Mulska*[1],**

***Ihor Baranyak*[2]**

FORMATION OF THE FORECASTING MODEL FOR UKRAINIAN – GERMAN MIGRATION SYSTEM

The article presents results of the research on the population's migration activity in the context of the formation of a new migration system (MS), such as the Ukrainian-German one. It has been determined that the expansion of the scale and diversification of the composition of migratory flows intensify their influence on contemporary demographic, socio-economic and ethno-cultural processes both in the donor country and in the recipient country. It is proved that the consideration of the migration component has become necessary in developing the demographic, social and economic, foreign and ethno-cultural strategies of the country's development.

Authors present a technique to construct forecasts of migration activity in the conditions of formation of the Ukrainian-German migration system. It is based on a three-stage algorithm: 1) forecasting the size and structure of the population of Germany and Ukraine; 2) forecasting macroeconomic indicators and conditions of labour markets of Germany and Ukraine; and 3) forecasting the volumes of potential migration in the conditions of formation of the investigated MS (Ukraine-Germany).

Based on the projection of the German population by 2060, and taking into account variations in the volume of immigration in the country, authors prove that a significant deformation of the age structure of the indigenous population as a result of the nation's 'hyper-aging' may lead to a demographic collapse, which makes it impossible for the country's economic growth to result in shortages of high-skilled workforce in the labour market. The arguments presented confirm the hypothesis of the dependence of the German economy on the immigration flows of human resources.

On the basis of the constructed economic-mathematical model, the authors estimated the probable variants of further development of the UGMS for medium-term (by 2025) and long-term (until 2030) perspectives under different developmental scenarios (the benchmark, optimistic, tendentious, and pessimistic ones).

The investigation has shown that during 2025-2030 in Ukraine, the demographic and, as a result, labour-saving crisis, caused by the emigration of human resources in young and middle age, coupled with low fertility rates, will aggravate in Ukraine.

---

[1] **Mulska, Olga Petrivna** – PhD in Economics, Research Scientist of the Department of Social and Humanitarian Development of the Regions, State Institution Dolishniy Institute of Regional Research of the National Academy of Sciences of Ukraine (4, Kozelnytska St., Lviv, 79026, Ukraine), oliochka.mulska@gmail.com; https://orcid.org/0000-0002-1666-3971

[2] **Baranyak, Ihor Yevhenovych** – Senior Engineer of the Department of Social and Humanitarian Development of the Regions, State Institution Dolishniy Institute of Regional Research of the National Academy of Sciences of Ukraine (4, Kozelnytska St., Lviv, 79026, Ukraine), ihorbaranyak@gmail.com; https://orcid.org/0000-0002-1467-0262

In this context, the feasibility of constructing a new migration policy with the effect of replacing the workforce has been substantiated[3].

Key words: migration activity, migration system, potential migration, demographic changes, forecasting of migration flows, Ukraine, Germany

JEL: J210, F 220, C530, C590

The problem statement and relevance. International migration is an important element of the modern demographic policy, but due to its impermanent nature, it remains the most unpredictable determinant of other demographic changes in the population. There are many social, economic and political drivers that can affect the intensity of international migration flows. In particular, migration is deterministic of stochastic factors that due to their nature are difficult to predict (financial and economic crises, military conflicts, fundamental political and social changes, etc.). The changes in migration flows can take the form of extreme short-term fluctuations, but on the other hand, in today's world migration processes are becoming more dynamic and complex. As a consequence, the projected migration activity of the population is associated with a high level of uncertainty and the prediction of migration activity, the volume of potential migration and the migration facilities of the population becomes an extremely difficult task that must be based on the identification and consideration of factors of influence with the help of special tools.

The inherent uncertainty about potential migration and future migration flows is compounded by the problems of quality and completeness of migration data that presuppose forecasts. Data sources may vary in coverage of specific migrant groups, measurement accuracy, and even in classifying or identifying characteristics of migration. Moreover, the existing migration theories (new labour migration economies, migration networks, migration systems, family migration economics, synthetic migration theories, etc.) need further development in the context of a changing global context that can be used for forecasting purposes.

Therefore, the construction of a system of estimates and projections of migration activity of the population under the conditions of formation of modern migration systems is actualized, including for Ukraine that is one of the largest migrant donor countries for the EU. Immigration in the recipient countries is becoming increasingly important in view of the diminishing impact of natural change on population dynamics that is especially important for countries such as Germany, Italy, Poland, etc. with zero or negative natural population growth [1].

The analysis of recent research and publications. Predicting migration activity is an extremely difficult task characterized by a high level of error, the highest among three components of demographic changes (fertility, mortality and migration). With this in mind, current methods of forecasting migration activity in Ukraine need improvement in order to be more relevant to current challenges in the socio-demographic field. In our opinion, the most detailed study of the problem of

[3] This publication is prepared withing the research project on "Migration activity of the population of the Carpathian region" (state registration No 0119U002010).

migration forecasting was carried out by specialists of M.V. Ptukha Institute for Demography and Social Studies of NAS of Ukraine [2] (E. Libanova, O. Pozniak [3], V. Sarioglo [4], O. Makarova, L. Tkachenko). Analytical evaluation of labour migration was carried out by O. Malynovska [5, 6] from the National Institute for Strategic Studies.

Scientific researches on regional and border migration (labour, educational), as well as internally displaced persons, are carried out by specialists of Dolishniy Institute of Regional Research of the National Academy of Sciences of Ukraine [7, 8] (U. Sadova, L. Semiv, M. Bil [9], O. Levytska). O. Ovchynnikova [10] deals with improving the methods of short term forecasting of regional migration of the population and M. Romaniuk deals with reimmigration [11]. A scientific breakthrough in forecasting the economic environment and transformation of the national economy was made by the scientists of the Institute for Economics and Forecasting of the National Academy of Sciences of Ukraine: V. Heyets [12], V. Blyznyuk [13] and M. Skrypnychenko.

However, currently there is a lack of specific publications concerning the methods of forecasting population migration for a particular country, taking into account the development trends of both the recipient country and the donor country. The literature on this subject provides only methods for predicting migration flows and does not pay sufficient attention directly to the methods of forecasting the volume of potential migration and migration mindset based on the so-called pull-push factors[4] that shape the migration activity environment and impact new migration systems.

The purpose of the article is to build a predictive model of migration activity (regarding general migration, including labour one) within the framework of the migration system development based on the case of Ukraine – Germany (Ukrainian – German migration system)

The presentation of the basic material of the research. Migration is one of the defining features of the 21st century. There are many approaches explain the phenomenon of international migration, its causes, consequences and the factors of influence. The systemic approach is the most common among them. On the one hand, it interprets international migration as a result of individual decisions arising from certain structural factors. On the other hand, it analyses the international migration in the context of international flows of goods and capital, as well as global and regional socio-economic, cultural and political circumstances. As a result, there is a complex system of interconnections between the various elements that affect the migration process and explain the vectors and dynamics of migration flows. Migration flows between donor and recipient countries are determined by interrelated factors within the framework of a certain common economic space – the migration system (hereinafter referred to as MS).

[4] The high level of development of the region, the high share of employment and the developed social infrastructure act as pull factors of the environment. The low wages, high levels of poverty form a push environment.

The prediction of migration activity within the framework of the Ukrainian – German migration system, in our opinion, can be represented as a closed-type model. The prediction of demographic changes is carried out using the system dynamics method based on initial data (Fig. 1).

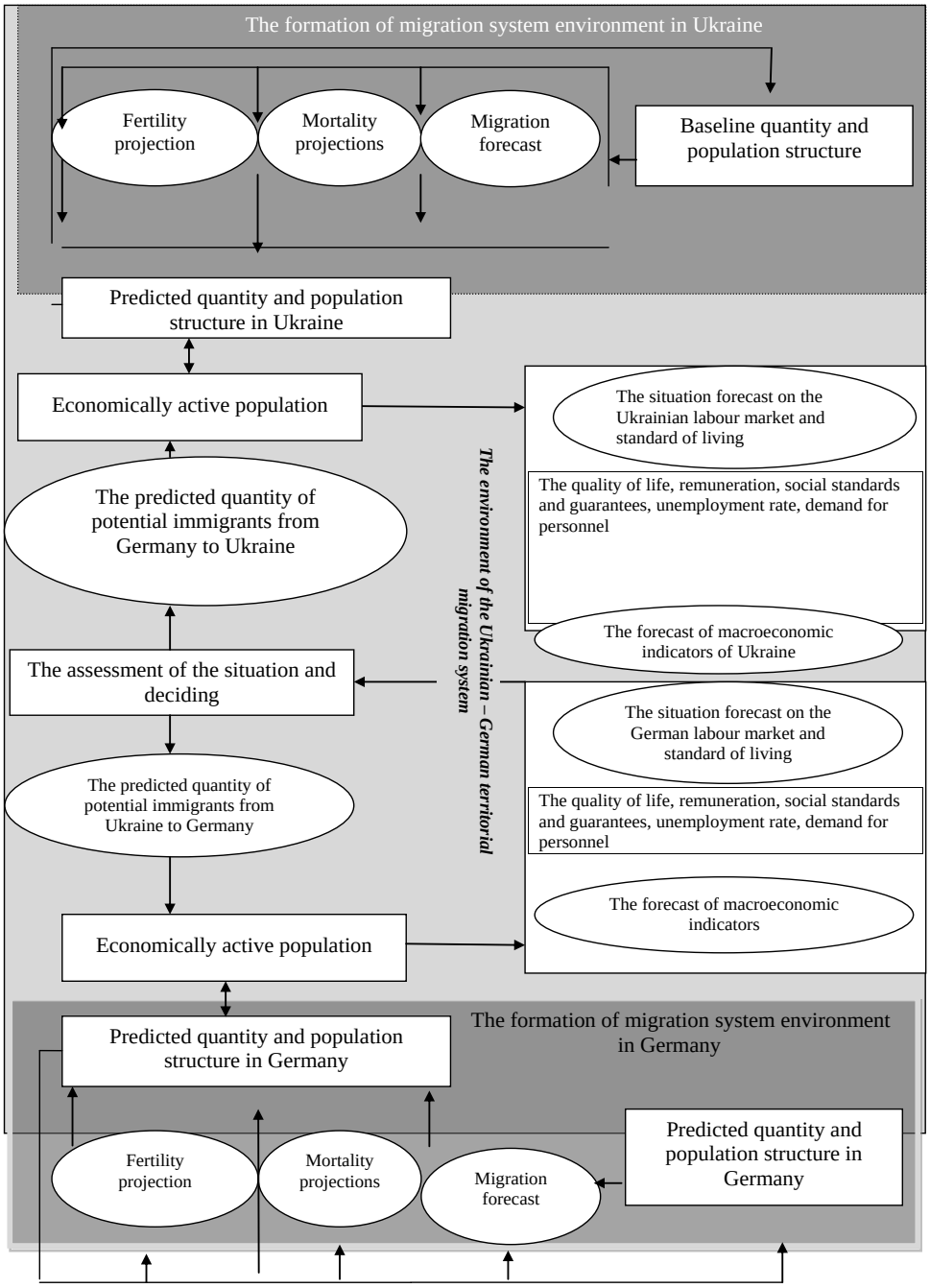

Fig. 1. The algorithm for predicting migration activity in the conditions of development of Ukrainian – German MS

Source: authors' development.

The authors applied a mathematical apparatus of econometric analysis, in particular, such methods as multiple correlation and regression analysis, multivariate analysis of variance, etc. All forecasting calculations are made based on systemic and process approaches.

The prediction algorithm is complicated by the demographic trends of the two countries, the tendencies of their economic development, and the changes in the labour market of Ukraine and Germany. The structure of the prognostic model for the development of the Ukrainian – German migration system is related to the three main stages of forecasting:

1) the quantity and the population structure of Germany and Ukraine;

2) the macroeconomic indicators and the labour market in Germany and Ukraine;

3) the quantity of potential immigrant in the Ukrainian – German migration system.

The German population projections, whose technique was developed by the Federal Statistical Office of Germany [14], is based on a notion of low natural growth rates and a slow increase in the average life expectancy of the population. Based on the analysis of demographic processes in Germany, it can be assumed that there will be no improvement in the indicators of natural demographic growth rates among the local German population[5]. Therefore, in the development of models relating to the determination of the projected population and population structure of the country, natural reproduction indicators are stable values and the main indicator that can significantly affect quantitative and structural changes is external migration.

The prospective population of Ukraine and Germany is estimated by the method of age groups movement. According to this method, every year the population quantity of a particular cohort depends on the demographic changes in the cohort of the previous year. For example, the number of seven-year-olds at the beginning of 2020 depends on the demographic processes in the cohort of six-year-olds in 2019.

The demographic cohort population prediction model is represented by formula 1.

$$P_{a+1}{}^{y+1} = P_a{}^{y} - D_a{}^{y} + NM_a{}^{y} \quad (1)$$

Source: the author's interpretation based on [15, p. 110]

In this model a – age cohort; y – year; P – population; D – number of deaths; NM – net migration (persons).

The analysis of German predicting models [16] showed that, if the current trends of natural reproduction and zero migration (net migration equals 0) hold, the demographic situation of the country can significantly worsen. The German population with zero net migration (migration balance) will decrease by 17 million people (or 25%) until 2017 and by 22 million people by the end of 2060. The share of

[5] The total fertility rate is 1.4 children per woman in fertile age, the average life expectancy for women and men is 88.4 years and 84.4 years, respectively.

the economically active population and children will decrease by 10% in the overall structure in 2050, which means a decrease of 15 million and 2.8 million, respectively. However, the number of elderly people aged 70 will increase by 4 million people and will make up 25% of the total population (Table 1). German demographers argue that in the absence of immigration, vacant demand for workers in all sectors of the country's economy will increase to 1.8 million in 2020 and 3.9 million in 2040.

It is worth noting that significant deformation of the age structure of the indigenous (a sign of "indigenous" is citizenship or residence in the country for a certain period or the fact that previous generations of relatives reside there) due to the "hyper-aging" of the nation can lead to demographic collapse that makes impossible economic grows of the country due to the shortage of labour and qualified personnel in the labour market. Such trends will contribute to the increase in the state budget expenditures for financing the pension fund and other social protection structures.

Table 1

Estimates of the size and age structure of the German population in 2030–2060, *thousand people*

Projection variants	**Volumes of migration (m)**			
	m=0	0 <m< 100	100 <m< 200	200 <m< 300
Population in 2017	82792			
Absolute growth in 2030	-7295	-3564	-1471	53
Absolute growth in 2050	-17051	-10891	-5371	-3174
Absolute growth in 2060	-22563	-15227	-8035	-4885
Age structure (2017), *%*: 0–14 years	13.0			
15–70 years	71.7			
70 years or more	15.3			
Age structure (2050), *%*: 0–14 years	11.6	11.6	11.7	12.1
15–70 years	63.4	64.6	64.5	66.1
70 years or more	25.0	23.7	23.8	21.8

Source: calculated by the authors based on the formula 1 and data [16].

The arguments presented confirm the initial statement of the prognostic assessment of the need and dependence of the German economy on the migration flows of human resources from other countries. Their intensity must increase every year in order to minimize the effects of the demographic crisis and to avoid significant imbalances in the labour market. As shown in Table 1 and Figure 2, by 2030 the annual positive migration balance (300,000 people) is sufficient to maintain a stable demographic situation in Germany. However, according to the 2030–2060

forecast, the annual positive migration balance should increase to around 0.5 million to cover natural demographic losses in the country.

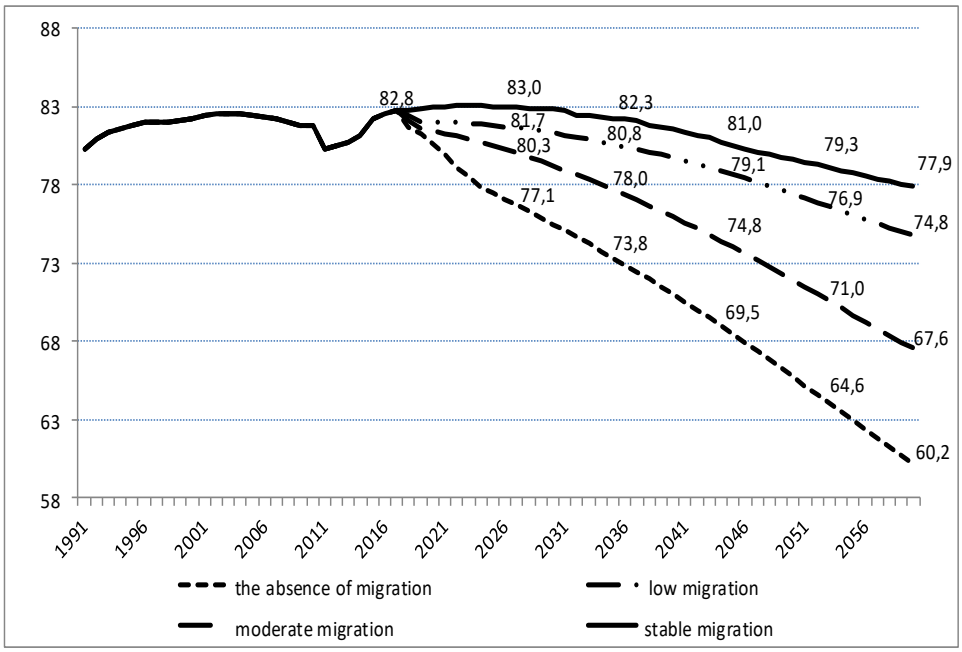

Fig. 2. The scenario approach to forecast population dynamics in Germany by 2060, taking into account different migration volumes, *thousand people*

Source: calculated and constructed by the authors based on data [14].

A retrospective analysis of the number and structure of residents showed that the population in Germany remained virtually unchanged during the study period. This is caused by a high proportion of immigrants and this trend will continue for another 10–20 years. Although it should be emphasized that the difference between the actual data and the reference data during this period will be balanced by significant migration. In that case, up to 2030, about 16 million migrants may live in Germany, which constitutes 20% of the country's population. In 2050 every third inhabitant and 2060 virtually every second German resident will have migrant or immigrant roots.

Ukraine's demographic prospects for natural reproduction will depend on the particular current trends. It is worth pointing out the large-scale internal (with the prospect of external) and external migration from Ukraine due to the military conflict in the Donbas region, the impoverishment of the population in recent years that encourages emigration and reduces the population, as well as the current European Ukraine's "leadership" in AIDS, tuberculosis, measles and other infectious diseases.

This scenario is confirmed by the results of research conducted by scientists of M.V. Ptukha Institute for Demography and Social Studies of NAS of Ukraine [17, p. 78-79]. According to the calculations of experts, the most likely scenario is the

decrease of the population in Ukraine to 37.1 million people at the beginning of 2060. The lower population limit is estimated at 28.3 million people. If the trend of the natural and migratory movement holds over the forecast period, the number of Ukrainian residents at the beginning of 2060s would reach the level of 32.4 million, which is 10 million less than in 2017.

Regarding the age structure of the population in the medium and long term, Ukraine expects a decrease in the proportion of economically active people. However, according to some projection variants, the indicator may fluctuate between 47.7-55.3% at the beginning of 2060. Maintenance of the tendency for the growth of the aging population and deterioration of the age structure of the Ukrainian population in the future will lead to a shortage of labour resources in the internal labour market.

A comprehensive representation of the cause and effect relationships of population migration in the Ukrainian – German migration system can be made based on the results of factor analysis. Using the step method of including factor variables, an economic and mathematical model was constructed that reflects the three most significant factors (unemployment rate in Germany, average wage in Ukraine and inflation index in Ukraine). According to the calculations, the long-term unilateral impact of socio-economic factors stimulated the development of the modern Ukrainian – German migration system and the shift of its equilibrium towards the German side. It is worth noting that the constructed model (2) shows how any change in the factors can transform the migration behaviour of Ukrainian-German migrants[6]:

$$Y=4.42-2.57*T_1-1.8*T_2+1.15*T_3 \quad (2)$$

In this model T_1 is the rate of increase in the unemployment growth in Germany;

T_2 is the rate of increase in the average level of wages in Ukraine;

T_3 is the rate of increase in the inflation index in Ukraine;

Y is the rate of increase in the arrival intensity ratios of Ukrainians to Germany (the number of arrivals per 1 thousand of local population).

To determine the degree of importance and the impact of each factor on the variation of the performance trait, the coefficients of elasticity were calculated that showed that an increase of 1% in the rate of inflation in Ukraine (T_3), other factors being equal, is expected to raise the intensity of Ukrainians coming to Germany by 1.08%. An increase in the average wage in Ukraine and unemployment in Germany by 1% will reduce the emigration propensity by 2.01 and 2.2% respectively. On the whole, the results of the regression model study revealed that when all factor points increase by 1%, the effective characteristic will decrease by 3.13%.

[6] 83% of the change in the rate of increase of arrival intensity ratios of Ukrainians to Germany for the period 2006–2017 is due to the factors that are included in the model (the coefficient of determination is 0.83). There is a close correlation between the level of emigration of Ukrainians to Germany and socio-economic factors that are confirmed by a multiple correlation coefficient (R) that equals 0.91. It is established that the Fisher criterion (F = 9.9) is greater than its critical (tabulated) value ($F_{crit.}$=2.96) and a level of trust is 0.95.

The values of the partial correlation coefficients, as well as the coefficients of elasticity, confirm the thesis that the system of socio-economic motivation plays an important role in the process of formation and development of the Ukrainian – German migration system.

Based on the constructed economic and mathematical model, the probable variants of the Ukrainian – German migration system development for the medium-term (up to 2025) and long-term (up to 2030) perspectives have been estimated. The methodology for forecasting the size of the Ukrainian community in Germany by 2030 proposes four variants (the reference, optimistic, tendentious, and pessimistic ones), taking into account the already simulated socio-economic factors affecting migration flows in the Ukrainian – German migration system (Table 2).

The reference scenario of medium-term perspective provides for maintainance of the current trends in Germany's economic development (reducing upward trend in wages against the backdrop of increasing labour shortages) and significantly improving socially-economic situation in Ukraine (reduction of inflation to 2.8% in 2025 and 1% in 2030, stabilization of the exchange rate, increase in the average wage to 34 thousand UAH in 2025 and up to 120 thousand UAH in 2030).

According to the calculations, such positive dynamics of indicators could, by 2030, stabilize the main economic indicators that today are affecting the development and distortion of the Ukrainian – German migration system.

The optimistic scenario suggests a possible deterioration in economic development in Germany: rising unemployment (from 3.5 to 5%), slowing rate of income growth for the country and Ukrainian migrants in particular. However, trends in the development of the Ukrainian migration system of the reference scenario remain.

The most likely scenario is tendentious because this approach is based on averaged trends observed in the study period (2006–2017) in Ukraine, except for the crisis years 2008–2009 and 2014–2015. According to this scenario, the inflation will be moderate (10–13% per year), the national currency will devaluate to 47 UAH / Euro in 2025 and 55 UAH / Euro in 2030, and there will be a 20% increase in the average annual wage.

The Ukrainian – German migration system forecast presented by a pessimistic scenario by 2030 predicts that the socio-economic indicators will be critically low like observed in times of financial instability and economic turmoil.

The results of the forecasts show that Ukraine will continue to be a donor of the workforce for the German economy in the coming years. However, the credibility of a long-term forecast depends on the economic growth parameters of both countries.

If there is economic development in Ukraine and the economic course of Germany remains unchanged as is envisaged in the reference scenario, the number of Ukrainians who move to Germany annually will remain at the level of 10–12 thousand people / year up to 2025 with a sharp decrease in 2030 to 1.5 thou-

sand people / year. Thus, by 2025 the number of ethnic Ukrainians in the community will grow and reach 380,000 people (Fig. 3).

Table 2

The projected values of the key indicators of the Ukrainian – German migration system development for 2025 and 2030

	Indicator	Actual values (as at 2017)	Projected values as at 2025				Projected values as at 2030			
			Reference	Optimistic	Tendentious	Pessimistic	Benchmark	Optimistic	Tendentious	Pessimistic
Input variable models	The level of inflation in Ukraine, *%*	13.7	2.8	2.8	9.7	20.1	0.8	0.8	9.7	20.1
	The unemployment rate in Germany, *%*	3.5	2.0	3.9	2.0	2.0	1.9	5.0	1.9	1.9
	The average remuneration in Ukraine, *thousand UAH*	7.1	33.7	33.7	27.4	15.2	120.4	120.4	61.6	24.5
	Exchange rate, *Euro / UAH*	30.0	38.5	38.5	47.0	50.0	40	40.0	55.0	62.5
	The average remuneration of Ukrainians in Germany, *thousand UAH*	49.8	88.4	64.9	107.9	114.8	118.0	68	155	176
Results	Total arrivals from Ukraine, *thousand people*	11.4	9.3	1.1	15.7	50.3	1.5	0.1	10.0	64.3
	The number of Ukrainians, *thousand people*	138.0	196.6	146	222	354	197.3	128	264	630
	The number of ethnic Ukrainians, *thousand people*	319	378	327	403	535	378	309	445	811
	The number of economically active Ukrainians, *thousand people*	144	186	142	198	263	170	119	200	364
	Individual economic gain of migrants, *million UAH*	6149	10148	4443	15965	26167	-1331	-6220	18604	55110

Source: calculated by the authors based on data [14, 18].

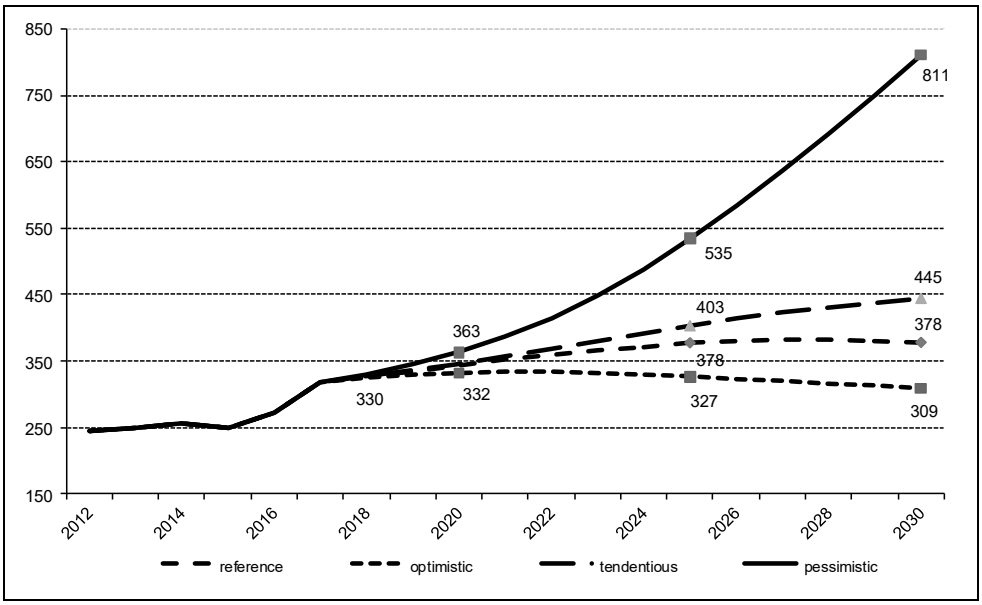

Fig. 3. The scenario version of the forecast of ethnic Ukrainians in Germany up to 2030, *thousand people*

Source: calculated and constructed by the authors based on data [14].

A reversal in the trend of this forecast is related to the equalization of the values of the main indicators that stimulate migration activity in the Ukrainian – German migration system, namely wages, unemployment and inflation. In 2030 in case of an average wage of 3 thousand Euros in both Ukraine and Germany, the individual economic gain of migration will be negative (Fig. 4). Under such circumstances, the number of potential emigrants from Ukraine could be significantly reduced and systematic labour migration would change to educational or tourist-family travels. In that case, the Ukrainian – German migration system will be in a state of socio-economic equilibrium and the new emigration will be more stochastic than purposeful and regular.

The decrease in the level of mobility of Ukrainian citizens in 2025–2030 in the reference scenario (except the economic factor) can be explained by the demographic characteristics of the essential features of the Ukrainians. The acute demographic and as a consequence labor crises were caused by the migration of human resources (the young and middle-aged population) combined with low fertility rates during the early 21st century. Therefore, the problem arises of maintaining the size and optimizing the age composition of the Ukrainian population as important characteristics of the national economic security. Ukrainian economic success will not be possible without skilled personnel in the future. The demand for personnel will increase exponentially under the conditions of sustained economic growth. To increase the welfare of the population, the labour market will need to mobilize not only internal but also external resources. It should be emphasized that the economic recovery of Ukraine is the basis for the transformation of the labour donor coun-

try into a labour recipient one. However, the intensity of migration flows from Germany to Ukraine should not be expected.

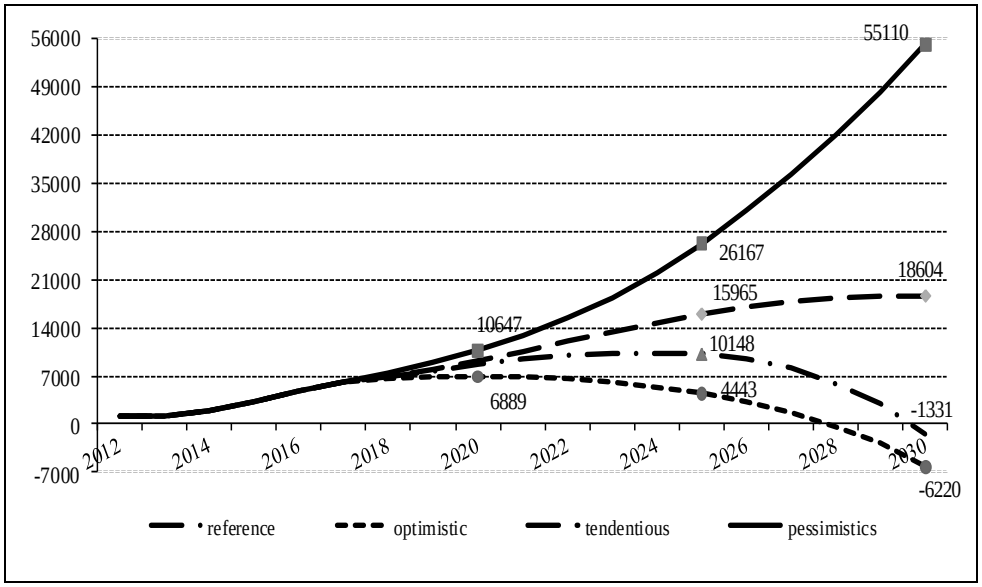

Fig. 4. The projections of individual economic gain of employed Ukrainians in Germany: scenario approach, *thousand UAH*

Source: calculated by the authors based on data [14, 18].

The results of the optimistic scenario forecast of the Ukrainian – German migration system show the improvement of the economic situation in Ukraine and its deterioration for Germany. An increase in the unemployment rate in Germany against the background of a possible "economic miracle" of Ukraine could create conditions for effective regulation of migration activity of the population within tourist flows, rather than labour activity up to 2025.

According to the results of the system dynamics analysis, it can be stated that the probability of rapid economic development of Ukraine and minimization of economic losses from labour migration is very low. The difficult military and political situation, two economic crises of the 21st century that were accompanied by a significant devaluation of the national currency, hyper-price increases, high unemployment rate and corruption scandals nullified Ukraine's economic breakthroughs. As a result, labour migration is increasing, the number of potential migrants is increasing and a large number of young people in Ukraine lost faith the possibility of increasing welfare and personal development in the country. Reference and optimistic forecasting options allow us to identify parity scenarios. According to these scenarios, the states can develop to achieve economic and demographic equilibrium within the Ukrainian – German migration system.

The trend forecast scenario presented here demonstrates the moderate growth of economic and social standards in Ukraine, which is most acceptable to us. The intensity of the Ukrainian-German migration flows in absolute terms will in-

crease to 400.000 people in 2025 and 450.000 people in 2030. During 2019–2027, the average annual number of newly arrived migrants from Ukraine will fluctuate within 13–15 thousand persons with a gradual decrease to 10 thousand persons in 2030.

According to the medium-term and long-term forecasts, the number of employed Ukrainians will remain at the level of 200.000 (Fig. 5). The income gap between Ukrainian and German migration system will raise the migrants' economic benefit from UAH 7 million in 2017 to UAH 18.6 million in 2030.

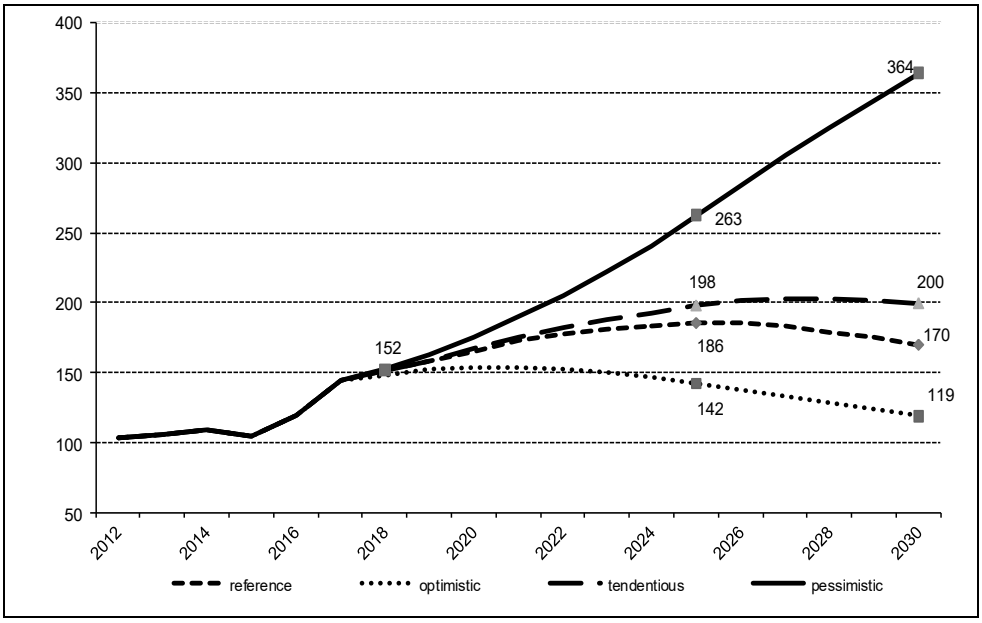

Fig. 5. The projections of employed Ukrainians in Germany up to 2030: scenario approach, *thousand people*

Source: calculated and constructed by the authors based on data [14, 18].

In the pessimistic scenario of the development of the Ukrainian economy that will be characterized by an increase in the average wage by 10% per year and a 20% price rise, the distortion of the Ukrainian – German migration system will only intensify. Increasing poverty among Ukrainians can cause a significant increase in the flow of migrants through the Ukrainian-German migration channel. With such unchanged values of the above factors, the number of migrants arriving from Ukraine will grow steadily and the number of ethnic Ukrainians who will officially reside in Germany will triple up to 2030 and register over 800.000.

The significant gap in the incomes between Ukraine and EU countries is a major determinant of migrants' choice of a potential Migration system, country of employment or permanent residence. This will increase individual economic gain 9 times (from 6.1 million UAH in 2017 to 55 million UAH in 2030) and the number of employed Ukrainians in Germany (from 144.000 to 364.000 in 2030 compared to 2017).

Conclusions and guidelines for future research

While modelling the scale of overall emigration from Ukraine, the authors have used a comprehensive approach. They took into account not only the tendencies of the influence of pull-push factors but also the peculiarities of migration policy of the recipient country (Germany) and the outflow of 8–10 million Ukrainian workers abroad, according to experts estimates. Taking into account the incompleteness of labour migration statistics that are necessary to build reliable econometric models, the use of expert forecasting methods is an effective tool for assessing the potential magnitude of migration. The main purpose of forecasting migration activity is to build reliable assumptions about future migration flows and their trends.

The constructed multivariate regression model allows evaluating different scenarios (reference, optimistic, tendentious and pessimistic ones) of further development of the Ukrainian – German migration system for the medium-term (up to 2025) and long-term (up to 2030) perspectives. Forecasts indicate that the population of Germany will decrease by 17 million people (or 25% up to 2017) and by 22 million by the end of 2060 if the migration balance is zero. The share of the economically active population will decrease by 10% in 2050 and the number of elderly people (over 70 years old) will make up 25% of the total population. According to the reference scenario, the annual flow of Ukrainian emigrants within the Ukrainian – German migration system will be 10–12 thousand people by 2025. The number of ethnic Ukrainians will increase to 380 thousand people and the number of employed Ukrainians will remain at 200 thousand people. The economic impact of migration within the Ukrainian – German migration system will increase from 7 million UAH in 2017 to 18.6 million UAH in 2030.

Forecasting migration volumes for the future will require not only innovative forecasting methods and models but also enhancing the quality of state regulation of migration activity, whose methods and means must be formed based on robust projections for the development of major migration systems. The current Ukrainian state migration policy remains "fragmented and contradictory on the content. Some of the fundamental elements are missing or underdeveloped (including emigration and diaspora)" [19] and therefore require improvement.

Considering the demographic situation in Ukraine and the results of the forecasting of migration activity within the Ukrainian – German migration system, the important tasks of state policy in the context of improving the organizational and economic mechanisms of migration policy implementation are: 1) the creation of a special central authority – the Ministry of Foreign Migration Relations. Its main task is seen in the formulation and implementation of state migration policy; 2) further development and creation of new enterprises with foreign (including German) investments in the territory of Ukraine that will help create new jobs, attract modern technologies, and increase export-import operations; 3) the integration of re-immigrants and immigrants from Germany into Ukrainian society.

The implementation of these tools will help to transform the Ukrainian – German migration system environment into a more predictable and manageable one aimed at realizing the social, humanitarian and economic interests of Ukraine and

Germany and their citizens who have or will have the status of migrants. It will create new effective incentives to revive immigration, including that of skilled German specialists, help to discourage labour emigration from Ukraine, reduce disparities in the national labour market and increase social guarantees and quality of life.

References

1. Kurier: Bevölkerung: Westeuropa wächst, Osteuropa schrumpft. Retrieved from https://kurier.at/chronik/weltchronik/bevoelkerung-westeuropa-waechst-osteuropa-schrumpft/400054985 [in German].
2. Libanova, E.M. (Ed.), Pozniak, O.V., Makarova, O.B., Sarioglo, V.G., Tkachenko, L.G. (2009). External labour migration of population. Kyiv: Ukrainian Center for Social Reforms; State Committee of Statistics of Ukraine [in Ukrainian].
3. Poznyak, O.V., Hnatiuk, T.O. (2014). State Migration Policy and its Impact on the Population Structure. In *Liudskyj rozvytok v Ukraini: istorychnyj vymir transformatsii derzhavnoi sotsialnoi polityky – Human development in Ukraine: the historical dimension of the transformation of state social policy* (p. 92-108). Kyiv: Ptoukha Institute for Demography and Social Studies of the National Academy of Sciences of Ukraine [in Ukrainian].
4. Saryoglo, V.G. (2016). 'Great data' as a source of information and tools for official statistics: potential, problems, perspectives. *Statystyka Ukrainy – Statistics of Ukraine,* 4, 12-19 [in Ukrainian].
5. Malinovska, O. (2015). Labour migration of Ukrainian population: what to expect at the nearest future? Retrieved from http://migraciya.com.ua/news/migrantworkers/ua-labour-migration-ukrainewhat-to-expectinthe-near-future-part-1 [in Ukrainian].
6. Malinovska, O. (2015). Possible development of labour migration abroad in the context of current situation in Ukraine. *Visnyk Pensiynogo fondu Ukrainu – Journal of Pension fund of Ukraine*, 3 [in Ukrainian].
7. Sadova, U. (Ed.). (2011). Regional Migration Policy and Mechanisms for its Implementation. National Academy of Sciences of Ukraine, Institute for Regional Research. Lviv [in Ukrainian].
8. Sadova, U. (Ed.), Grinkevich, O., Semiv, L., Tesliuk, R., Bil, M., Bidak, V., Rindzak, O., Levytska, O., Mulska, O. (2019). Ukrainian migration in the context of the global and national challenges of the 21st century. Lviv [in Ukrainian].
9. Bil, M.M. (2017). Retrospective survey of spatial mobility of the population. *Demohrafiia ta sotsialna ekonomika – Demography and Social Economy*, 1, 66-78. doi: https://doi.org/10.15407/dse2017.01.066 [in Ukrainian].
10. Ovchinnikova, O. (2017). Models of Regional Migration of the Population. *Intelekt XXI – Intelekt XXI*, 4, 27-32 [in Ukrainian].
11. Romanyuk, M. (2016). Overseas Labor Migration and Remembrance in the Context of National Security of Ukraine. *Rehionalna ekonomika – Regional Economy*, 4, 22-30 [in Ukrainian].
12. Heyets, V. (2016). Features of the relationship of economic and political preconditions of the reconstruction of the economy of Ukraine. *Ekonomika Ukrainy – Economy of Ukraine*, 12, 3-21. doi: https://doi.org/10.15407/eip2016.01.007 [in Ukrainian].
13. Blyzniuk, V. (2011). Peculiarities of labor mobility of the Ukrainian labor market. *Visnyk Skhidnoukrainskoho natsionalnoho universytetu imeni Volodymyra Dalia – Bulletin of the Volodymyr Dahl East-Ukrainian National University*, 12-19 [in Ukrainian].

14. Statistical Office of Germany. Database of statistics. Retrieved from https://www-genesis.destatis.de/genesis/online/data [in German].
15. Segida, K. (2016). Methodological Foundations of Geodemographic Forecasting. *Problemy bezperervnoyi heohrafichnoyi osvity i kartohrafiyi – Problems of Continuous Geographical Education and Cartography*, 24, 109-116 [in Ukrainian].
16. Euronews (2015). Retrieved from http://ua.euronews.com/2015/09/07/germany-s-winning-refugee-welcome-formula
17. Poznyak, O.V., Shevchuk, P.E. (2014). Demographic prospects of Ukraine until 2060. *Demohrafiia ta sotsialna ekonomika – Demography and Social Economy*, 1 (21), 72-84. doi: https://doi.org/10.15407/dse2014.01.072 [in Ukrainian].
18. Statistical Office of Ukraine. Database of statistics. Retrieved from http://www.ukrstat.gov.ua/ [in Ukrainian].
19. Malinovska, O. (2014). The Migration Policy of Ukraine: Status and Prospects of Development, Analytical Report M1/2014. Kyiv: Institute for Economic Research and Policy Consulting [in Ukrainian].

Received 24.04.19

Мульска, Ольга Петрівна
канд. екон. наук, науковий співробітник відділу проблем соціально-гуманітарного розвитку регіонів,
ДУ "Інститут регіональних досліджень ім. М.І. Долішнього НАН України"
вул. Козельницька, м. Львів, 479026
oliochka.mulska@gmail.com
https://orcid.org/0000-0002-1666-3971

Бараняк, Ігор Євгенович
провідний інженер відділу проблем соціально-гуманітарного розвитку регіонів,
ДУ "Інститут регіональних досліджень ім. М.І. Долішнього НАН України"
вул. Козельницька, м. Львів, 479026
ihorbaranyak@gmail.com
https://orcid.org/0000-0002-1467-0262

ПРОГНОСТИЧНА МОДЕЛЬ ФОРМУВАННЯ УКРАЇНО-НІМЕЦЬКОЇ МІГРАЦІЙНОЇ СИСТЕМИ

Викладено результати дослідження міграційної активності населення в рамках україно-німецької міграційної системи (далі – УНМС). Розширення масштабів та урізноманітнення складу міграційних потоків посилюють їх вплив на сучасні демографічні, соціально-економічні та етнокультурні процеси й у країні, що є донором, і в країні, що є реципієнтом. Врахування міграційної компоненти необхідне при формуванні демографічної, соціальної та економічної, зовнішньої та етнокультурної стратегії розвитку країни.

Застосована методика побудови прогностичної моделі розвитку УНМС ґрунтується на алгоритмі, що передбачає три етапи: 1) прогнозування чисельності та структури населення Німеччини та України; 2) прогнозування макро-

економічних показників та кон'юнктури ринків праці Німеччини та України; 3) прогнозування обсягів потенційної міграції в рамках УНМС.

На основі прогнозу чисельності населення Німеччини до 2060 р. з урахуванням різноманітних варіантів обсягів імміграції у країні доведено, що значна деформація вікової структури корінного населення внаслідок "гіперстаріння" нації може призвести до демографічного колапсу, що унеможливлює економічне зростання країни через дефіцит робочої сили та кваліфікованих кадрів на ринку праці. Наведені аргументи підтвердили гіпотезу про залежність німецької економіки від імміграційних потоків людських ресурсів.

З допомогою побудованої економіко-математичної моделі оцінено ймовірні варіанти подальшого розвитку УНМС на середньострокову (до 2025 р.) та довгострокову (до 2030 р.) перспективи за різних сценаріїв розвитку (еталонного, оптимістичного, тенденційного, песимістичного).

Дослідження показали, що впродовж 2025–2030 рр. в Україні загостриться демографічна та – як наслідок – працересурсна криза, спричинена еміграцією людських ресурсів у молодому та середньому віці в поєднанні з низькими показниками народжуваності. У цьому контексті обґрунтовано доцільність та визначені напрями формування нової міграційної політики з ефектом працезаміщення.

Ключові слова: *міграційна активність, міграційна система, потенційна міграція, демографічні зміни, прогнозування міграційних потоків, Україна, Німеччина*

Мульская Ольга Петровна
канд. экон. наук, научный сотрудник
ГУ "Институт региональных исследований имени М.И. Долишнего НАН Украины"
ул. Козельницкая, г. Львов, 479026
oliochka.mulska@gmail.com
https://orcid.org/0000-0002-1666-3971

Бараняк Игорь Евгеньевич
ведущий инженер
ГУ "Институт региональных исследований имени М.И. Долишнего НАН Украины"
ул. Козельницкая, г. Львов, 479026
ihorbaranyak@gmail.com
https://orcid.org/0000-0002-1467-0262

ПРОГНОСТИЧЕСКАЯ МОДЕЛЬ ФОРМИРОВАНИЯ УКРАИНО-НЕМЕЦКОЙ МИГРАЦИОННОЙ СИСТЕМЫ

Изложены результаты исследования миграционной активности населения в рамках украино-немецкой территориальной миграционной системы (далее –

УНМС). Расширение масштабов и разнообразия состава миграционных потоков усиливают их влияние на современные демографические, социально-экономические и этнокультурные процессы в стране-доноре и в стране-реципиенте. Учитывать миграционный компонент необходимо при разработке демографической, социальной и экономической, внешней и этнокультурной стратегии развития страны.

Использованная методика построения прогностической модели развития УНМС основывается на алгоритме, предусматривающем три этапа: 1) прогнозирование численности и структуры населения Германии и Украины; 2) прогнозирование макроэкономических показателей и конъюнктуры рынков труда Германии и Украины; 3) прогнозирование объемов потенциальной миграции в условиях формирования исследуемой УНМС.

На основании прогноза численности населения Германии к 2060 году с учетом различных вариантов объемов иммиграции в стране доказано, что значительная деформация возрастной структуры коренного населения вследствие "гиперстарения" нации может привести к демографическому коллапсу, что делает невозможным экономический рост страны вследствие дефицита рабочей силы и квалифицированных кадров на рынке труда. Приведенные аргументы подтвердили гипотезу о зависимости немецкой экономики от иммиграционных потоков человеческих ресурсов.

С помощью построенной экономико-математической модели оценены возможные варианты дальнейшего развития УНМС на среднесрочную (до 2025 года) и долгосрочную (до 2030 года) перспективы при различных сценариях развития (эталонном, оптимистическом, тенденциозном, пессимистическом).

Исследования показали, что в течение 2025–2030 гг. в Украине обострится демографической и – как следствие – трудоресурсный кризис, вызванный эмиграцией человеческих ресурсов в молодом и среднем возрасте в сочетании с низкими показателями рождаемости. В этом контексте обоснована целесообразность и определены направления формирования новой миграционной политики с эффектом трудозамещения.

Ключевые слова: *миграционная активность, миграционная система, потенциальная миграция, демографические изменения, прогнозирование миграционных потоков, Украина, Германия*