

# “Relationship between net migration and economic development of European countries: Empirical conclusions”

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# RELATIONSHIP BETWEEN NET MIGRATION AND ECONOMIC DEVELOPMENT OF EUROPEAN COUNTRIES: EMPIRICAL CONCLUSIONS

## Abstract

The study aims to investigate the relationships between the volume of net migration and the economic development of individual European countries, which will make it possible to forecast the level of GDP and strengthen their migration policy. Correlation-regression analysis was used based on statistical data from Eurostat and the State Statistics Service of Ukraine for the period 2014–2021 for selected European countries (the EU-27 member states, Switzerland, and Ukraine). The correlation-regression analysis showed a relationship between the volume of net migration and the level of GDP. The linear correlation equations forecasted the value of the GDP level depending on the influence of a single factor – the volume of net migration. The attention is focused on the importance of migration, which ensures economic growth for Poland. It is attractive due to a simpler mechanism for moving immigrants than in other EU-27 countries, ease of language learning and easier adaptation, territorial proximity, and a higher standard of living compared to neighboring countries that were part of the Soviet Union. Thus, an increase in net migration to Poland by 1% will lead to an increase in gross domestic product by 1.43 million euros. Due to Russia's war against Ukraine, net migration from Ukraine to Poland has increased significantly, potentially increasing Poland's GDP in 2023 by 0.08% or 529.54 million euros.

## Keywords

migration, economic development, gross domestic product, regression analysis, model, international economy

## JEL Classification

F22, F29, C25, E20

## INTRODUCTION

Migration is a critical factor in economic development on a par with financial, physical, human, and intellectual capital. Currently, there are about 300 million international migrants in the world, or 4% of the world's population, of which 60% are migrant workers (IOM, 2023). Migration processes have intensified due to wars in Africa, Europe, and Asia. In 2023, about 36.5 million refugees were recorded (IOM, 2023). The volume of migration will grow rapidly in 2024 due to the strengthening of the migration policy of EU member states and the USA. For example, in 2023, compared to 2022, the number of asylum-seekers to EU countries increased by 20% (Dzerkalo Tyzhnia, 2024a). Due to Russia's war against Ukraine, the EU countries have provided the opportunity for immigrants from Ukraine, in particular refugees, to get a chance to stay in them. Among the EU countries, Germany accepted the largest number of Ukrainian refugees (1,215 million immigrants), while Poland accepted 0.96 million immigrants and Czechia – 0.365 million immigrants (Visit Ukraine, 2023). The highest levels of support are recorded in Finland – 92%, Sweden – 89.3%, Spain – 87.9%, Italy – 85.7%, Poland – 84.7%, Romania – 83%, Ireland – 79.2%, the

Netherlands – 78.4%, Hungary – 77.5%, France – 76.4%, and Germany – 73.6% (Directorate-General for Neighbourhood and Enlargement Negotiations, 2023).

The primary reasons for migration are the political, socio-economic, and environmental instability of migration donor countries (Migration Data Portal, n.d.). They also include globalization and climate change (Dao et al., 2016), the difference between the wages in the donor country and the higher wages in the recipient countries, and the desire of citizens for a better life in Europe (Libanova, 2019).

The majority of migrants, especially labor migrants, go to high-income countries, in particular, to the USA and European states (Czaika et al., 2021). On the one hand, migration, particularly labor migration, has a positive effect on the economic and demographic development of recipient countries. From an economic point of view, migrants create added value in entire sectors of the economy. For example, the vast majority of construction work in the USA is now performed by migrants, who account for the lion's share of employment in agriculture (OECD, 2014; Dzerkalo Tyzhnia, 2024b). This increases the amount of tax revenues in the budget and contributes to increasing the flexibility of the labor market and the competitiveness of local industry. On the other hand, recipient countries are forced to spend additional financial resources to ensure the security and social protection of migrants. There are fears among the political elites of the USA and the EU that the latest migration may negatively affect the demographic transformation of recipient countries. The increase in migration flows necessitated both the improvement of migration legislation and the formation of a system of interstate regulation of migration processes. Considering growing migration, it is paramount to implement migration measures of a legal and economic nature.

The aggravation of modern migration processes requires the study of its impact on the economic development of countries. The existing statistical base, considering the limited access due to wars, allows one to partially investigate the influence of factors on economic development. Among such factors, it is necessary to investigate net migration for the economic development of countries (gross domestic product) in Europe, provided that other factors remain unchanged.

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## 1. LITERATURE REVIEW

Ensuring economic growth is a strategic goal of every country. The literature shows the main factors that affect economic growth. Emphasis is placed on the proper EU strategy that ensures economic development, where its prerequisite should be human capital – knowledge and values of people (Pelinescu, 2015). The human capital must provide the prerequisites for the formation of a science-intensive economy.

Trade is an important factor in economic growth. Busse and Roeniger (2015) emphasize that trade is the main determinant of economic growth. However, the correlation-regression analysis showed that attention should be paid to the specification of export-import operations. The rational structure of export-import trade makes it possible to have a positive influence, not economic growth. Procházka and Čermáková (2015) confirmed a positive relationship between spending on re-

search and development and economic growth. Mafizur and Khan (2016) stressed the importance of international trade, putting a hypothesis on the connection between trade and economic growth. Using econometric methods, Bercu et al. (2019) found a connection between international trade and the growth of gross domestic per capita product. Studying 14 countries in Eastern Europe and Central Europe during 1995–2017, they proved that economic growth is affected by electricity consumption. Thus, there is a causal relationship between electricity consumption and economic growth. Deficiencies in the energy system lead to a slowdown in economic growth. Ihnatenko et al. (2019) noted three factors used in regional models of economic development: land, labor, capital, and their derivatives. The study suggests expanding the factors of economic development models, including capital, human resources, the level of innovation, the level of corruption and shadow economy, and competitive advantages.

Rahman and Alam (2021) researched the influence of factors on economic growth targeting 20 largest world economies for the period 1980–2018 using correlation-regression analysis. The following factors affecting economic growth were included in the model: energy use, trade, capital, labor, foreign direct investment, and human capital development. It was found that the above-mentioned influencing factors have a positive effect on economic growth, but at the same time, the specified influence can have different meanings depending on the short-term or long-term perspective.

Kwilinski et al. (2022) and Poliakov and Zayukov (2022) show that global migration is an extremely complex phenomenon and has a contradictory nature regarding the impact on the economic development of recipient countries. Jover and Diaz-Parra (2022) found that migration is a potential force that stimulates the development of the tourism sector and ensures the economic growth of cities.

In modern global processes, international migration significantly affects the economic development and cooperation of countries (Savin et al., 2023). In 2015, migrants created about 10% of the world's gross domestic product (GDP), or about 1 trillion US dollars (Woetzel et al., 2016). For example, the Canadian economy loses more than 11 billion US dollars annually due to the insufficient use of migrant labor skills (Reits et al., 2014). About 70% of international migrants are labor migrants; that is, they fill the ranks of the labor force in countries in which they are employed (IOM, 2023). Mostly these labor migrants come from developing to developed countries.

Calcagnini et al. (2021) showed that the migration of highly skilled migrants has a positive effect on production. Qualified labor migrants (Constant, 2014) make the main contribution to the creation of GDP. In addition, migrant workers with lower qualifications are crucial for the GDP of countries in which they are employed. At the same time, they supplement the labor market with their special labor skills, which local labor resources do not have, and occupy jobs that are not in demand on the labor market among local residents.

Remittances by labor migrants to their countries of residence contribute to the development of

the economy in these countries, in particular, to the GDP and attraction of investments (Batista & Narciso, 2018). For example, over the past ten years, the volume of remittances from Ukrainian labor migrants to Ukraine significantly exceeds the volume of direct foreign investment (Zanuda, 2018). Migration has a positive effect on the development of trade, which is a component in the formation of the GDP of both countries (Shukla & Cantwell, 2018). An inverse correlation was found between the integration of migrant workers in the host country and the export of migrant workers from the country. Cai et al. (2021) showed that China's exports to 205 countries in the world, where Chinese migrants work, lead to the fact that less integrated Chinese labor migrants stimulate the demand for goods in China.

Most studies confirm a direct relationship between migration and economic growth. This relationship depends on many factors, including the skill level of migrants, the rate of assimilation, external factors, or fiscal impact. At the same time, immigration has a more favorable effect on economic growth under conditions when the flow of migrants consists of highly qualified labor (Borjas, 2022). Migration not only contributes to economic growth but also enables the implementation of the Sustainable Development Goals (Kwilinski et al., 2022). Population migration by 16% contributes to the overall score of the Sustainable Development Goals (Pan et al., 2023), but the impact of migration on economic growth is difficult to assess.

Wasilczuk and Karyy (2022) and Heinisch and Wohlab (2016) emphasized the relationship between migration and macroeconomic indicators. At the same time, one emphasizes the need to study the structure of economically active migrants, in particular, their level of education, during the analysis of the relationships between migration and economic development. The constructed quantitative model of the impact of migration on GDP growth showed that population migration within China had a positive impact on the development of China's economy, particularly its demographic, economic, and social growth (Wang & Conesa, 2022; Petrunenko et al., 2022). The correlation-regression analysis shows the influence between labor migration and economic development in the EU-15 countries. Migration

had a positive effect on economic development, but when the share of qualified migrants was high (Rayevnyeva et al., 2023; Kozlovskiy et al., 2020). Using the applied decomposition analysis, the influence of factors (migration, interest rate, active population, exports, and consumer price index) on GDP was investigated. The influence between migration and GDP was found. That is, migration affects GDP by 10-14%. In addition, based on the analysis of impulse responses of the SVAR model, there is a strong relationship between migration and GDP; a 1% increase in migration leads to an increase in real GDP by 0.1% (Rayevnyeva et al., 2023).

The literature review proved that migration has a positive effect on economic growth, but it is difficult to identify the influencing factors. Such factors can include race, language, religion, nationality, financial situation, education, or work skills (Bove & Elia, 2017). In addition, Davis (2014) emphasizes the problems of determining the impact of migration on economic growth, as this impact in some studies is insignificant. The existence of the relationship between migration and the development of the economy, in particular business, is often controversial (Hajro et al., 2021).

The study of factors influencing economic development (human capital, labor force, energy resources, trade, direct foreign investment, and migration) concluded that it is difficult to build a model that would take into account all factors of economic growth. Therefore, this study aims to investigate a separate aspect of the impact of migration as a separate factor of influence, with other factors remaining unchanged, on the gross domestic product of European countries, in particular Ukraine.

## 2. METHODOLOGY

The study analyzed net migration volumes in selected European countries in 2013–2021 using the Eurostat database (statistical data as of January 3, 2024 in Eurostat for the net migration indicator are given for 2021). Next, it calculated changes in the volume of net migration in the studied European countries in 2021 compared to 2013 and analyzed the volumes of net

migration in the EU-27 member states (Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, Iceland, and Norway), Switzerland, and Ukraine in 2013–2021. Further, the study assessed GDP in certain European countries, in particular in the EU-27 member states and in Ukraine in 2013–2021 and calculated changes in the volume of GDP in 2021 compared to 2013. The paper also studied the impact of net migration on the level of gross domestic product based on the statistical database of Eurostat and the State Statistics Service of Ukraine for the period 2014–2021. Moreover, it used correlation-regression equations for the studied countries to assess the level of data adequacy and statistical reliability, forecasting Poland's GDP in 2023 based on the linear regression equation.

The study uses two indicators – net migration and gross domestic product. Methodologically, the net migration (NT) indicator, according to Eurostat and the State Statistics Service of Ukraine, is calculated according to this formula (Eurostat, n.d.; SSSU, 2021):

$$NM = A - D, \quad (1)$$

where  $NM$  – net migration, persons,  $A$  – the number of migrants arriving in the country, persons,  $D$  – the number of emigrants who left the country, persons.

The net migration indicator shows migration growth if its value is positive and migration contraction if its value is negative.

The next indicator is gross domestic product (GDP). This macroeconomic indicator shows the volume of goods and services produced by all business entities and allows for an overall assessment of the level of economic growth (decline). Methodologically, gross domestic product can be determined by two approaches: according to expenses and income. The components of GDP income are given in current prices in millions of euros for selected European countries, and for Ukraine – in millions of hryvnias.

The impact of net migration ( $x$ ) on the level of gross domestic product ( $Y$ ) is determined based on the correlation-regression analysis. Carrying out a correlation-regression analysis when assessing the impact of migration ( $x$ ) on the level of gross domestic product involves the construction of correlation equation (Chatterjee & Simonoff, 2013; Ilyash et al., 2020):

$$Y_x = b_0 + b_1x, \quad (2)$$

where  $Y_x$  – linear equation,  $b_0, b_1$  – parameters (coefficients) of the equation,  $x$  – impact factor.

The unknown parameters of the regression equation ( $b_0, b_1$ ) are proposed to be found by the method of least squares. For this, a system of normal equations is built. The closeness of the connection is estimated using the linear correlation coefficient. The share of variation of the studied outcome characteristic ( $Y$ ) is due to the influence of factors ( $x$ ) included in the regression equation 1 is determined using the coefficient of determination ( $D$ ). The algorithm for identifying the impact of net migration on gross domestic product is as follows:

- analyze statistical data on net migration and GDP;
- construct regression equations (equation 1) for the studied European countries;
- assess the adequacy and statistical reliability of the constructed linear equation;
- analyze the impact of net migration on the level of gross domestic product.

Assessing the adequacy and reliability of the constructed correlation-regression equation (equation 1) involves the calculation of the following indicators: closeness of relationship ( $r$ ), portions of variance of the investigated outcome feature ( $D$ ), multiple correlation coefficient probabilities ( $F$ ), sample correlation coefficient ( $z$ ), standard error ( $S_z$ ), the lower limit of the correlation coefficient confidence interval ( $rL$ ), and the upper limit of the correlation coefficient confidence interval ( $rU$ ). The calculation of the above indicators was carried out using the MS Excel program.

### 3. RESULTS

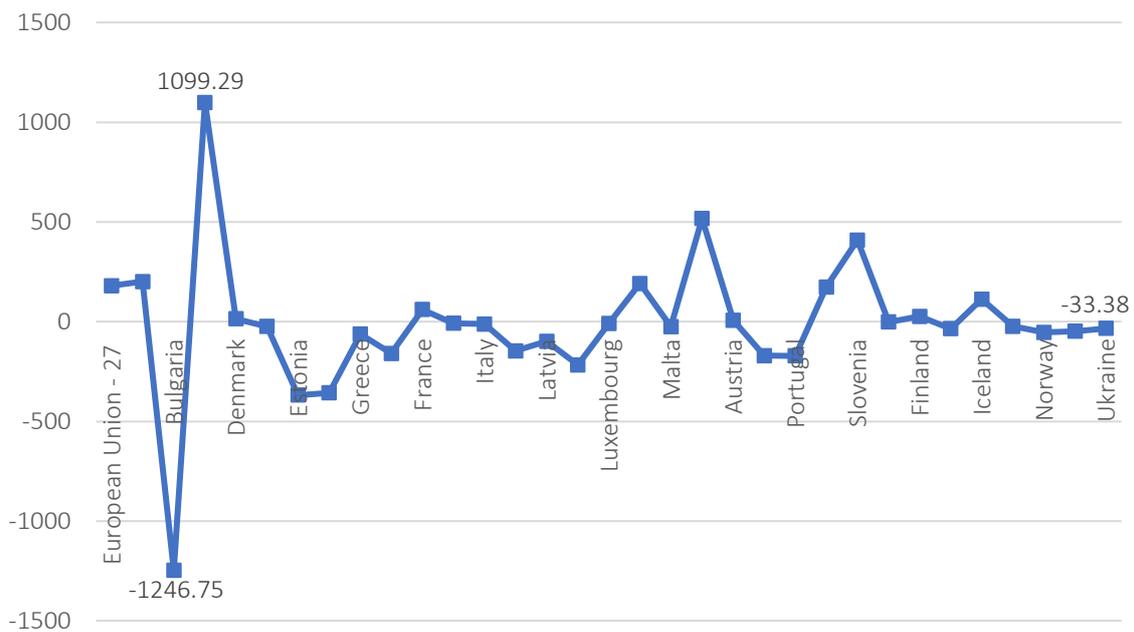
This study analyzes volumes of net migration in individual European countries in 2013–2021. It also calculates changes in the volume of net migration in the studied European countries in 2021 compared to 2013. The impact of net migration on the level of gross domestic product was studied, correlation-regression equations were constructed for the studied countries, and the level of their adequacy and statistical reliability was assessed; the level of Poland's GDP in 2023 is predicted based on the constructed linear regression equation.

#### 3.1. Analysis of migration statistics in individual European countries

The statistical base for migration analysis is taken from Eurostat and the State Statistics Service of Ukraine (Eurostat, n.d.; SSSU, 2021). Figure 1 calculates the change in the volume of net migration in individual European countries for 2013–2021.

Figure 1 shows that in 2021, compared to 2013, the volumes of net migration in the vast majority of the considered countries had unstable dynamics and decreased. Based on Eurostat (n.d.), in the EU-27 countries, the volume of net migration was 1.27 million people; the largest volumes were recorded in Germany – 331,205 people, Italy – 160,054 people, France – 159,370 people, Spain – 148,070 people, and the Netherlands – 103,763 people. In 2021, Ukraine had a positive volume of net migration – 21,261 people. The smallest volumes of net migration were in such European countries as Liechtenstein – 153 people, Slovakia – 2,338 people, Slovenia – 2,480 people, Iceland – 4,335 people, Malta – 4,639 people, and Cyprus – 5,591 people. The negative value of net migration was recorded in Latvia (–286 people), Croatia (–4,512 people), Romania (–22,219 people), and Greece (–22,476 people).

The largest volume of net migration in EU-27 countries was observed in 2015 – 1.59 million people and the smallest in 2013 – 450.14 thousand people. Among EU-27 countries, net migration volumes increased the most in 2021, compared to 2013, in Czechia (1099.29%), the Netherlands (517.53%), Slovenia (409.24%), Belgium (201.19%), Hungary (191.61%), Romania (174%), Iceland (113.13%),



**Figure 1.** Changes in the volume of net migration in individual European countries in 2021 compared to 2013, %

and France (61.08%). The highest levels of decline in the volume of net migration were recorded in Bulgaria (-1246.75%), Estonia (-367.69%), Ireland (-356.81%), Lithuania (-216.94%), Poland (-170.4%), and Portugal (-170.77%). The largest volumes of net migration for 2013–2021 were recorded in Ukraine in 2013 (31,913 people) and the smallest in 2020 (9,316 people) (SSSU, 2021).

### 3.2. Analysis of gross domestic product statistics in individual European countries

Gross domestic product (GDP) is an important macroeconomic indicator that indicates the economic development of countries. Figure 2 presents changes in the volume of GDP in selected European countries in 2021 compared to 2013.

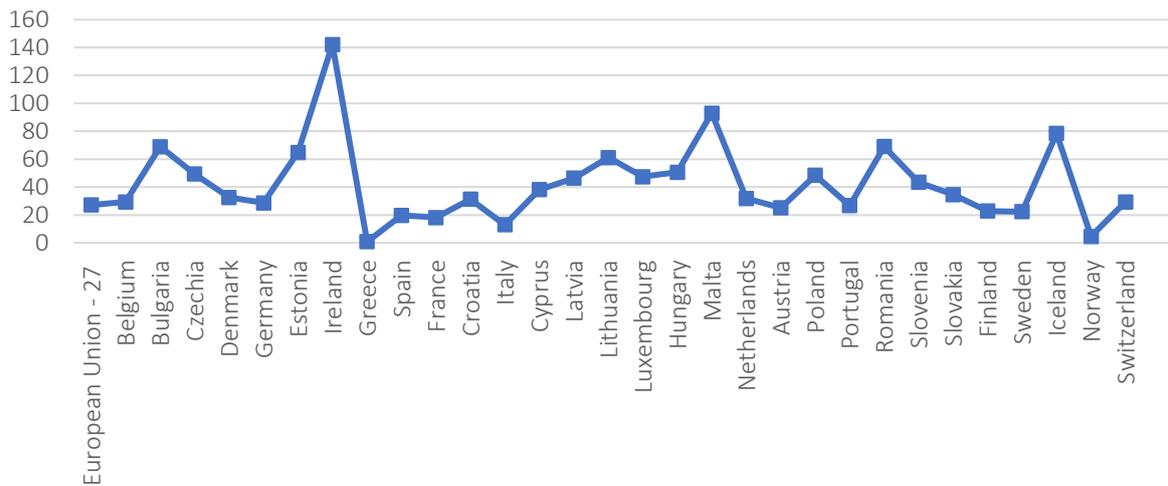
In 2021, compared to 2013, the selected European countries had an increase in GDP. The greatest growth was recorded in Ireland (142.11%), Malta (92.93%), Iceland (78.42%), Romania (69.04%), Bulgaria (68.96%), Estonia (64.82%), Lithuania (61.18%), and Hungary (50.59%). The smallest growth of the corresponding indicator was recorded in Greece (0.89%), Norway (4.68%), Italy (12.96%), France (18.18%), and Spain (19.75%). In

general, in the EU-27 member states, the corresponding growth was 27.13%.

According to the GDP indicator (Eurostat, n.d.), Germany generates the largest volume of GDP (3,617,450 million euros). The countries with the largest created volume of GDP are France (2,502,118 million euros), Italy (1,822,344.5 million euros), Spain (1,222,290 million euros), and the Netherlands (870,587 million euros). The smallest GDP volumes are shown by Liechtenstein (6,517.5 million euros), Malta (15,327.3 million euros), and Iceland (21,647.7 million euros). In general, the economy of the EU-27 countries produced 15,907,188.8 million euros in 2022, which is 8.66% more compared to the values of 2021 (14,640,070.8 million euros).

The volumes of GDP created by the EU-27 countries from 2013 to 2019 demonstrated positive growth dynamics – by 21.74%. In 2020, the volume of GDP compared to 2019 fell by -3.91%. The main reason for the fall in GDP created by all EU-27 member states is the COVID-19 pandemic. In 2021, due to the developed stabilization measures, it was possible to ensure economic growth in the EU member states, compared to 2020, by 8.68%, and in 2022, compared to 2021, by 8.66%.

Source: Eurostat (n.d.).



**Figure 2.** Changes in the volume of GDP created in individual European countries in 2021 compared to 2013, %

The GDP volume in Ukraine in actual prices for the period 2013–2021 showed an annual growth. Thus, in 2021, compared to 2013, the volume of GDP in actual prices increased in Ukraine by 257.98% (SSSU, 2021).

### 3.3. The impact of net migration on the volume of the gross domestic product

The study applied a correlation-regression analysis to study the impact of net migration as a separate influencing factor, with other factors remaining

unchanged, on the level of gross domestic product. Table 1 shows results of regression equations (equation 1).

Constructed correlation-regression equations are characterized by sufficiently high levels of correlation coefficients ( $r$ ), determination ( $D$ ), and Fisher coefficients ( $F$ ) are greater than the normative (table) value ( $F_t$ ). For example, Latvia showed the following parameters:  $r = 0.93$ ;  $D = 0.865$ ; the Fisher coefficient ( $F = 6.110$ ) is greater than the normative (table) value ( $F_t = 2.447$ ). That is, ( $F > F_t$ ).  $z = 1.77$ ;  $Se = 0.45$ ;  $C_{95\%} = 1.96$ ;  $rL = 0.71$ ;

**Table 1.** Impact of net migration ( $x$ ) on the level of gross domestic product ( $Y$ )

Source: Eurostat (n.d.), SSSU (2021).

| Country                       | $r$   | $D$   | $F$   | $F_t$ | $z$   | $S_e$ | $C_{95\%}$ | $rL$  | $rU$ | Equation                 |
|-------------------------------|-------|-------|-------|-------|-------|-------|------------|-------|------|--------------------------|
| European Union – 27 countries | 0.43  | 0.185 | 1.159 |       | 0.46  |       |            | -0.40 | 0.87 | $Y = 11440534.4 + 1.41x$ |
| Belgium                       | 0.50  | 0.250 | 1.399 |       | 0.54  |       |            | -0.32 | 0.89 | $Y = 378345.47 + 1.67x$  |
| Bulgaria                      | 0.60  | 0.360 | 1.845 |       | 0.70  |       |            | -0.18 | 0.92 | $Y = 54204.11 + 0.43x$   |
| Czechia                       | 0.88  | 0.744 | 4.561 |       | 1.38  |       |            | 0.46  | 0.98 | $Y = 160178.59 + 1.54x$  |
| Denmark                       | -0.49 | 0.240 | 1.372 |       | -0.53 |       |            | -0.89 | 0.33 | $Y = 311158.04 - 0.94x$  |
| Germany                       | -0.66 | 0.436 | 2.135 |       | -0.79 |       |            | -0.93 | 0.09 | $Y = 3511016.66 - 0.48x$ |
| Estonia                       | 0.82  | 0.672 | 3.470 | 2.447 | 1.15  | 0.45  | 1.96       | 0.26  | 0.97 | $Y = 20388.55 + 1.14x$   |
| Ireland                       | 0.58  | 0.336 | 1.756 |       | 0.67  |       |            | -0.21 | 0.91 | $Y = 240400.49 + 3.56x$  |
| Greece                        | 0.33  | 0.109 | 0.852 |       | 0.34  |       |            | -0.49 | 0.84 | $Y = 119877.89 + 0.48x$  |
| Spain                         | 0.86  | 0.739 | 4.218 |       | 1.31  |       |            | 0.41  | 0.98 | $Y = 1087621.60 + 0.36x$ |
| France                        | 0.69  | 0.476 | 2.335 |       | 0.85  |       |            | -0.03 | 0.94 | $Y = 2156141.03 + 1.64x$ |
| Italy                         | 0.59  | 0.348 | 1.769 |       | 0.67  |       |            | -0.20 | 0.91 | $Y = 1516592.78 + 1.38x$ |
| Latvia                        | 0.93  | 0.865 | 6.110 |       | 1.65  |       |            | 0.65  | 0.99 | $Y = 32828.37 + 0.76x$   |
| Lithuania                     | 0.87  | 0.757 | 4.229 |       | 1.31  |       |            | 0.41  | 0.98 | $Y = 46153.89 + 0.29x$   |
| Luxembourg                    | -0.53 | 0.281 | 1.550 |       | -0.60 |       |            | -0.90 | 0.27 | $Y = 88696.08 - 2.84x$   |

**Table 1 (cont.).** Impact of net migration (x) on the level of gross domestic product (Y)

| Country         | r     | D     | F     | F <sub>t</sub> | z     | S <sub>e</sub> | C_95% | rL    | rU   | Equation                |
|-----------------|-------|-------|-------|----------------|-------|----------------|-------|-------|------|-------------------------|
| Hungary         | 0.33  | 0.109 | 0.852 | 2.447          | 0.34  | 0.45           | 1.96  | -0.49 | 0.84 | Y = 119877.89 + 0.48x   |
| Malta           | 0.04  | 0.002 | 0.109 |                | 0.04  |                |       | -0.68 | 0.73 | Y = 11985.66 + 0.02x    |
| The Netherlands | 0.87  | 0.757 | 4.318 |                | 1.33  |                |       | 0.43  | 0.98 | Y = 570805.04 + 2.40x   |
| Austria         | -0.66 | 0.436 | 2.152 |                | -0.79 |                |       | -0.93 | 0.08 | Y = 411876.70 - 0.71x   |
| Poland          | 0.94  | 0.884 | 6.958 |                | 1.77  |                |       | 0.71  | 0.99 | Y = 476373.94 + 1.43x   |
| Portugal        | 0.88  | 0.774 | 4.524 |                | 1.37  |                |       | 0.46  | 0.98 | Y = 191212.30 + 0.53x   |
| Romania         | 0.60  | 0.360 | 1.824 |                | 0.69  |                |       | -0.19 | 0.92 | Y = 249175.29 + 1.13x   |
| Slovenia        | 0.56  | 0.314 | 1.650 |                | 0.63  |                |       | -0.24 | 0.91 | Y = 41835.01 + 0.35x    |
| Slovakia        | 0.23  | 0.053 | 0.579 |                | 0.23  |                |       | -0.57 | 0.80 | Y = 80468.51 + 2.12x    |
| Finland         | 0.55  | 0.303 | 1.603 |                | 0.61  |                |       | -0.26 | 0.90 | Y = 188941.65 + 2.44x   |
| Sweden          | -0.49 | 0.240 | 1.363 |                | -0.53 |                |       | -0.89 | 0.33 | Y = 515457.82 - 0.52x   |
| Iceland         | 0.84  | 0.706 | 3.831 |                | 1.23  |                |       | 0.34  | 0.97 | Y = 14650.07 + 1.06x    |
| Norway          | 0.12  | 0.014 | 0.297 |                | 0.12  |                |       | -0.64 | 0.76 | Y = 350271.46 + 0.47x   |
| Switzerland     | -0.43 | 0.185 | 1.158 |                | -0.46 |                |       | -0.87 | 0.40 | Y = 671861.38 - 1.66x   |
| Ukraine         | 0.14  | 0.019 | 0.352 |                | 0.14  |                |       | -0.63 | 0.77 | Y = 2713435.45 + 34.16x |

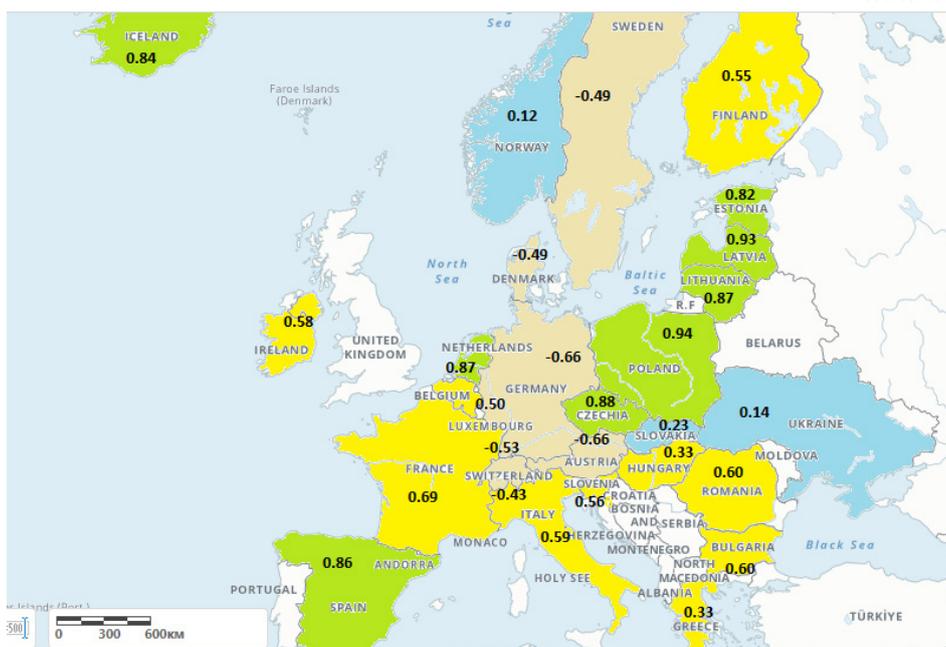
$rU = 0.99$ . According to Table 1, net migration to Poland affects the creation of gross domestic product by 86.5%. Other factors influence the remaining 13.5%. This equation proves that the said influence is positive and directly proportional. That is, with an increase in the volume of net migration by 1%, the volume of gross domestic product will increase in Poland by 0.76 million euros.

positive and directly proportional effect on the level of GDP. Thus, 18.5% of the created GDP in these countries depends on net migration. Second, Ukraine also revealed a positive impact of net migration as a separate influencing factor, with other factors being constant, on the level of the gross domestic product. For greater visualization, Figure 3 presents the results.

The correlation-regression analysis made it possible to draw the following conclusions. First, for the EU-27 member states, net migration has a

Figure 3 shows that in Czechia ( $r = 0.88$ ), Estonia ( $r = 0.82$ ), Spain ( $r = 0.86$ ), Latvia ( $r = 0.93$ ), Lithuania ( $r = 0.87$ ), the Netherlands ( $r = 0.87$ ),

Source: Table 1 and UN (n.d.).



**Figure 3.** Density of relationship (r) between net migration and the volumes of the created gross domestic product in certain European countries

Poland ( $r = 0.94$ ), Portugal ( $r = 0.88$ ), and Iceland ( $r = 0.84$ ) the relationship between net migration and the volume of the gross domestic product is quite high (marked in green). The average level of relationship is observed in Belgium ( $r = 0.50$ ), Bulgaria ( $r = 0.60$ ), Ireland ( $r = 0.58$ ), Greece ( $r = 0.33$ ), France ( $r = 0.69$ ), Italy ( $r = 0.59$ ), Hungary ( $r = 0.33$ ), Romania ( $r = 0.60$ ), Slovenia ( $r = 0.56$ ), and Finland ( $r = 0.55$ ) (marked in yellow). At the same time, for these countries the actual value of the Fisher coefficient is less than the normative value ( $F < F_t$ ). In this case, the correlation coefficient ( $r$ ) is not considered probable. In Malta ( $r = 0.04$ ), Slovakia ( $r = 0.23$ ), Norway ( $r = 0.12$ ), and Ukraine ( $r = 0.14$ ), the relationship is weak (marked in blue). Unfortunately, as can be seen from the conducted correlation-regression analysis, there is practically no corresponding relationship for the conditions of Ukraine. That is, immigrants who stayed to live and work in Ukraine have little impact on the creation of the country's GDP. In addition, a negative relationship was noted in (marked in cream color) Denmark ( $r = -0.49$ ), Germany ( $r = -0.66$ ), Luxembourg ( $r = -0.53$ ), Austria ( $r = -0.66$ ), Sweden ( $r = -0.49$ ), and Switzerland ( $r = -0.43$ ). At the same time, for these countries, the actual value of the Fisher coefficient is less than the normative value ( $F < F_t$ ). In this case, the correlation coefficient ( $r$ ) is not considered probable.

For example, the study forecasts Poland's GDP level in 2023 (as of February 23, 2024, there is no data on GDP on Eurostat). Poland is attractive because of a simpler mechanism for immigrants to move than in other EU-27 countries, ease of language learning and adaptation, territorial proximity, and a higher standard of living compared to neighboring countries that were part of the Soviet Union. This country received one of the largest numbers of immigrants, in particular refugees from Ukraine. Based on Table 1, a regression equation was constructed:

$$Y = 476373.94 + 1.43x. \quad (3)$$

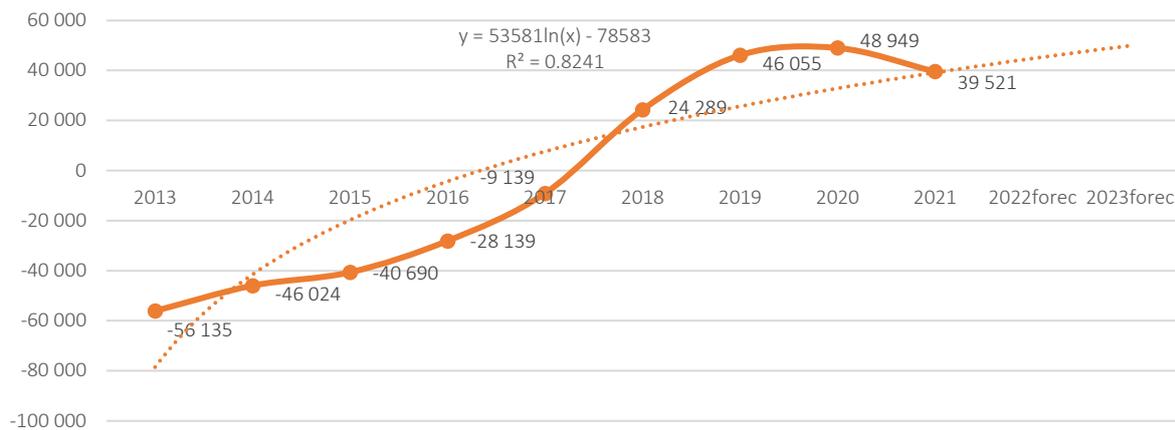
The constructed correlation-regression equation for Poland is characterized by the following parameters:  $r = 0.94$ ;  $D = 0.884$ ; the Fisher coefficient ( $F = 6.958$ ) is greater than the normative (table) value ( $F_t = 2.447$ ), that is ( $F > F_t$ ).  $z = 1.77$ ;  $Se = 0.45$ ;  $C_{.95\%} = 1.96$ ;  $rL = 0.71$ ;  $rU = 0.99$ . Accordingly, net mi-

gration to Poland, as a separate influencing factor, other factors remaining unchanged, has an 88.4% influence on the creation of the gross domestic product, and the remaining 11.6% are influenced by other factors. This equation proves that the said influence is positive and directly proportional. That is, with an increase in the volume of net migration by 1% the volume of the gross domestic product will increase in Poland by 1.43 million euros.

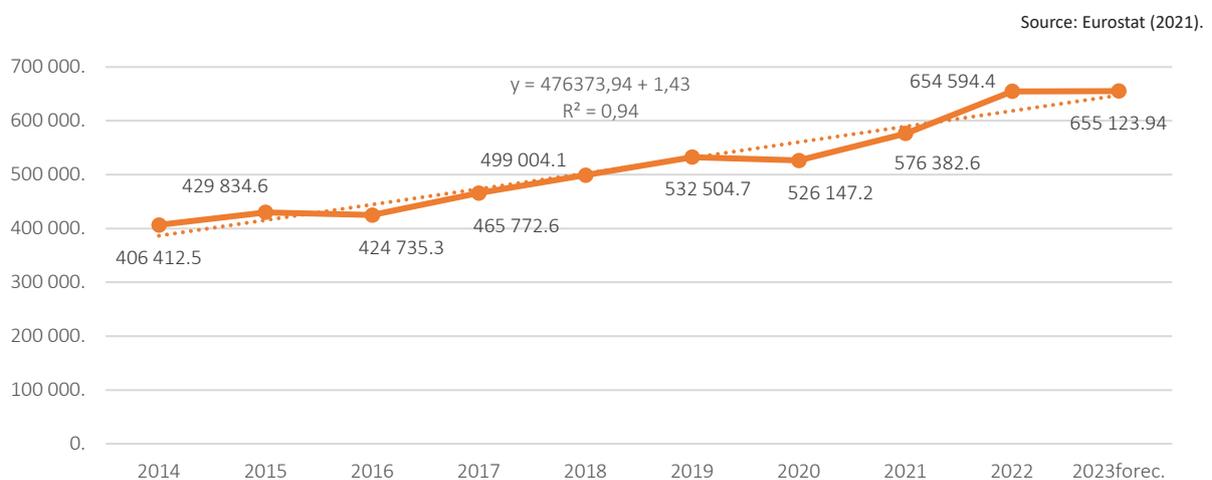
Based on the constructed correlation equation for Poland, the study hypothetically predicts how the volume of GDP may increase in 2023 due to the increase in the number of migrants. The fact that the volume of net migration will increase may be evidenced by the outbreak of the war between Russia and Ukraine, which provoked forced migration to Poland. According to Visit Ukraine (2022), as of July 2022, there were 3.37 million citizens from Ukraine in Poland with the status of refugees, which is about 8% of the population. From the end of February to July 2022, 1,225 million people registered in the PESEL system. About 300,000 citizens of Ukraine work in Poland. Based on the dynamics of net migration data in Poland for the period 2013 to 2021, their potential growth in 2022–2023 was determined using MS Excel (based on the application of a trend line) (Figure 4). Figure 4 shows that in 2023 the volume of net migration in Poland in 2022 may amount to about 40,000 people, in 2023 – about 50,000 people. It is practically difficult to predict the volume of net migration in the conditions of war. This requires further research and the availability of statistical data, which is not currently available. Based on the above data on the number of refugees from Ukraine, the study predicts how the GDP will increase due to the war in Ukraine, in particular due to the spending of funds by Ukrainians in Poland, their employment, and assistance to Poland from the financial institutions of the European Union. The study should also take into account that due to the growth of refugees from Ukraine in 2022–2023, the volume of net migration could potentially increase in 2023 up to 125 thousand people taking into account those migrants who are not registered in the PESEL system.

Using the constructed linear correlation-regression equation, Figure 5 forecasts the level of Poland's GDP in 2023 (taking into account one factor – the volume of net migration).

Source: Eurostat (n.d.), Visit Ukraine (2022).



**Figure 4.** Actual and projected volumes of net migration in Poland, persons



**Figure 5.** Projected volume of GDP in Poland taking into account one factor – net migration, millions of euros

Therefore, the impact of net migration, as a separate factor of influence, other factors remaining unchanged, in particular due to migrants from Ukraine to Poland in the potential amount of 125 thousand people, will make it possible to potentially increase Poland's GDP in 2023 by 529,54 million euros, or 0.08%.

## 4. DISCUSSION

The study of the impact of migration on the economic development of European countries is debatable and promising. Conditionally, this influence can be divided into two groups: positive and negative. The positive impact of migration on economic development is manifested in:

- providing the labor market with a workforce for which there are vacancies (IOM, 2023);
- ensuring economic cooperation and trade between countries (Savin et al., 2023; Cai et al., 2021);
- effective use of production factors (Calcagnini et al., 2021);
- import of special labor skills, which makes the labor market of the host country of migrants more flexible (Constant, 2014; Borjas, 2022);
- development of the Sustainable Development Goals of countries (Kwilinski et al., 2022);

- creation of gross domestic product and creation of prerequisites for its growth (Savin et al., 2023; Woetzel et al., 2016; Constant, 2014; Batista & Narciso, 2018; Shukla & Cantwell, 2018; Pan et al., 2023; Wang & Conesa, 2022; Rayevnyeva et al., 2023).

The majority of researchers confidently assert a positive impact of migration on the economic development of countries. At the same time, the indicated influence in individual studies is insignificant (Davis, 2014), contradictory (Hajro et al., 2021), and difficult to assess. It is difficult to determine the influencing factors (race, language, religion, nationality, financial situation, education, work skills, etc.) (Bove & Elia, 2017). The negative impact of migration on the development of the economy is reduced to the need for host countries to make investments in healthcare, social security, strengthening of the block of security structures (police, emergency services, migration structures, customs structures, intelligence, etc.) (IOM, 2023).

Obtained results confirm a significant positive relationship between the variables. The mentioned

impact is not homogeneous and varies in individual European countries. For example, when conducting a correlation-regression analysis for EU-27 member states, the factor of net migration, as a separate influencing factor, with other factors remaining unchanged, affects the level of gross domestic product by 18.5%. The constructed correlation-regression equation proves that the indicated influence is positive and directly proportional.

The study has several limitations. First, the study aimed to determine the impact of net migration as a separate influencing factor, with other factors remaining unchanged, on the level of gross domestic product. That is, those migrants who intend not only to be labor migrants but intend to assimilate in the host country. Future studies can include additional factors in the correlation-regression model that will characterize the object of labor migration, as exactly 70% of all world migrants are labor migrants. It is promising for further research to take into account such factors as wishes and intentions of labor migrants to assimilate in the host country, health, age, educational level, and availability of labor skills valuable for the labor market.

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## CONCLUSION

The purpose of this study was to identify the influence of net migration as a separate influencing factor, with other factors remaining unchanged, on the level of gross domestic product among individual European countries. The study of this interrelationship between the factors of net migration and the resulting indicator – gross domestic product revealed a mostly positive impact. Therefore, a sufficiently highly positive and directly proportional influence, as a separate influencing factor, with other factors remaining unchanged, was found in Czechia ( $r = 0.88$ ), Estonia ( $r = 0.82$ ), Spain ( $r = 0.86$ ), Latvia ( $r = 0.93$ ), Lithuania ( $r = 0.87$ ), the Netherlands ( $r = 0.87$ ), Poland ( $r = 0.94$ ), Portugal ( $r = 0.88$ ), and Iceland ( $r = 0.84$ ). The correlation-regression equations are characterized by statistical reliability and adequacy.

In some European countries, the relationship between net migration, as a separate influencing factor, with other factors remaining unchanged, and the volume of the gross domestic product is average: Belgium, Bulgaria, Ireland, Greece, France, Italy, Hungary, Romania, Slovenia, and Finland. At the same time, the calculated actual value of the Fisher coefficient for these countries is less than the normative value. In this case, the correlation coefficient ( $r$ ) is not considered probable. In addition, there are European countries where the relationship between net migration, as a separate influencing factor, with other factors remaining unchanged, and the volume of the gross domestic product is low: Malta, Slovakia, Norway, and Ukraine. Unfortunately, there is practically no corresponding relationship for the conditions of Ukraine. That is, immigrants who stayed to live and work in Ukraine have little influence on the creation of the country's GDP. In the conditions of the Russian-Ukrainian war, refugees from Ukraine, in particular, those who have become employed citizens, create GDP in other countries. For their return, it is necessary to introduce economic and legal measures, develop a system of motivation for the return of migrants and refugees from Ukraine, and restore the economy using relocated enterprises.

Separately, it should be emphasized that the relationship between net migration, as a separate influencing factor, with other factors remaining unchanged, and the volume of the gross domestic product is negative, inversely proportional, and average in Denmark, Germany, Luxembourg, Austria, Sweden, and Switzerland.

The study proved that there is a relationship between the factor – net migration, as a separate influencing factor, with other factors remaining unchanged, and the resulting indicator – the gross domestic product of the vast majority of European countries. It is high in some countries, and insignificant in others. At the same time, migrants, especially labor migrants, make a significant contribution to the economic growth of host countries. That is why international organizations, in particular the International Organization for Migration, develop a set of measures and provide recommendations to the countries to ensure safe and decent conditions for migrants (labor, refugee, educational, etc.). This study provides an additional argument in favor of migration in terms of economic development not only for host countries, but also for those countries from which migrants come. Therefore, in the conditions of globalization, all countries benefit from migration.

## AUTHOR CONTRIBUTIONS

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Writing – review & editing: Serhii Kozlovskiy, Ihor Vechirko, Ruslan Lavrov, Ivan Zayukov, Hennadii Mazur.

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