Migration Flows and Their Impact on Demography and the Economy of Central and Eastern European Countries

BENADALLAH Zaynab[1], CHEKROUNI Djamila[2]

[1]Applied Economics Laboratory (LEA), Faculty of Legal, Economic and Social Sciences - AGDAL, Mohammed V University, Rabat, Morocco
[2]Applied Economics Laboratory (LEA), Faculty of Legal, Economic and Social Sciences - AGDAL, Mohammed V University, Rabat, Morocco

benabdallah.zaynab@hotmail.com; d.chekrouni@gmail.com

Abstract: This paper analyzes the impact of migration on the demography and economy of Central and Eastern Europe, focusing on countries such as Poland, Romania, Bulgaria, and Ukraine during the period 2000–2021. Using a fixed-effects panel data model, the study explores the dual nature of migration's consequences in the region. Demographically, sustained emigration of young graduates and skilled labor contributes to a significant brain drain, while low birth rates accelerate population aging, notably in Romania and Bulgaria. This demographic shift reduces the pool of young active workers and increases strain on labor markets. Additionally, rapid urbanization intensifies challenges related to infrastructure and housing in major cities. On the economic front, labor immigration particularly from Ukraine helps to alleviate workforce shortages and supports key sectors like construction and services, especially in Poland. Conversely, the emigration of highly skilled workers undermines vital sectors such as healthcare, education, and industry, ultimately limiting innovation and economic growth. The study concludes that migration exerts a complex influence, generating both opportunities and structural challenges for Central and Eastern European countries.

Keywords—Central and Eastern Europe, Demography, Economy, Migration, Panel Data Model

INTRODUCTION

Central and Eastern Europe has long been a major crossroads for migration, particularly after World War II. The region has experienced several critical historical phases, each uniquely shaping migration flows. Following the war, this area saw massive population movements driven by geopolitical upheavals, border changes, and the establishment of communist regimes. These migrations were largely governed by restrictive migration policies, though some forms of internal and external mobility were encouraged, particularly toward neighboring countries under Soviet influence (Buchholz, 2020).The fall of communism in 1989 and the collapse of authoritarian regimes in Eastern Europe marked the beginning of a new migratory chapter. The post-communist transition opened up greater mobility opportunities while presenting complex demographic, economic, and political challenges. The accession of several Central and Eastern European countries to the European Union after 2004 was a major turning point for the region's migration dynamics. This integration facilitated worker mobility but also triggered significant emigration waves, particularly from Poland, Romania, and Bulgaria. For instance, between 2004 and 2018, nearly 3 million Poles emigrated, primarily to countries like the United Kingdom, Germany, and the Netherlands, representing around 10% of Poland's active workforce (Buchholz, 2020). Similarly, Romania experienced substantial emigration, with approximately 3.6 million Romanians living abroad in 2021, accounting for nearly 18% of its population (Eurostat, 2023).However, migration in the region has not been a one-way phenomenon. In response to significant emigration, several countries in the region have also welcomed substantial migration inflows. For example, in 2022, Poland hosted over 2 million Ukrainians fleeing the conflict in Ukraine, many of whom took up jobs in key sectors such as construction, agriculture, and services (Buchholz, 2020). These migrants played an essential role in alleviating labor shortages in the Polish economy, particularly in low-skilled sectors. In 2021, approximately 1.2 million Ukrainian workers were employed in Poland, predominantly in low-skilled jobs (Eurostat, 2023).This migratory reality raises several important questions: **How do migration flows influence the demography and economy of Central and Eastern European countries?**

The primary objective of this article is to conduct an in-depth analysis of the impacts of migration on the demography and economy of the region. To achieve this, the study will follow a three-part approach:

(i) a review of theoretical and empirical literature on migration's demographic and economic consequences,

(ii) a detailed examination of recent migration trends in Central and Eastern Europe, and

(iii) an empirical investigation using a fixed-effects panel data model to measure the effects of migration on population dynamics and economic indicators, while accounting for intra-regional disparities and contextual specificities

1- THEORETICAL AND EMPIRICAL LITERATURE REVIEW

International migration is a complex phenomenon with multiple repercussions for both origin and host countries. Studies on this topic have multiplied due to the significant impact of migration on demographic, economic, and social dimensions, with effects varying widely depending on geographical and socio-economic contexts.

1.1 Demographic Impacts of Migration

International migration has contrasting effects on the demographic structures of origin and host countries. In host countries such as France, Germany, the United Kingdom, and the United States, the arrival of migrants plays a central role in demographic growth and the composition of the labor force. These countries, facing significant demographic aging, benefit from the influx of young migrants, often of working age. According to Sjaastad (1962), migration can be viewed as a response to economic imbalances between regions of origin and destination, and sometimes as a survival strategy in countries where opportunities are limited. Migrants, typically younger than the local population and originating from low-fertility countries, help counteract the effects of demographic aging by renewing the labor force. Lutz (2006) highlights that the arrival of young migrants allows aging societies, such as those in Western Europe, to maintain a dynamic workforce essential for sustaining economic growth.Conversely, in origin countries, emigration has concerning demographic consequences. The departure of young adults, especially skilled ones, directly impacts the structure of the remaining population. The emigration of skilled workers, often referred to as a "brain drain" by Hatton and Williamson (1998), deprives these countries of their most promising talents, thereby slowing their economic development. This loss of human capital exacerbates demographic aging, as young adults, the main drivers of economic growth, are the most likely to migrate. This is particularly alarming for developing or transitioning countries, where the massive departure of young people leaves an older, less active population, increasing pressure on healthcare and social security systems.Migration also influences fertility rates. Initially, migrants from high-fertility countries tend to have more children than the local population, which can temporarily boost fertility in host countries. However, as they integrate, their family behaviors evolve. According to Adserà and Ferrer (2014), migrants, especially those from societies with more traditional family cultures, tend to adopt fertility rates similar to those of the local population by the second or third generation. This "convergence" of fertility rates reflects the integration of migrants into the host country's culture.Regarding health, migrants, particularly young adults, often exhibit better health than the local population. Gushulak and MacPherson (2006) suggest that improved living conditions and access to healthcare in developed countries contribute to this better health, potentially reducing mortality rates in host countries, especially when migrants come from more precarious backgrounds.In origin countries, demographic transition often involves declining birth rates, a trend accelerated by emigration. Notestein (1945) showed that demographic transition generally entails declining birth and mortality rates, but in some Eastern European countries, this trend persists despite advances in healthcare systems. This slows demographic growth and exacerbates population aging, a situation worsened by ineffective public policies. Coleman (2009) emphasized that family support and pro-natalist policies are often insufficient to reverse this trend.Demographic aging, as noted by Preston, Hill, and Drevenstedt (1996), is a major challenge, particularly for countries with a large aging population. Lee (2003) stresses the need to adapt social and

economic policies to address the growing needs of the elderly while maintaining a balance with the active population.

1.2 Economic Effects of Migration

The economic effects of migration are a major focus of research. According to Sjaastad (1962), migration primarily results from economic disparities between regions of origin and destination. Individuals migrate in search of better employment opportunities, higher wages, and an improved quality of life. As a result, migration can lead to a global redistribution of labor, with varied effects depending on the type of migration and the skill level of migrants.In host countries, the economic impact of migration depends on the migrants' profiles. On one hand, low-skilled migrants, often employed in sectors such as agriculture, construction, or services, may exert downward pressure on wages in these fields. Borjas (2003) argues that this can increase competition with local low-skilled workers, leading to reduced purchasing power and potentially higher unemployment among less-qualified local workers. This phenomenon is frequently observed in sectors where migrants accept more precarious working conditions or lower wages, often seen as a form of economic competitiveness.On the other hand, the impact of highly skilled migrants is markedly different. Dustmann and Frattini (2014) demonstrate that these migrants contribute positively to the economy by bringing rare skills that stimulate innovation, productivity, and economic growth. For instance, in countries like the United States and the United Kingdom, migrant workers in high-tech sectors, research, education, and healthcare play a crucial role in driving economic dynamism. These migrants engage in high-value-added industries, thereby boosting per capita GDP. By enriching human capital and introducing new ideas and technologies, they enhance the global competitiveness of host countries.Migration also supports demographic dynamism in host countries, particularly by offsetting the effects of population aging. Lutz (2006) explains that migrants, who are often young and of working age, help replenish the labor force, sustaining economic growth, especially in European countries facing low birth rates. By their presence, migrants help support social security and pension systems by maintaining the number of contributors, which is critical in aging societies where the ratio of active workers to retirees is increasingly imbalanced.Conversely, countries of origin also experience significant economic effects from migration, often less favorable. One of the main consequences of migration is the loss of human capital, particularly when migrants are skilled workers. Hatton and Williamson (1998) highlight that the emigration of young graduates and skilled workers—a phenomenon frequently observed in developing and transitioning countries—leads to brain drain. This loss of expertise in strategic sectors such as healthcare, education, or research hinders these countries' economic development, slowing growth and innovation. The shortage of qualified personnel compromises the quality of public services and obstructs infrastructure improvements, a critical issue for developing countries reliant on human capital for modernization.However, international migration can also have indirect positive effects on countries of origin through remittances sent by migrants. Ratha (2003) notes that these financial transfers represent a significant income source for families remaining in the home country, helping to reduce poverty and stimulate local consumption. In some countries, remittances constitute a substantial share of national GDP and fund investments in education, healthcare, and entrepreneurship. Nevertheless, this reliance on remittances carries risks. During global economic crises, when migrants face financial difficulties or increased unemployment, remittance flows may decrease, adversely affecting the economies of origin countries. Additionally, this dependence on remittances may divert attention from developing sustainable local economic solutions.Migration also influences urbanization, particularly in host countries where migrants tend to concentrate in major cities. This rapid urbanization presents several challenges. On one hand, the influx of migrants into urban areas can strain infrastructure, housing, and social services. UN-Habitat (2020) emphasizes that accelerated urbanization may lead to uncontrolled slum growth and precarious living conditions in large urban centers, especially if urban planning policies are inadequate. Rapid urbanization can also exacerbate congestion, pollution, and housing insecurity, complicating migrant integration and diminishing the quality of life for all residents in these areas.Governments in host countries must therefore implement suitable public policies to manage this demographic growth, invest

in infrastructure, and ensure access to healthcare, education, and housing. Long-term investments in urban areas are essential to prevent the emergence of ghettos and to guarantee that migrants live in decent conditions.

1.3 Empirical Perspectives

Empirical research on migration demonstrates that its effects are complex and vary significantly depending on the context. For instance, the study by Hugo et al. (2014) on the Philippines highlights a paradoxical phenomenon: while the emigration of young adults leads to population declines in certain regions, remittances sent by migrants help offset this loss by stimulating the local economy, particularly in sectors such as health and education. This suggests that financial transfers can play a crucial role in the economic development of origin regions, even though the loss of skilled labor remains a major challenge.

Similarly, the study by Adserà and Ferrer (2014) on the fertility of migrants in Europe reveals that first-generation migrants generally exhibit higher fertility rates than local populations. However, over time and with increased integration, these rates tend to align with those of the host populations. This "convergence" phenomenon reflects the gradual adaptation of migrants' social behaviors to the cultural norms of the host country.

The research by Dustmann et al. (2005) on the impact of immigration in the United Kingdom demonstrates that the effect of immigration on unemployment largely depends on the complementarity of migrants' skills relative to those of local workers. In sectors where migrants fill complementary roles (e.g., in unskilled jobs or areas experiencing labor shortages), the impact on unemployment is generally neutral or even positive. Conversely, when migrants directly compete with local workers in certain sectors, this can negatively affect the local labor market.

Finally, the studies by Kerr and Kerr (2018) on the impact of skilled migrants in the United States emphasize that these individuals play a key role in innovation and economic competitiveness, particularly in technology and education sectors. Skilled migrants contribute to enhanced productivity and foster innovation, thereby supporting sustainable economic growth.

2- DESCRIPTIVE ANALYSIS OF MIGRATION IN CENTRAL AND EASTERN EUROPE: HISTORICAL CONTEXT, DEMOGRAPHIC AND ECONOMIC IMPACTS

2.1 Historical Context of Migration in Central and Eastern Europe

The history of migration in Central and Eastern Europe (CEE) has been deeply influenced by major political, economic, and social events. The region experienced several waves of migration during the 20th century due to geopolitical changes, economic transformations, and strict migration policies that shaped human flows across this part of Europe.

The Soviet Bloc Period (1945–1991)

During the Soviet Bloc era, Central and Eastern Europe were under the influence of the Soviet Union and communist regimes that imposed strict controls on population movements. Migration was primarily internal, limited to movements within the Eastern Bloc. These movements mostly involved rural-to-urban migration or population shifts between neighboring Eastern countries, often driven by the search for employment or better living conditions. International migration was highly restricted. Emigration to the West was not only difficult but also severely repressed, particularly for those attempting to flee totalitarian regimes or escape economic hardship. Migrants who managed to leave the region were often political refugees or individuals fleeing persecution.

The Fall of the Soviet Regime and Border Opening (1989–1991)

The late 1980s marked a decisive turning point. With the fall of the Berlin Wall in 1989 and the collapse of the Soviet regime, the countries of Central and Eastern Europe began gradually opening their borders. This liberalization led to a significant influx of both internal and international migration. Populations that had been previously confined within national borders began seeking better economic opportunities and improved living conditions beyond their home countries.Internal migrations increased significantly, with population movements between cities and rural areas, as well as toward Western European countries.

Germany, the United Kingdom, and France became key destinations for those seeking better working conditions, higher wages, and a more prosperous economy. This period was marked by massive emigration, particularly among young adults and skilled workers, who sought to escape transitioning economies and political instability in some countries.

European Union Accession (2004–2007)

The integration of several Central and Eastern European countries into the European Union between 2004 and 2007 had a major impact on migration flows. EU membership facilitated the movement of workers between the new member states and existing EU countries. Nations like Poland, the Czech Republic, and Slovakia experienced a massive exodus of their citizens to destinations such as the United Kingdom, Germany, France, and the Netherlands, attracted by greater job opportunities and significantly higher wages.Poland serves as one of the most striking examples of this phenomenon, with approximately 2.5 million Poles emigrating to the United Kingdom between 2004 and 2017. Migration was primarily motivated by wage disparities and economic inequalities between Eastern and Western Europe, as well as by the opening of labor markets in host countries facilitated by the EU's free movement policies.

Global Financial Crisis and Its Impact on Migration (2008–2014)

The 2008 global financial crisis worsened economic conditions in many Central and Eastern European countries, particularly in Romania, Bulgaria, and Hungary. The recession led to a deterioration in economic conditions, prompting a new wave of skilled labor migration, particularly in sectors such as healthcare, education, and technology. This period was marked by a "brain drain" phenomenon, with a significant loss of qualified talent seeking opportunities in wealthier EU countries.The tightening of economic conditions further motivated young adults to migrate to Western Europe, reinforcing existing migration dynamics. In some cases, regional governments attempted to curb emigration by offering tax incentives and programs aimed at encouraging the return of skilled workers, but these efforts yielded limited results.

Refugee Crisis and Political Tensions (2015–2020)

The 2015 European migration crisis disrupted migration dynamics across the region, particularly in Central and Eastern Europe. Conflicts in Syria, Afghanistan, and humanitarian crises in Africa led to massive movements of refugees fleeing war and violence. Central European countries, including Hungary, Poland, and the Czech Republic, strongly resisted accepting refugees, citing security concerns and integration challenges. This resistance created tensions with Western European countries such as Germany and Sweden, which welcomed large numbers of refugees, highlighting divisions over migration policies within the EU.This crisis exposed fractures within the European Union, sparking debates about solidarity among member states and the management of external borders. While some countries strengthened their reception policies, others sought to limit migration flows, leading to a fragmented approach to migration within Europe.

The Ukraine Crisis and Its Migration Impact (2020–2024)

The situation in Ukraine dramatically changed in 2022 with Russia's large-scale invasion, triggering one of the largest population displacements in Europe since World War II. The war caused a major humanitarian crisis, forcing millions to flee conflict zones. Estimates suggest that over 8 million Ukrainians were displaced internally, while more than 7 million sought refuge in other European countries.Neighboring countries such as Poland, Slovakia, Hungary, and Moldova bore the brunt of hosting the majority of Ukrainian refugees. Other EU countries, including Germany, France, and the Czech Republic, also played key roles in accommodating displaced populations. Ukrainians benefited from temporary protections within the EU, granting them easier access to labor markets and services such as healthcare, education, and housing.This conflict reinforced solidarity within the European Union but also tested the capacity of European countries to host and integrate large numbers of refugees. The war in Ukraine further intensified political tensions among EU member states, particularly regarding asylum policies and the responsibilities of hosting refugees.

2-2 Demographic Impact of Migration

Migration has a significant demographic impact on both origin and destination countries, altering their population composition and dynamics profoundly.One of the most immediate and visible effects of migration is net migration, which represents the difference between the number of people entering and leaving a country. In Central and Eastern European countries like Romania and Bulgaria, a negative net migration balance is observed, meaning many people, particularly skilled young adults, leave these countries in search of better economic opportunities abroad. For instance, Romania experienced a net migration of approximately -4.5 million people between 1990 and 2020 (Eurostat, 2023). Conversely, countries like Germany have a positive net migration balance. The influx of migrants to Germany has contributed to population growth, partially offsetting the natural population decline caused by low birth rates. According to the Federal Statistical Office of Germany, Germany welcomed about 4.2 million migrants between 2011 and 2021, with a substantial proportion coming from Central and Eastern Europe, helping to sustain the workforce in essential sectors such as healthcare, agriculture, and construction (Federal Statistical Office of Germany, 2022).
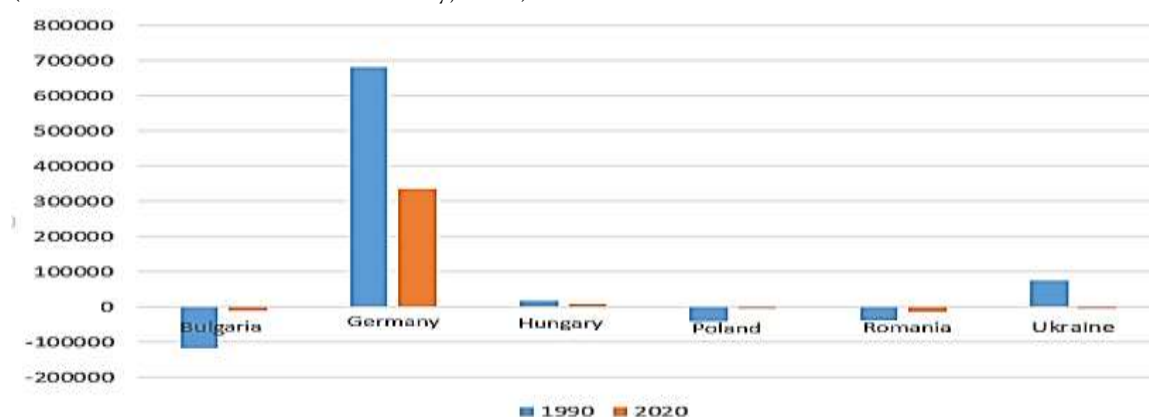

Figure 1: Net Migration (Inflows vs. Outflows, 1990–2020)

Source: World Bank Data

Migration also influences fertility and birth rates. Many Central and Eastern European countries have fertility rates well below replacement levels, leading to population aging. For example, Poland (1.4 children per woman in 2021) and Romania (1.6 children per woman in 2021) have fertility rates far below the replacement rate of 2.1. This natural decline is exacerbated by emigration, as young adults leave these countries, further reducing the population of reproductive age. In host countries like Germany, immigration partially compensates for this demographic deficit. In 2020, migrants accounted for about 13.2% of Germany's total population (Eurostat, 2023). Migrants, often young, help stabilize birth rates and support the labor force, although birth rates in these countries remain low.
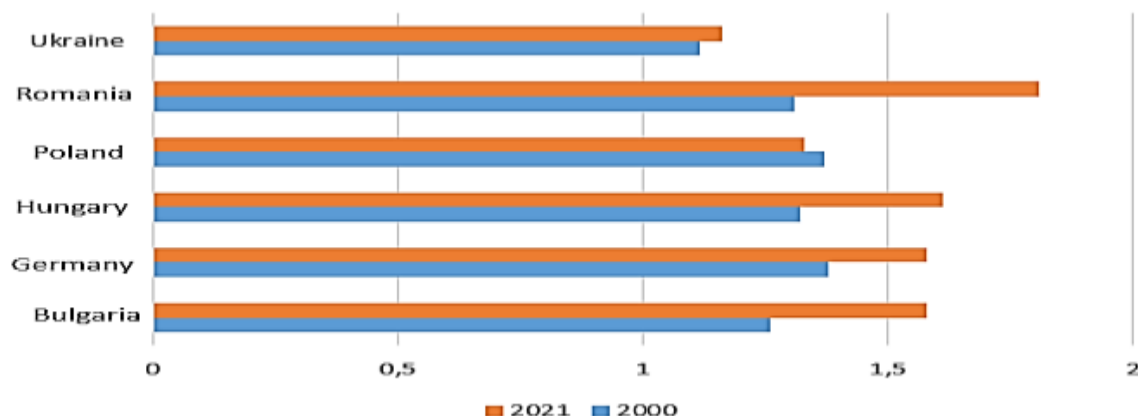

Figure 2: Fertility Rate Trends (2000–2021)

Source: World Bank Data

Mortality rates are another crucial factor affected by migration. Countries experiencing significant emigration of young populations face rapid population aging, resulting in rising mortality rates. For instance, Romania and Bulgaria recorded relatively high mortality rates of 12.5 and 14.5 deaths per 1,000 inhabitants in 2021, compared to 9.5 in Germany (Eurostat, 2023). This demographic aging accelerates population decline in these countries. In host countries, however, migration can mitigate these effects by introducing younger populations, temporarily alleviating the negative impacts of an aging population.
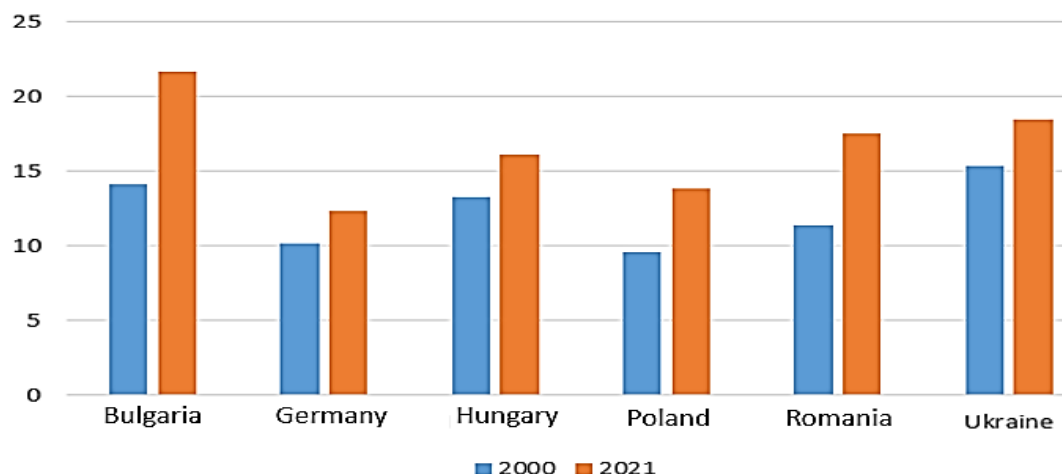

Figure 3: Mortality Rate Trends (2000–2021)

Source: World Bank Data

Migration also alters the age structure of populations, concentrating young adults in certain countries. Nations experiencing significant emigration, such as Poland or Bulgaria, see their populations age rapidly. In Bulgaria, over 20% of the population is aged 65 or older, compared to 15% in Germany (Eurostat, 2023). This places increased pressure on healthcare systems, social security, and infrastructure for the elderly. Conversely, in countries like Germany or the United Kingdom, immigration of young, active adults helps maintain a more balanced workforce, which is crucial for sustaining the economy and pension systems.
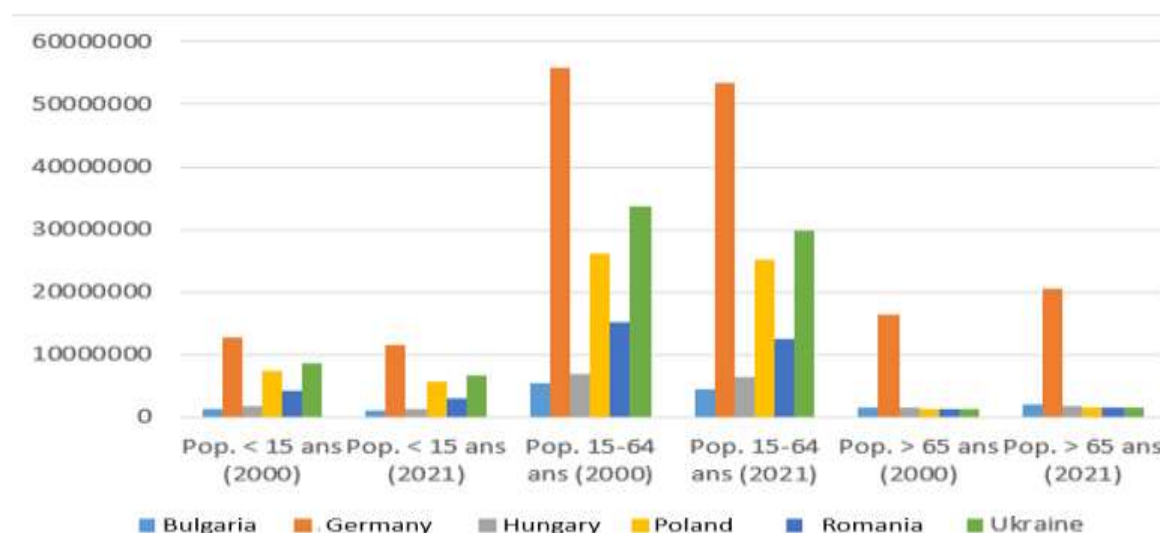

Figure 4: Population Distribution in Europe (2000–2021)

Source: World Bank Data

2-3 Economic Impact of Migration

Migration has a significant economic impact on both origin and host countries. In Central and Eastern Europe, the massive emigration of skilled workers directly affects employment, unemployment, and economic growth. The loss of labor in key sectors such as healthcare, education, and technology creates shortages that slow local growth. For example, Bulgaria lost nearly 12% of its trained doctors between 2000 and 2015, with most migrating to countries like Germany and the United Kingdom (World Bank, 2019). This talent drain has exacerbated shortages in vital sectors, especially in rural areas where public services and healthcare are already limited.In Romania, the outflow of young graduates and skilled workers led to a 6% decrease in employment rates between 2007 and 2021, a trend directly linked to emigration (Eurostat, 2023). While unemployment remains below the European average, it reached 5.5% in 2021 (Eurostat, 2023), a notable increase compared to previous years. The loss of skilled workers reduces the labor force and hinders local economic growth. Moreover, public sectors such as healthcare and education struggle to attract new talent, as salaries and working conditions remain uncompetitive.
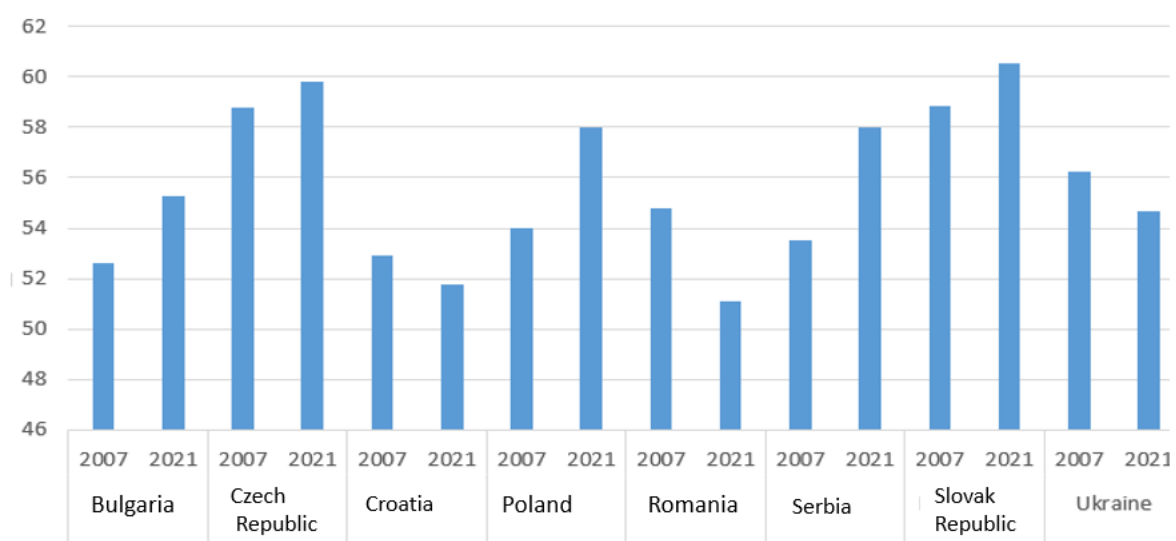

Figure 5: Workforce Trends (2007–2021)

Source: World Bank Data

Remittances sent by migrants play a crucial role in the economies of origin countries. These financial transfers represent a stable source of income for many families, particularly in poorer regions. In 2020, Romania received approximately $4.3 billion in remittances, equivalent to 2.5% of its GDP (World Bank, 2020). However, while these flows support domestic consumption and provide vital assistance to families, they do not compensate for the loss of skilled labor in strategic sectors such as healthcare and technology. Despite the increase in remittances, the long-term negative impact of brain drain remains significant.In host countries, the economic impact of migration is more direct. The arrival of migrant workers helps address labor shortages in sectors such as agriculture, construction, healthcare, and services. In Germany, for example, the influx of migrants has supported high employment rates. In 2021, Germany's employment rate reached 76%, bolstered by the integration of migrants into high-demand sectors such as healthcare and engineering (Federal Statistical Office of Germany, 2022). This workforce has played a crucial role in maintaining Germany's economic growth, contributing to a GDP per capita of $53,000 in 2021 (World Bank, 2023).Migrants have also contributed to innovation and competitiveness in high-value sectors such as technology and financial services. In 2020, highly skilled migrants accounted for approximately 25% of workers in Germany's technology sector, bringing critical skills essential for innovation (OECD, 2021). However, immigration also presents challenges, particularly regarding labor market integration. Migrants often face higher unemployment rates than local populations due to barriers such as language, credential recognition, or discrimination. For instance, in 2020, Syrian refugees in

Germany had an unemployment rate of 19.8%, significantly higher than the migrant average of 11.3% (German Federal Ministry of Finance, 2023).Immigration plays a vital role in the economic growth of host countries, notably by increasing the available workforce and supporting labor-intensive sectors such as agriculture, construction, and services. According to the World Economic Forum (2023), migrants have contributed approximately 1.4% to Germany's annual per capita GDP growth in recent years, with notable contributions in sectors like construction and healthcare. This dynamic is also evident in other host countries, where migration supports GDP growth and long-term competitiveness.

3- Theoretical Model and Methodology

The primary objective of this study is to analyze the impact of migratory flows on demographic and economic variables in Central and Eastern European (CEE) countries. To achieve this, we adopt an econometric approach using a fixed-effects panel data model. This method allows us to account for country-specific and time-specific effects while controlling for unobservable factors unique to each geographic unit and each year. This approach is particularly suitable for studying the complex relationships between migration and socio-economic variables at the national level.

Using panel data not only enables us to analyze fixed effects specific to each country but also allows us to explore temporal variations over time, taking into account the contextual differences in each country in the region. Furthermore, this method provides the ability to measure the dynamic effects of migration on demographic and economic variables in the short, medium, and long term.

The countries selected for this study were chosen based on their migratory specificities, enabling a comparative analysis of the impacts of migration within a particular regional context. These countries, whether they are sources or destinations of migration, exhibit diverse migratory situations, providing insights into the complex dynamics of migration in this region of Europe.

Poland: Poland has become one of the main destinations for migrants, especially from neighboring countries such as Ukraine, Belarus, and other Central Asian nations. Since 2022, the war in Ukraine has intensified the influx of Ukrainian refugees. Additionally, many foreign workers, primarily from Ukraine and India, come to Poland seeking better economic opportunities.

Czech Republic: The Czech Republic attracts numerous migrant workers, primarily from Ukraine, Vietnam, and Russia. Since Russia's invasion of Ukraine in 2022, the country has also welcomed a significant number of Ukrainian refugees.

Slovakia: Although Slovakia is less affected by migratory flows than other countries in the region, it receives migrants mainly from Ukraine and Russia. The country has implemented measures to host Ukrainian refugees fleeing the ongoing conflict.

Bulgaria: Bulgaria serves as a significant transit point for migrants from Turkey to the European Union. It has also hosted refugees from Syria, Iraq, and other Middle Eastern countries. However, the country faces challenges in managing migratory flows and protecting migrants' rights.

Romania: Romania is a destination for migrants from Central Asia and North Africa, although its migratory flows are less significant than in other EU countries. Since the onset of the Ukraine conflict in 2022, Romania has hosted numerous Ukrainian refugees while also serving as an entry point to Europe for migrants from the Balkans and Africa.

Serbia: While Serbia is not an EU member, it plays a key role in migratory flows due to its geographic position. It serves as a major transit point for migrants from the Middle East, Africa, and Asia seeking to reach the EU. Serbia has a relatively open migration policy, though many migrants find themselves stuck at European borders.

Croatia: Croatia occupies a strategic position as a transit point for migrants seeking to reach other European countries. Despite strict border control policies, many migrants continue to traverse the country to reach nations such as Italy or Germany.

Ukraine: While Ukraine is primarily a country of origin for migrants, particularly due to the ongoing conflict, it also hosts migrants from neighboring countries such as Russia, Belarus, and other regions.

While many Ukrainians flee the war, some economic migrants also come to Ukraine in search of employment.

3.1 Theoretical Model

The proposed theoretical model relies on the decomposition method to analyze the impact of net migration on demographic and economic indicators. This model incorporates both demographic and economic variables to capture the complex effects of migration on host societies.

3-1-1 Demographic Model

Instead of using a single equation to estimate the overall population change, the demographic model is now decomposed into separate components to more accurately assess the individual contributions of net migration, fertility, birth rates, and mortality rates. This decomposition is based on the work of Lutz et al. (2014) and van Imhoff et al. (2000), who adopted a similar approach to separate the effects of migration, fertility, and mortality in demographic changes.

The revised demographic model is expressed as follows:

$$\Delta P_{it} = \alpha_i + \beta_1 \Delta M_{it} + \beta_2 \Delta F_{it} + \beta_3 \Delta N_{it} + \beta_4 \Delta D_{it} + \epsilon_{it}$$

Where:

ΔP_{it} : Change in the demographic variable of interest (e.g., total population) for country i from year $t-1$ to year t,

ΔM_{it} : Change in net migration for country i,

ΔF_{it} : Change in fertility rate for country i,

ΔN_{it} : Change in birth rate for country i,

ΔD_{it} : Change in mortality rate for country i,

α_i: Country-specific fixed effect,

ϵ_{it} : Random error term.

This decomposition allows for a more accurate assessment of how each factor contributes to demographic shifts. It also takes into account the age structure of migrants, which plays a crucial role in shaping fertility and mortality dynamics. For example, migration flows composed largely of young adults can increase fertility rates, while large-scale migration can alter age-related population dynamics, influencing mortality rates and life expectancy.

3-1-2 Economic Model

The economic model is designed to analyze the impact of net migration, employment rate, and urbanization on the evolution of GDP per capita. This model decomposes the effects of these economic variables to provide a clearer understanding of their respective contributions to economic growth.

The revised economic model is expressed as follows:

$$\Delta Y_{it} = \alpha_i + \gamma_1 \Delta M_{it} + \gamma_2 \Delta E_{it} + \gamma_3 \Delta Urb_{it} + v_{it}$$

Where:

ΔY_{it} : Change in GDP per capita for country i from year $t-1$ t-1 $t-1$ to year t,

ΔM_{it} : Change in net migration for country i,

ΔE_{it} : Change in employment rate for country iii,

ΔUrb_{it} : Change in urbanization rate for country iii,

α_i: Country-specific fixed effect,

v_{it} : Random error term.

This decomposition allows for a more accurate assessment of how each factor contributes to economic growth. By isolating the effects of net migration, the employment rate, and the urbanization rate, the model provides an in-depth analysis of how these factors influence GDP per capita. Net migration, for example, can have a direct impact on economic growth by increasing the labor force, which in turn stimulates consumption and demand for goods and services (Borjas, 1999). Similarly, a higher employment rate reflects better utilization of the available labor force, leading to an increase in production and, consequently, economic growth. Furthermore, urbanization, by concentrating human and economic resources in urban areas, can enhance productivity and stimulate economic growth (Lucas, 1988). This

model thus allows for an analysis of the impact of migration, employment, and urbanization on the economic performance of countries, highlighting the specific effects of these variables.

3-3 Description of Variables

Variable	Description and Data Source
Net Migration	Net migration represents the difference between the number of incoming and outgoing migrants in a country during a given period. Crucial for analyzing migration flows. *Source: World Bank*
Fertility Rate	Measures the average number of children a woman would have based on current birth rates. Reflects demographic dynamics. *Source: World Bank*
Birth Rate	Represents the number of live births per 1,000 inhabitants annually. Used to analyze demographic evolution. *Source: World Bank*
Mortality Rate	Measures the number of deaths per 1,000 inhabitants per year. Useful for assessing migration's impact on demographic structure and mortality. *Source: World Bank*
Population by Age	Describes population distribution by age groups. Allows the study of migration's effect on different age cohorts. *Source: World Bank*
Total Population	Total number of residents in a country at a given time. Helps assess demographic trends and migration's impact on population growth. *Source: World Bank*
Employment Rate	Proportion of working-age population (15–64) that is employed. Key for evaluating migration's labor market effects. *Source: World Bank*
Urbanization Rate	Proportion of population living in urban areas. Reflects migration's influence on urban concentration. *Source: World Bank*
GDP per Capita	Economic output per person, measuring national productivity. Key to evaluating migration's economic impact. *Source: World Bank*

4- ESTIMATIONS AND RESULTS

Two econometric models were used to estimate the impact of migration flows on the demographics of Central and Eastern European countries: the fixed effects model and the random effects model. These models allow for comparing the impact of net migration on demographic variables while accounting for national specificities and global effects.The fixed effects model controls for the unique characteristics of each country, such as migration policies, institutions, and cultural particularities. In contrast, the random effects model assumes that these effects are independent of the explanatory variables, which may not fully capture the impact of national specificities. The results of both models are presented below and compared in Table I.

Table   I
Fixed effects and random effects regression results

Variable	Fixed Effects – Coefficient *(p-value)*	Random Effects – Coefficient *(p-value)*
Net Migration	-1,756,231 *(p = 0.0000)*	-1,662,293 *(p = 0.0000)*
Working Age Population (15–64)	182,361.2 *(p = 0.0000)*	1,242,707 *(p = 0.0000)*
Elderly Population (> 65)	0.863762 *(p = 0.0000)*	148,832.2 *(p = 0.0000)*
Mortality Rate	-12,072.23 *(p = 0.3758)*	-40,640.89 *(p = 0.0000)*

Fertility Rate	845,924.9 (p = 0.0000)	1,046,328 (p = 0.0000)
Birth Rate	-202,994.9 (p = 0.0000)	-242,828.7 (p = 0.0000)
Constant (C)	-1,461,116 (p = 0.0177)	-1,005,803 (p = 0.0038)
R-squared	0.999907	0.999868
Adjusted R-squared	0.999899	0.999862
F-statistic	123,288.8	180,155.1
Prob (F-statistic)	0.000000	0.000000

Source: World Bank data

The results obtained from the random effects and fixed effects models highlight several important factors influencing the demographics of Central and Eastern European countries.In the random effects model, net migration emerges as a crucial factor in demographic decline. The coefficient of -1,662 indicates that emigration, when departures exceed arrivals, directly contributes to the reduction of the total population. This result is highly significant, with a probability of 0.0000, reinforcing the idea that emigration exerts significant pressure on demographics. This phenomenon can be explained by the classical economic migration theory (Sjaastad, 1962), which suggests that individuals migrate primarily for economic reasons, such as wage disparities and more favorable job prospects.Emigration, particularly that of skilled youth, deprives these countries of a portion of their human capital, exacerbating the aging of the working population. The brain drain in countries like Poland, Romania, and Bulgaria illustrates this trend, where young graduates leave to seek better opportunities in Western Europe, amplifying economic and demographic tensions (Hatton and Williamson, 1998). This not only compromises these countries' ability to sustain stable economic growth but also creates a vicious cycle of demographic decline.Regarding the fertility rate, the coefficient obtained for the fertility rate in the random effects model (1,046,328) indicates a positive effect on the total population. However, in many Central and Eastern European countries, fertility rates remain low, contributing to demographic aging. According to the demographic transition theory (Lutz, 2006), these countries first experienced high birth rates before undergoing a phase of declining fertility rates, largely due to social transformations related to industrialization and urbanization. This low fertility complicates generational renewal and presents major challenges, particularly in terms of pension funding and elderly care (Coleman, 2009).Public policies supporting families, such as parental leave, child benefits, and childcare infrastructure, are crucial to reversing this trend. For example, Hungary has recently implemented fiscal incentives to encourage childbirth, but these initiatives remain insufficient given the magnitude of the challenge.The coefficients related to age structure, particularly for those under 15 and over 65, show that demographic composition by age directly impacts the population. The theory of demographic aging (Preston, Hill & Drevenstedt, 1996) explains that countries with a significant proportion of young or elderly people must adjust their social and economic policies according to this structure. In the case of Central and Eastern European countries, rapid aging requires substantial adjustments in the healthcare, pension, and elderly care sectors, while a high proportion of youth generates pressures on educational systems and the labor market (Lee, 2003).Countries like Bulgaria and Romania are experiencing particularly marked demographic aging, which leads to increased needs for healthcare and pension funding.The mortality rate, with a coefficient of -40,640.89, is also a key factor in the reduction of the population. Although the effect of mortality is less pronounced than that of net migration, it remains a concerning issue. This phenomenon can be explained by the theory of health transition (Omran, 1971), which posits that Central and Eastern European countries are still undergoing a health transition, with relatively high mortality rates, mainly due to cardiovascular diseases and non-communicable diseases. Inadequate healthcare systems, unequal access to services, and the prevalence of risky behaviors such as smoking contribute to this high mortality, especially among young adults and the elderly.Regarding the fixed effects model, the results generally confirm those of the random effects model, but reveal important nuances, particularly regarding net migration. The coefficient associated with net migration in the fixed effects model is -1,356,231, indicating a more pronounced effect of emigration on

the total population compared to the random effects model. This difference suggests that national specifics such as migration policies, economic conditions, and political stability strongly influence the intensity of emigration. In this sense, the fixed effects model proves more suitable for accounting for these contextual variations. Indeed, Czaika and Haas (2014) emphasize that migration is often shaped by factors specific to each country, while Docquier and Rapoport (2012) highlight the lasting effects of net emigration, particularly the loss of skilled labor in transition countries.The birth rate, in this model, shows a coefficient of -242,828.7, meaning that the decline in birth rates reduces the total population. This trend is particularly pronounced in some countries where birth rates have significantly fallen in recent decades, exacerbating the challenges of demographic aging. According to the demographic transition theory (Notestein, 1945), societies go through a phase where both birth and death rates decrease. However, in some transition countries, birth rates remain low, preventing sufficient generational renewal. Furthermore, human capital theory (Becker, 1993) indicates that family decisions are influenced by economic factors, such as the cost of education and women's participation in the labor market, which may discourage families from having more children. Thus, public policies, such as parental leave and financial assistance, play a crucial role in reversing this trend (Aassve, 2010).Finally, in the fixed effects model, the mortality rate coefficient remains negative and significant, confirming that higher mortality rates contribute to population decline. This phenomenon is particularly concerning in countries where health conditions remain less favorable, especially for aging populations. The health transition, theorized by Omran (1971), suggests a reduction in mortality through improvements in healthcare and prevention. However, this transition remains incomplete in some countries, where public health policies need strengthening, particularly to ensure universal access to healthcare, as recommended by Börsch-Supan (2003).In order to determine the most appropriate model, a Hausman test was conducted (Table 2). This test allows for a comparison of the results from the fixed effects and random effects models to check whether the coefficients of the random effects model are biased. The test produced a Chi-Sq. statistic of 68.56 with a probability of 0.0000, which leads to the rejection of the null hypothesis that the coefficients of the random effects model are consistent. This result confirms that country-specific effects are significant, and the fixed effects model is the most appropriate for this analysis. It becomes clear that the variation between countries, influenced by factors such as their migration, economic, and health policies, must be considered to obtain more accurate and relevant estimates.Additional tests were conducted to verify whether there is a correlation between the errors of the different cross-sectional sections of the panel. The results of the Breusch-Pagan LM and Pesaran CD tests are as follows:

Table   II
Test results for model specifications

Test	Statistic	d.f.	Prob.
Hausman Test	68.563258	–	0.0000
Breusch–Pagan LM	331.1709	28	0.0000
Pesaran Scaled LM	40.51292	–	0.0000
Bias-Corrected Scaled LM	40.32244	–	0.0000
Pesaran CD	-2.363224	–	0.0181

Source: World Bank data
• Breusch-Pagan LM Test: The statistic of 331.17 and the probability of 0.0000 indicate a strong dependence between the cross-sectional sections. This suggests that the errors are not independent between the countries studied, which could affect the accuracy of the results if this dependence is not accounted for.
• Pesaran CD Test: The statistic of -2.36 and the probability of 0.0181 also confirm the existence of dependence between the cross-sectional sections. This test suggests that the errors across countries are not

independent, which may imply a correlation in the migration and demographic trends of the countries in the region.

Regarding the Impact of Migration Flows on the Economy of Central and Eastern European Countries, the results from the random effects and fixed effects models highlight several key factors influencing the economies of Central and Eastern European countries. These results shed light on the complex relationships between migration flows and economic variables (TableIII).

Table-III

Estimates from random and fixed effects models

Variable	Random Effects Model	Fixed Effects Model
Net Migration	0.007215 (p = 0.3107)	0.005254 (p = 0.4635)
Urbanization Rate	264.6304 (p = 0.0590)	664.7271 (p = 0.0008)
Unemployment Rate	-728.8655 (p = 0.0000)	-743.1832 (p = 0.0000)
Active Population	-665.2452 (p = 0.0000)	-774.6919 (p = 0.0000)
Constant (C)	38323.20 (p = 0.0009)	19887.90 (p = 0.1541)
R-squared	0.457378	0.812421
Adjusted R-squared	0.444611	0.799762
F-statistic	35.82346	64.17879
Prob (F-statistic)	0.000000	0.000000

Source: World Bank data

In the random effects model, although net migration shows a positive coefficient (0.007215), it does not have a statistically significant impact on GDP per capita in Central and Eastern European countries (p = 0.3107). This suggests that, unlike other regions of the world, migration flows in these countries do not have an immediate or direct notable effect on economic growth. This observation is confirmed by economic migration theory, as proposed by Sjaastad (1962), which suggests that migrants are primarily motivated by differences in wages and employment opportunities. In Central and Eastern European countries, migration flows may not be large or sustainable enough to cause an immediate change in local economies.In contrast, other variables show more pronounced relationships. The urbanization rate, with a coefficient of 264.6304 (p = 0.0590), is positively related to a slight increase in GDP per capita. This aligns with the endogenous growth theory, as presented by Lucas (1988), which suggests that urbanization fosters network economies and the concentration of human capital, thereby boosting productivity and innovation. Thus, urbanization, through population density and developed infrastructure, generates increasing returns that can stimulate economic growth.The unemployment rate, on the other hand, has a negative and significant impact on economic growth. With a coefficient of -728.8655 (p = 0.0000), it confirms the predictions of neoclassical theory, which posits that high unemployment reduces the productive capacity of the economy and thus inhibits its growth. Similarly, the reduction in participation in the active economy, particularly due to labor migration, is confirmed by a coefficient of -665.2452 (p = 0.0000). This "brain drain" phenomenon, well-documented in studies such as those by Hatton and Williamson (1998), shows that migration of skilled workers can lead to a loss of human capital, thus hindering economic growth.The results from the fixed effects model, which account for national specificities, corroborate these observations while offering important nuances. In this model, net migration remains of little influence on GDP per capita, with a coefficient of 0.005254 (p = 0.4635), confirming the absence of a discernible immediate effect of migration flows on economic performance. This trend could also be explained by the theory of circular migration, where migrants sometimes return to their home countries, minimizing the long-term impact of their departure on the economy.However, urbanization continues to play a crucial role, with a coefficient of 664.7271 (p = 0.0008), highlighting that urbanization has a significant and beneficial effect on the economy of the countries in the region. This observation supports Lutz's (2006) demographic transition theory, which indicates that urbanization is linked to more sustained economic and social development, fostering investments in infrastructure and improving access to education and public services, thereby boosting productivity.At the same time, the

unemployment rate and participation in the economy continue to show a negative effect on economic growth, with coefficients of -743.1832 (p = 0.0000) and -774.6919 (p = 0.0000), respectively. This dynamic mirrors Solow's (1956) long-term growth theory, where an underutilized or inadequately skilled workforce contributes to weaker growth, especially in societies where economic reforms are slow to be implemented. To determine the most suitable model for the analysis, several tests were conducted to compare the results of the fixed effects and random effects models.

Table IV

Diagnostic test results for panel data models

Test	Statistic	d.f.	Prob.
Test de Hausman	18.496496	4	0.0010
Breusch-Pagan LM	124.7949	28	0.0000
Pesaran Scaled LM	12.93476	-	0.0000
Bias-Corrected Scaled LM	12.74428	-	0.0000
Pesaran CD	7.258667	-	0.0000

Source: World Bank data

The Hausman test produced a Chi-Sq. statistic of 18.496496 with a p-value of 0.0010. This p-value, which is less than 0.05, indicates that the fixed effects model is preferable over the random effects model, as it suggests that country-specific effects need to be taken into account to obtain more accurate estimates. In other words, the unique characteristics of each country significantly influence economic relationships and must be integrated into the model.Furthermore, to test the validity of the results obtained and verify the existence of dependencies between countries in the region, a residual dependence test was conducted. This test showed a strong correlation between the residuals of the countries, as evidenced by the Breusch-Pagan LM test statistics (124.7949, p = 0.0000) and Pesaran CD (7.258667, p = 0.0000). This correlation indicates that the economies of Central and Eastern European countries are interconnected by common economic factors, such as regional migration policies, global economic conditions, or other unobserved variables. These factors can have simultaneous impacts on multiple countries, necessitating a more in-depth analysis to understand the interactions between these economies.

4-1 Benchmarking on the Impact of Migration Flows on the Demographics of Central and Eastern European Countries:

After studying the impact of international migration on the economy, it is relevant to compare these results with European countries. This comparison highlights demographic trends and challenges specific to each nation.

Table-V-Country-level fixed effects estimations and model statistics
Source: World Bank data
Regarding net migration, Serbia stands out with a positive net migration of 0.2499, suggesting an influx

Variable	Bulgaria	Czech Republic	Croatia	Poland	Romania	Serbia	Slovak Republic	Ukraine
NET MIGRATION	-0.0768 p = 0.1781	0.0438 p = 0.1450	-0.0394 p = 0.0012	3.01E-06 p = 0.4587	0.0593 p = 0.2944	0.2499 P = 0.0183	0.0089 P = 0.8124	0.0282 P = 0.5275
POP (15-64 years)	1.1247 p = 0.0000	1.1784 p = 0.0000	1.1753 p = 0.0000	-1.31E-06 p = 0.3245	1.1672 p = 0.0000	1.0877 P = 0.0000	1.2440 P = 0.0000	1.1921 P = 0.0000
POP (≤ 15 years)	87,783.10 p = 0.0000	112,807.8 p = 0.0000	49,809.64 p = 0.0000	-1.8265 p = 0.0032	257,974.1 p = 0.0000	86,225.61 P = 0.0000	64,113.57 P = 0.0000	522,617.0 P = 0.0000
POP (≥ 65 years)	1.1709 p = 0.0000	1.2011 p = 0.0000	1.2007 p = 0.0000	-5.73E-06 p = 0.0038	1.0940 p = 0.0000	0.9740 P = 0.0000	1.2450 P = 0.0000	1.1818 P = 0.0000
Mortality Rate	-69.96 p = 0.9002	-450.77 p = 0.4986	392.33 p = 0.1337	-0.3919 p = 0.2346	-432.47 p = 0.7255	-754.7277 P = 0.1842	208.4648 P = 0.2699	5,658.399 P = 0.1006
Fertility Rate	-140,327.1 p = 0.0480	33,541.59 p = 0.1634	-1,503.77 p = 0.7942	55.34 p = 0.0025	-70,021.11 p = 0.4371	36,765.14 P = 0.2852	4,108.524 P = 0.7135	51,737.99 P = 0.8398
Birth Rate	21,912.26 p = 0.0468	-5,259.99 p = 0.1325	1,397.49 p = 0.0569	-6.97 p = 0.0032	16,428.36 p = 0.2778	-5,326.79 P = 0.3281	-567.7436 P = 0.6901	-2,217.445 P = 0.9481
C (Constant)	-1,117,572.0 p = 0.0000	-1,815,781.0 p = 0.0000	-828,364.8 p = 0.0000	152.37 p = 0.0050	-3,748,197.0 p = 0.0000	-658,337.4 P = 0.0004	-1,325,984 P = 0.0000	-9,335,253 P = 0.0000
R-squared	0.999979	0.999990	0.999994	0.876268	0.999993	0.999976	0.999971	0.999975
Adjusted R-squared	0.999967	0.999986	0.999990	0.814402	0.999990	0.999964	0.999957	0.999963
F-statistic	86,759.03	207,856.2	312,186.0	14.16	287,259.8	84,036.28	70,072.17	81,330.16
Prob(F-statistic)	0.000000	0.000000	0.000000	0.000023	0.000000	0.000000	0.000000	0.000000
Durbin-Watson Stat	1.1826	1.6552	1.3044	1.8428	1.2827	1.4019	1.6754	0.8496

of migrants into the country. In contrast, countries like Bulgaria, Croatia, and Ukraine show negative values, indicating that these countries experience more emigration than immigration. However, statistical tests reveal that, except for Serbia, these values are not statistically significant, suggesting that migration flows do not play a central role in the demographic dynamics of these countries.Concerning the working-age population (15-64 years), most countries show significant results, meaning that the working population remains a key factor in their economies. The Czech Republic and Croatia have relatively high values, while Poland shows a lower proportion of this age group, which may indicate an aging population or a decline in the working population in that country. Serbia, on the other hand, shows a lower activity rate compared to other countries in the region, although the difference is not statistically significant.The young population (under 15 years) is particularly important in countries like Romania, the Czech Republic, and Ukraine, where the numbers indicate a large number of children and adolescents. This could imply greater pressure on educational and social infrastructure in these countries. These results are significant for all countries, highlighting the importance of youth in the demographic structure.Population aging, measured by the proportion of people aged 65 and over, is a marked trend in countries like Bulgaria, the Czech Republic, and Croatia, where the proportion of elderly people exceeds 1.2. In contrast, Serbia shows a

lower proportion of elderly people, suggesting that the country may be less affected by the effects of demographic aging. This variable presents significant results in all countries, emphasizing the reality of population aging in this region.Mortality rates vary considerably, with particularly high values in Ukraine (5,658.399), which could be due to health issues or ongoing conflicts. In contrast, countries like Bulgaria and Croatia show low or negative mortality rates, but these results are not always significant. Overall, the relationship between mortality and migration or demographic structure seems weak in this study.Fertility and birth rates also present interesting divergences. Bulgaria and Croatia record low and negative fertility rates, which may pose a major challenge for their demographic renewal. In contrast, the Czech Republic and Poland show higher fertility rates, although the results are not always statistically significant. Birth rates follow a similar trend, with negative values in some countries, suggesting stagnation or a decline in population in these regions.Thus, this comparison reveals significant differences in the migratory and demographic dynamics of the countries studied. While some countries like Serbia experience a net attraction of migrants and exhibit a relatively stable demographic structure, others like Bulgaria, Croatia, and Ukraine face more significant challenges related to emigration and population aging. These results underscore the importance of adapting public policies to the specific demographic realities of each country to address the social, economic, and migration challenges these nations face.

4-2 Benchmarking on the Impact of Migration Flows on the Economy of Central and Eastern European Countries:

The analysis of the results reveals significant variations in the impact of international migration on the economy of the countries studied, reflecting the specific contexts of each nation. The coefficients of economic and migration variables show complex relationships that largely depend on the economic, social, and demographic characteristics of each country.

Table   VI

Regression results on the impact of migration and economic factors: country comparison

Variable	Bulgaria	Czech Republic	Croatia	Poland	Romania	Serbia	Slovak Republic	Ukraine
MIGRATION_ NETTE	-0.016000 (0.4209)	-0.137845 (0.0355)	0.042678 (0.1461)	0.008507 (0.3703)	-0.007419 (0.1910)	0.061675 (0.0011)	-0.506291 (0.0001)	0.001515 (0.6113)
Active Population	209.8202 (0.3776)	-5594.587 (0.0012)	808.3283 (0.0759)	-1049.299 (0.0281)	-245.5278 (0.0108)	-18.5875 (0.8773)	-2480.935 (0.0002)	-354.9005 (0.2894)
Urbanization rate	979.2911 (0.0014)	-700.6119 (0.8134)	2169.147 (0.0002)	-4327.306 (0.0137)	5885.382 (0.0000)	2055.444 (0.0000)	-3426.669 (0.0000)	903.3315 (0.0003)
Unemployment rate	-114.4572 (0.0847)	-2471.309 (0.0000)	-158.7365 (0.3295)	-291.1867 (0.0735)	-1084.317 (0.0001)	-2.616738 (0.9638)	-468.8285 (0.0006)	-297.0430 (0.0134)
C (Constant)	-74603.29 (0.0000)	418309.6 (0.0170)	-147149.8 (0.0008)	337445.1 (0.0073)	-287465.1 (0.0000)	-105697.3 (0.0000)	356468.5 (0.0000)	-36672.45 (0.2221)
R-squared	0.930120	0.885587	0.747279	0.901064	0.968683	0.922182	0.954906	0.804711
Adjusted R-squared	0.912650	0.858666	0.687815	0.877785	0.961315	0.903871	0.944295	0.758760
F-statistic	53.24104	32.89603	12.56696	38.70722	131.4600	50.36429	89.99682	17.51257
Durbin-Watson stat	0.761931	1.557144	0.636690	1.037461	1.507873	1.296707	1.453631	0.878738
Prob(F-statistic)	0.000000	0.000000	0.000061	0.000000	0.000000	0.000000	0.000000	0.000007

Source: World Bank data

Regarding net migration, the effects vary significantly from one country to another. In the Czech Republic, net migration has a significant negative effect (coefficient of -0.137845, p = 0.0355), suggesting that the influx or departure of migrants may create economic pressures, particularly on the labor market or public infrastructure. In contrast, in Serbia, the positive coefficient of 0.061675 (p = 0.0011) indicates a beneficial effect of migration, suggesting that the arrival of migrants may have a positive impact, particularly by increasing the available workforce and stimulating the economy. In Slovakia, the particularly negative coefficient of -0.506291 (p = 0.0001) shows that net migration exerts significant pressure on the economy, possibly due to challenges in migrant integration or the costs associated with managing migration flows. In contrast, countries such as Bulgaria, Croatia, Poland, Romania, and Ukraine show no significant impact of net migration, suggesting that migration does not have a direct or marked relationship with the economy in this specific model.Regarding the active population, the results are also mixed. In the Czech Republic, the negative coefficient of -5594.587 (p = 0.0012) indicates that a reduction in the active population has an unfavorable effect on the economy, which may be related to demographic issues, such as an aging population or low participation in the labor market. Similarly, negative coefficients are observed in Poland (-1049.299, p = 0.0281) and Romania (-245.5278, p = 0.0108), suggesting that a decrease in the active population in these countries negatively impacts economic growth, likely due to the migration of workers abroad. In contrast, countries like Serbia and Ukraine show no statistically significant link, which could mean that the active population has no major effect on the economy in these contexts.As for the urbanization rate, the effects are also varied. In Romania, Serbia, and Croatia, the positive and significant coefficients (5885.382; 2055.444; 2169.147, respectively) suggest that urbanization promotes economic growth by stimulating industrialization and attracting investment. However, in Poland (-4327.306, p = 0.0137) and Slovakia (-3426.669, p = 0.0000), negative coefficients indicate that rapid urbanization may present economic challenges, such as high costs for infrastructure and public services, which hinder economic growth. In Bulgaria and Ukraine, urbanization seems to have a positive,

albeit more moderate, impact.Regarding the unemployment rate, the results show that an increase in unemployment is generally associated with a decline in the economy in most countries. In the Czech Republic, Romania, and Slovakia, the negative and significant coefficients (-2471.309; -1084.317; -468.8285, respectively) indicate that unemployment exerts negative pressure on the economy, consistent with the expectation that rising unemployment limits growth. In Bulgaria and Poland, although the coefficients are negative, they are not statistically significant, suggesting that the impact of unemployment is less pronounced in these countries. Finally, in Serbia, the non-significant coefficient (-2.616738, p = 0.9638) indicates that unemployment does not have a significant effect on the economy in this country.Thus, the results show that the impact of international migration and associated economic variables varies considerably from one country to another. Each country appears to respond differently to migration flows depending on its specific context.

DISCUSSION OF RESULTS

The results of the analysis of migration flows and their effects on the demographics and economies of Central and Eastern European countries reveal complex and multifaceted dynamics. Indeed, migration, although it has diverse implications depending on national contexts, exerts a significant influence on both the demographic structure and the economic performance of the countries concerned, particularly Poland, the Czech Republic, Slovakia, Bulgaria, Romania, Serbia, Croatia, and Ukraine.One of the main impacts of migration flows in these regions is the phenomenon of "brain drain." In Romania, for example, hundreds of thousands of young graduates have migrated to countries like Germany, France, the United Kingdom, and Italy, attracted by better economic and professional prospects (Voicu and Voicu, 2014). According to World Bank data and OECD reports, nearly 3 million Romanians left their country between 1990 and 2017 (World Bank, 2017). This phenomenon has resulted in a significant loss of skilled labor, reducing the capacity for innovation and hindering the development of key sectors such as technology, healthcare, and education (Gheorghiu, 2016). The medical sector, for example, suffers particularly from this emigration, with thousands of doctors and nurses leaving for better working conditions abroad (Kovács et al., 2018).This massive emigration has also contributed to an accelerated demographic aging in countries like Bulgaria and Ukraine (Duh, 2019). In Bulgaria, the population has decreased by about 1.5 million people since the 1990s, and this demographic decline has been directly linked to the emigration of young adults (Todorova, 2018). The loss of young active individuals places a heavy burden on social security and healthcare systems. In fact, in a country like Bulgaria, where birth rates are low, the absence of new generations to support the aging population creates enormous challenges in maintaining pension and healthcare financing (Bulgaria National Statistical Institute, 2020).Fertility rates in these countries have also experienced a downward trend. For example, in Romania, the fertility rate is below the generational replacement threshold, exacerbating population aging (Sârbu, 2021). In Bulgaria, this phenomenon is even more pronounced, with one of the lowest fertility rates in the European Union (Eurostat, 2023). This decline in the number of births, coupled with a high mortality rate, especially among the elderly, contributes to demographic decline (Dumitru et al., 2017). Mortality rates in some countries, such as Ukraine and Bulgaria, are also concerning, often linked to public health issues such as cardiovascular diseases and alcohol-related disorders (Chesney et al., 2015).In parallel, the low birth rate, which remains a major challenge in these regions, is worsened by the emigration of young adults, further reducing the number of births (Lazar et al., 2019). These combined dynamics—low birth rates, emigration of the youth, and high mortality rates—create a vicious cycle that is difficult to break. This phenomenon contributes to imbalances in the population structure, with an increasing number of elderly individuals, which places additional pressure on healthcare systems, pensions, and social services (Apostol, 2018).Another observable effect of migration flows is the development of urbanization, primarily in major capitals like Warsaw, Bucharest, and Sofia. Rapid urbanization, driven by both internal and external migrations, has contributed to an increased concentration of resources and economic opportunities in large cities. These cities are becoming economic hubs, but they also face challenges related to infrastructure

saturation. The rapid growth of the urban population has placed significant pressure on housing markets, transportation, and public services. In Bucharest, for example, the demand for housing has skyrocketed, causing prices to rise, which has made it difficult for a large part of the population, especially young adults and low-income families, to access housing. Traffic congestion, housing shortages, and social inequalities have intensified tensions in these urban areas.Migration flows have also had repercussions on GDP per capita in these regions. In countries like Poland, the Czech Republic, and Slovakia, migration has contributed to economic growth by partially compensating for the demographic losses caused by emigration. For instance, in Poland, GDP per capita saw a significant increase over recent decades, rising from $8,000 in 2000 to over $15,000 in 2020 (World Bank, 2020). This increase was fueled by a combination of internal economic reforms and an influx of migrant workers, mainly from Ukraine, who supported key sectors like construction, agriculture, and services (Sienkiewicz, 2019).In contrast, emigration and the loss of skilled labor have created deficits in specific sectors, particularly in rural areas and essential industries. In Ukraine, for example, the loss of skilled agricultural workers has severely affected production in this vital sector, worsening poverty and inequality between urban and rural areas (Ponomarenko et al., 2018). This emigration has also hindered the development of a diversified and modern economy, as the loss of skilled labor in industrial sectors has reduced the country's ability to reindustrialize. Serbia has experienced a similar phenomenon, impacting its ability to modernize and address shortages in sectors such as technology and engineering (Nikolić, 2021). Unemployment also remains a key factor in migration dynamics. In countries like Serbia and Ukraine, despite migration, unemployment remains relatively high, particularly among the youth and in rural areas. In Ukraine, although millions of skilled workers have left the country, unemployment remains high, with a lack of opportunities in key sectors for young graduates (Nikitin, 2017). The industrial and service sectors, which should be the engines of growth, are underdeveloped, and many young people remain unemployed despite their level of qualifications. The youth unemployment rate in these countries is often higher than the national average, reflecting the lack of job opportunities suited to their skills (Eurostat, 2023).Migration may alleviate some pressure on the labor market, but it also creates imbalances, particularly in sectors that depend on skilled labor. However, some countries, like Poland, have successfully leveraged migration by attracting foreign workers, primarily from Ukraine, to fill labor shortages in sectors such as construction and services. Poland has experienced a significant influx of Ukrainian workers, which has helped support its labor market and maintain economic growth. This workforce has helped offset demographic losses related to the emigration of Poles to the West. As a result, Poland has seen sustained economic growth, and its GDP per capita has risen significantly (Gajewski, 2022). This phenomenon has allowed Poland to benefit from a dual effect: emigration to Western Europe has been offset by immigration of both skilled and unskilled workers from Ukraine and other neighboring countries.Demographic and migratory trends directly influence the structure of the working-age population. In countries like Romania and Bulgaria, the flight of young skilled workers has led to a significant decrease in the working-age population, creating an imbalance in the economy and increasing pressure on social protection systems. In Romania, the working-age population has decreased significantly since the 2000s, with an employment rate that remains below the EU average (Gheorghiu, 2016). Deficits in the working-age population result in low productivity and difficulties in attracting foreign investment, which is necessary to modernize infrastructure and stimulate growth.Finally, migration policies play a crucial role in managing these flows. In Central and Eastern Europe, migration policies vary significantly from country to country. In some countries, like Poland, policies to attract foreign labor have been implemented to support economic growth. However, other countries, like Bulgaria and Romania, have had more difficulty managing migration flows and implementing effective integration policies. The EU, through its asylum and migration policies, also plays a crucial role, although divergences between member states complicate the joint management of migration flows. Talent retention policies, as well as those supporting rural regions to encourage the reintegration of migrants and their return, are potential strategies being considered to limit the negative impact of migration.

CONCLUSION

This paper has examined the complex interplay between migration flows and socio-economic transformations in Central and Eastern Europe. While immigration has partially alleviated labor shortages particularly in countries like Poland, which has integrated large numbers of Ukrainian workers into its economy the region continues to face structural demographic imbalances, such as declining fertility rates and accelerated population aging. These dynamics place additional strain on public services and social protection systems.Moreover, the persistent outflow of young, skilled individuals has contributed to a significant loss of human capital, undermining innovation capacity and long-term development potential, especially in critical sectors such as healthcare and information technology. The resulting brain drain not only weakens domestic labor markets but also deepens regional disparities within the European Union.

To address these challenges, migration must be approached not as a short-term labor solution, but as a strategic component of demographic and economic planning. Effective and inclusive migration policies tailored to the specific needs of each country are essential. This includes enhancing integration mechanisms, improving the recognition of foreign qualifications, and fostering social cohesion through better access to housing, education, and services.Future research could further explore the long-term demographic impacts of circular migration, the role of diaspora networks in knowledge transfer, and the effectiveness of regional cooperation frameworks in managing mobility. Ultimately, turning the challenges of migration into sustainable development opportunities requires a coordinated vision that bridges national interests with broader European solidarity.

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