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Economic Determinants of European Migration Flows Through Cluster Analysis and Panel Data Modeling

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Abstract

This study analyzes the relationships between national economic indicators and migration flows among 35 European countries and the European Union over the period 2015-2023. Using a two-step methodology, cluster analysis identifies four distinct country profiles based on their economic performance (GDP per capita, unemployment rate) and migration attractiveness. Panel data econometric modeling with country and time fixed effects confirms that GDP per capita has a significant positive effect on immigration flows, while unemployment rates exert a strong negative influence. Furthermore, major external shocks, such as the COVID-19 health crisis and the war in Ukraine, substantially modify these relationships, reducing or amplifying migration flows.

The results reveal a clear segmentation of European countries into homogeneous groups, highlighting the complexity of economic determinants of intra-European migration. The econometric analysis, based on a balanced panel of 315 country-year observations, demonstrates robust statistical relationships. A €1,000 increase in GDP per capita is associated with an average increase of 12,450 immigrants per year, while each additional percentage point of unemployment corresponds to a decrease of 25,431 immigrants annually. The COVID-19 crisis reduced immigration flows by approximately 55,000 people per year, whereas the Ukraine war generated an additional influx of 132,500 immigrants annually, likely attributable to refugee movements.

Cluster analysis identifies four distinct groups: (1) high-GDP countries with very high immigration and low unemployment, including Germany, Nordic countries, and high value-added economies; (2) developed countries with moderate GDP, significant migration flows, and elevated unemployment; (3) Central and Eastern European countries characterized by modest economic development and reduced migration flows; and (4) small- to medium-sized economies with good GDP per capita but moderate immigration and stable low unemployment.

These findings contribute to a better understanding of economic dynamics and cyclical shocks influencing contemporary migrations in Europe. The research validates classical "push-pull" migration theories while enriching understanding through an updated, multidimensional perspective. Results suggest that migration policies would benefit from differentiation according to economic profiles and integration of major crisis management to better anticipate flows and ensure social cohesion.

The study's limitations include its macroeconomic focus, which does not account for individual migrant profiles, and the relatively short time span. Future research should integrate microeconomic data, institutional variables, and advanced modeling techniques to capture non-linearities and heterogeneities not addressed here.

Categories: Labor Economics, Political Economy, Trade and economic development
Keywords: migration flows, macroeconomic factors, labor market, cluster analysis, panel data modeling, covid-19 impact, ukraine war migration, european migration
JEL Classifications: F22, J61, C23, R23

Introduction

The dynamics of migratory flows in Europe represent a fundamental issue at the intersection of public policies, labor markets, and social balance. For several decades, migrations have deeply influenced the demographic structure and economic trajectories of countries, which means a nuanced understanding of their determinants is needed (Caselli et al., 2024). Theoretical approaches in migration economics classically distinguish two kinds of forces: pull factors, which attract people to certain countries, and push factors, which encourage them to leave their home country (Lee, 1966). In this way, a high level of wealth, often measured by per capita GDP, constitutes a strong pull factor, while a high unemployment rate typically represents a push factor (Dritsaki and Dritsaki, 2024).

The human capital theory, originally developed in labor economics (Becker, 1964) (Borjas, 1990), interprets migration as a rational investment where individuals weigh the costs of moving against expected economic benefits. In this framework, the income gap per capita and career prospects play a decisive role in migration decisions. Later works show that saturated labor markets or those marked by high unemployment significantly reduce the attractiveness of migratory destinations (Todaro, 1969) (Dustmann et al., 2016). Moreover, the existence of diaspora networks, specific welcoming policies, and effective institutions can soften or reinforce the effect of purely economic determinants (Bertoli and Fernández-Huertas Moraga, 2013).

Despite abundant literature, some gaps persist. Few studies integrate a typological classification of countries based on macroeconomic indicators, such as cluster analysis, with robust econometric modeling using recent longitudinal panel data within a single empirical framework. Yet, this double approach allows a better account of European heterogeneity by identifying groups of countries sharing similar economic and migratory profiles (Joint Research Centre, 2020).

The recent context increases this interest. The combined effects of the COVID-19 health crisis and the Ukrainian conflict constitute major exogenous shocks that have redefined, at least temporarily, migration patterns on the continent (QuantMig, 2023) (People in Need, 2025). The COVID-19 crisis led to a sudden drop in flows due to health restrictions and border closures, showing how political and health constraints can override long-term economic determinants (Marchiori et al., 2012). Conversely, the war in Ukraine resulted in a rapid and massive increase in migratory flows, mostly motivated by the search for protection, which shifts the nature of migration from an economic logic to a humanitarian one.

From this perspective, our study relies on data covering the period 2015-2023 for 35 European countries and the European Union, by combining country profile identification according to GDP per capita, unemployment rate, and migratory flows, and a fixed-effects panel model estimating the impact of these variables on immigration flows. This approach aims to offer a finer understanding of the links between economy and migration in a context marked by strong regional disparities and major geopolitical and health events.

Literature review and hypothesis development

The "push" and "pull" factors theory developed by (Lee, 1966) remains one of the foundational conceptual frameworks for understanding international migration. This model distinguishes the repulsive forces of the origin country (push) from the attractive forces of the destination country (pull), creating a migration differential. Nevertheless, this "binary" approach has faced criticism, notably from (de Haas, 2021), who highlights its inability to explain why individuals exposed to identical push-pull forces do not all migrate.

Recent empirical developments have enriched this classical framework by highlighting migration heterogeneity and sectoral specificities. The (OECD, 2024) demonstrates that European labor markets increasingly exhibit sector-specific demands, with particular shortages in healthcare, ICT, and skilled manufacturing that shape migration patterns beyond aggregate economic indicators. Contemporary studies reveal that different migrant profiles-skilled workers, family reunification migrants, and refugees-respond differently to economic determinants, creating complex migration systems rather than uniform flows (Fasani and Mazza, 2023).

In this context, alternative approaches were developed distinguishing two complementary dimensions: on the one hand, the aspiration to migrate (the desire to leave motivated by various reasons) and, on the other hand, the effective capacity to migrate (the financial, social, legal, and informational resources needed to realize this project). According to this framework, migration results from the conjunction of these two elements within opportunity structures specific to each potential destination (de Haas, 2021).

Despite these criticisms, economic disparities between countries remain a key driver of international migration. Relative wealth, measured by GDP per capita, acts as a powerful pull factor by offering better employment opportunities, a higher standard of living, and broader access to public services (De et al., 2015). The neoclassical theory of migration, originally developed by (Todaro, 1969), posits that individuals migrate to maximize their expected utility, mainly through improved income. This perspective is enriched by (Borjas, 2014), who demonstrates that wealthy countries particularly attract skilled migrants due to higher returns on skills-a phenomenon known as the "brain drain".

Recent empirical studies confirm this relationship. For example, (Achour, 2025) finds that GDP per capita in destination countries explains 65% of Tunisian migration flows. Similarly, (Boubtane et al., 2016) show, using OECD country data, that higher GDP per capita is associated with greater attractiveness to migrants, with richer economies consistently receiving more immigration flows. Moreover, (Caselli et al., 2024) observes that in the EU, countries with the highest GDP per capita consistently attract more immigrants, a trend especially evident after 2020. Immigration in the EU reached a historic level in 2022, with two-thirds of jobs created between 2019 and 2023 filled by non-EU citizens, highlighting the attractiveness of Europe’s prosperous economies.

The theory of selective migration (Roy, 1951) (Borjas, 1987) enriches this analysis by suggesting that GDP per capita gaps influence not just the volume but also the qualitative composition of migratory flows. High-income countries tend to attract positively selected migrants whose skills exceed the average in their country of origin (Borjas, 1987). These theoretical and empirical arguments support the following hypothesis:

H1: There is a positive relationship between GDP per capita and immigration flows in European countries.

Labor migration economics attaches central importance to labor market conditions as a major decision factor (Todaro, 1969) (Harris and Todaro, 1970). The Harris-Todaro model, a pillar of migration theory, posits that the migration decision depends on the differential in expected income, adjusted by the probability of finding a job at the destination (Todaro, 1969) (Harris and Todaro, 1970). Thus, a high unemployment rate sends a negative signal to potential migrants, indicating job scarcity and increased competition, thereby reducing the country's attractiveness.

This relationship between the host country's unemployment rate and migration decision is also addressed by job search theory developed by (Mortensen, 1986) and (Pissarides, 2000). In this approach, rational migrants factor in the likely duration of the job search and associated costs in cost-benefit calculations. It was argued by (Dustmann, et al, 2016) that saturated labor markets particularly discourage economically motivated migrants seeking rapid employment.

Recent research by (Dritsaki and Dritsaki, 2024) on the European Union empirically confirms a significant negative effect of unemployment on net immigration flows, even after controlling for GDP gaps and other structural factors. Using a panel vector autoregressive approach covering 27 EU countries over the period 1990-2020, the authors identify a bidirectional causal relationship between migration and unemployment: high unemployment discourages immigration, while also generating feedback effects on economic growth. These theoretical and empirical insights underpin the following hypothesis:

H2: There is a negative relationship between the unemployment rate and immigration flows in European countries.

Literature on the economic determinants of immigration reveals significant heterogeneity in the application of theoretical mechanisms across national and regional contexts. This aligns with broader critiques of the universality of migration theories formulated by (Arango, 2000) and reprised by (de Haas, 2010), advocating for more contextual approaches to migration phenomena.

This heterogeneity has motivated the development of typological approaches in migration research. Prior studies have employed cluster analysis to identify distinct migration regimes across European countries, notably the work of (Triandafyllidou and Gropas, 2007) who distinguished between traditional immigration countries, new immigration destinations, and transit countries. Similarly, (Castles and Miller, 2009) conceptualized "migration systems" that combine economic, institutional, and historical factors in specific regional configurations.

Authors (Bertoli and Fernández-Huertas Moraga, 2013) empirically show that the impact of economic variables is shaped by country-specific structural and institutional factors, such as migration policies, institutional quality, historical links, and geographic proximity. This heterogeneity justifies the use of analytic methodologies designed to identify homogeneous groups of countries.

Cluster analysis, recommended by the (European Commission, 2024), is an appropriate tool for identifying groups of countries sharing similar combinations of GDP, unemployment, and migration flows. This method reveals distinct “migration regimes” in the sense of (Castles and Miller, 2009), where specific configurations of economic, institutional, and geographic factors generate characteristic migration patterns. Building on these typological foundations, our cluster analysis extends previous classifications by incorporating recent crisis impacts (COVID-19, Ukraine war) and employing a quantitative approach that combines economic indicators with migration flows in a single analytical framework. These regimes also integrate the influence of pre-existing diasporas, which open privileged channels between origin and destination countries (Vertovec, 2009), as well as bilateral mobility agreements that can institutionalize certain corridors beyond economic considerations alone (Triandafyllidou and Gropas, 2007).

The (QuantMig project, 2023), funded by the European Commission, confirms this segmentation within Europe, distinguishing Central and Eastern European economies from Western European states as regards migration profiles, economic determinants, and absorption capacities. This regional differentiation reflects contrasting development trajectories, varied institutional legacies, and positions in European value chains. These theoretical and empirical arguments lead to the following hypothesis:

H3: There are homogeneous groups of countries with similar migration determinants.

Crisis migration theory, developed by (Richmond, 1993) and furthered by (Zolberg,et al., 1989), distinguishes voluntary migration from forced migration while recognizing a continuum between these categories. This framework is particularly relevant for understanding the impact of exogenous shocks on migration behaviors, which may temporarily or permanently alter typical migration incentives.

The vulnerability windows theory proposed by (Wisner, 2003), adapted by (Hunter, et al, 2015), posits that exogenous shocks create periods of instability where traditional migration determinants may be suspended or reversed. These windows result in a temporary redistribution of push and pull factors, substantially modifying established migration balances.

For example, (Marchiori, et al., 2012) analyze how environmental shocks disrupt cost-benefit migration decisions. Their dynamic general equilibrium model shows that extreme events can either stimulate migration ("displacement effect") or constrain it ("poverty trap effect"). In Europe, recent shocks illustrate this dynamic: the COVID-19 pandemic significantly reduced inbound migration flows due to mobility restrictions and economic contraction European Commission (Joint Research Centre, 2020), creating a temporary discontinuity in the economy-migration link. In parallel, the war in Ukraine prompted a massive influx of refugees, shifting the migration patterns' center of gravity starting in 2022 (People in Need, 2025).

More recently, EU immigration reached historic highs in 2022 and remained above pre-pandemic levels in 2023, largely due to Ukrainian refugee reception. This shows how geopolitical shocks can redefine migration determinants, create new corridors, and reshape established economic balances. These theoretical and empirical developments support the following hypothesis:

H4: Economic and geopolitical crises alter the relationship between economy and migration.

The remainder of this article is structured as follows. First, the existing literature is reviewed and the research hypotheses are developed. Next, the methodology is presented, encompassing the description of the data, the country classification, and the panel econometric model. This is followed by a presentation and discussion of the empirical results. Finally, the article concludes by summarizing the main findings and outlining implications for both future research and policy decisions.

Research Method

Methodology

Data and Sample

This study is based on a balanced panel covering the period 2015-2023 for 35 European countries. All datasets come from Eurostat official statistics, ensuring both consistency and reliability. The choice of this time window makes it possible to capture recent trends in migration flows while incorporating the effects of major shocks such as the COVID-19 pandemic and the war in Ukraine.

Our final sample consists of 315 country-year observations (35 countries × 9 years), providing suitable statistical robustness for the selected panel econometric methods. All time series underwent rigorous filtering to ensure the absence of missing or outlier values for the entire study period.

Variables

Table *1* presents the variables used, their abbreviations, operational definitions, and data sources.

Variable	Abbreviation	Description	Source
Annual immigration inflow	IMMI	Annual number of immigrants per country (2015–2023)	(Eurostat Migration and Asylum Statistics, 2025)
Real GDP per capita (€)	RGDP	Real gross domestic product per capita, chain-linked volumes, reference 2020	(Eurostat GDP per capita in PPS, 2025)
Total unemployment rate (%)	UNEM	Percentage of the labor force unemployed	(Eurostat Labour Force Survey, 2025)
COVID-19 dummy (2020–2021)	COVID	Dummy: 1 if year = 2020 or 2021, 0 otherwise	Author's construction
Ukraine war dummy (2022–2023)	UKRW	Dummy: 1 if year = 2022 or 2023, 0 otherwise	Author's construction

TABLE 1: Selected variables, abbreviations, and sources

Source: Author; data from (Eurostat Migration and Asylum Statistics, 2025), (Eurostat GDP per capita in PPS, 2025), and (Eurostat Labour Force Survey, 2025)

The main explanatory variables reflect the fundamental economic determinants identified in the theoretical and empirical literature on international migration. Real GDP per capita serves as a proxy for the overall economic attractiveness of destination countries, whereas the unemployment rate reflects labor market conditions and job opportunities.

The crisis variables (COVID-19 and the Ukraine war) are designed to isolate the effects of major exogenous shocks on migration dynamics. These dummies are constructed to capture periods of direct impact: 2020-2021 for the pandemic, corresponding to the years of strictest sanitary restrictions, and 2022-2023 for the Ukrainian conflict, covering the outbreak and initial migratory effects.

Analytical Strategy

Our methodological approach is structured into two complementary steps: a descriptive multivariate classification and an explanatory panel econometric modeling.

Step 1: Country typology via multivariate analysis

First, countries are classified according to their economic and migratory profiles. Using the means and standard deviations calculated over 2015-2023 for our three base indicators (IMMI, RGDP, UNEM), we obtain six analysis variables.

A principal component analysis (PCA) is performed on these six standardized variables to reduce dimensionality and identify the main axes structuring cross-country differences. This step is followed by a K-means clustering, whose robustness is checked through hierarchical agglomerative clustering. The optimal number of clusters is determined through a multi-criteria approach combining: (1) within-cluster inertia minimization with examination of the elbow method, (2) silhouette scores maximization, (3) theoretical interpretability of resulting groups, and (4) stability validation across different clustering methods. The choice of four clusters proved optimal as it showed the most significant inertia reduction compared to k = 3, while k = 5 produced overly fragmented groups with limited theoretical coherence.

Step 2: Panel data econometric modeling

Next, an econometric model is estimated to quantify the relationships between economic factors and migration flows. We specify a bilateral fixed-effects panel model, controlling for both unobserved country-specific heterogeneity (μ_i) and common time effects (λ_t):

$$IMMI_{it} = \alpha + \beta_1 RGDP_{it} + \beta_2 UNEM_{it} + \beta_3 COVID_t + \beta_4 UKRW_t + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where *i* indexes countries and *t* indexes years. The specification presented in Equation (1) offers several analytical advantages. Country fixed effects (μ_i) control for all country-specific characteristics that remain constant over time and may influence migration attractiveness, such as institutions, culture, or geography. Year fixed effects (λ_t) capture common time shocks affecting all European countries

simultaneously. To account for the panel structure, robust standard errors clustered at the country level are employed, addressing both heteroskedasticity and potential autocorrelation. The validity of the estimation strategy is assessed through multiple econometric tests, namely the Hausman test for selecting between fixed and random effects, the Wooldridge test for detecting autocorrelation, and the modified Wald test for heteroskedasticity. Robust estimation is adopted based on these diagnostic results, which are presented in Appendix 1.

Results And Discussion

Results

Descriptive Statistics of Key Variables

The descriptive analysis over the 2015-2023 period highlights substantial disparities between countries regarding migration flows, real GDP per capita, and the unemployment rate. As shown in Table *2*, countries such as Germany, Spain, France, and the Netherlands stand out for their high average immigration volumes, while Central and Eastern European states such as Bulgaria and Croatia exhibit lower flows. GDP per capita disparities strikingly contrast high-income economies (Luxembourg, Norway, and Switzerland) with lower-income economies (Bulgaria and Romania). Regarding unemployment, rates range from less than 3% in the Czech Republic and Poland to over 10% in Greece and Spain.

Country	IMMI (Average)	IMMI (SD)	RGDP (Average) (€)	RGDP (SD)	UNEM (Average) (%)	UNEM (SD)
Belgium	148,740	26,098	41,993	1,403	6.6	1.12
Bulgaria	35,979	10,368	9,245	878	6.0	1.88
Czechia	110,921	91,229	20,629	882	2.6	0.29
Denmark	84,489	19,102	53,084	2,231	5.6	0.39
Germany	1,080,588	361,118	42,978	797	3.4	0.52
Estonia	25,912	11,280	20,515	1,366	5.9	0.99
Ireland	101,664	27,088	74,016	11,265	6.1	2.04
Greece	97,038	22,172	16,539	1,031	18.0	5.47
Spain	696,930	315,421	25,752	1,432	16.9	4.28
France	373,802	27,986	36,027	1,079	9.1	1.12
Croatia	31,053	18,691	13,657	1,591	10.2	4.10
Italy	329,904	56,057	31,055	1,102	10.6	1.77
Cyprus	24,088	8,170	24,257	2,401	9.6	3.36
Latvia	15,290	10,450	15,346	2,626	7.9	1.15
Lithuania	43,893	18,980	16,611	3,117	7.4	1.17
Luxembourg	25,715	3,184	104,609	2,062	5.8	0.70
Hungary	77,747	14,597	14,788	1,234	4.2	0.98
Malta	23,270	7,742	28,360	3,830	4.1	0.75
Netherlands	211,978	53,702	48,335	2,164	4.7	1.51
Austria	136,271	33,555	43,168	1,207	5.5	0.52
Poland	235,516	32,308	14,967	1,679	3.9	1.59
Portugal	91,286	55,108	20,283	1,128	9.0	3.99
Romania	197,111	67,329	11,469	1,472	5.4	1.09
Slovenia	24,112	7,462	22,759	1,987	5.1	1.06
Slovakia	6,962	935	17,180	1,146	7.8	2.58
Finland	41,659	14,279	42,057	1,203	7.8	0.58
Sweden	117,084	25,830	45,786	1,007	7.4	0.68
Iceland	10,428	3,181	56,609	2,986	4.1	1.11
Norway	64,406	14,893	60,968	1,528	4.1	0.55
Switzerland	165,226	34,886	77,329	1,561	4.6	0.29

TABLE 2: Descriptive statistics 2015–2023

IMMI, RGDP, and UNEM refer to annual immigration inflow, real GDP per capita (€), and total unemployment rate (%), respectively.

SD: Standard Deviation

Source: Author

European Country Typologies: Cluster Analysis Results

Using our three base indicators (annual immigration inflow, real GDP per capita, and total unemployment

rate), we first calculated for each country the means and standard deviations over the period 2015-2023, resulting in six analysis variables. Applying PCA on these six standardized variables, followed by K-means clustering, allowed us to identify four distinct national profiles within our European sample. The chosen solution of four clusters proved optimal based on internal coherence and inter-group differentiation criteria.

Figure *1* shows the projection of countries on the PCA factorial plane defined by the first two principal axes, color-coded according to cluster membership. This visualization reveals a clear structuring of the European space based on economic and migratory performance.

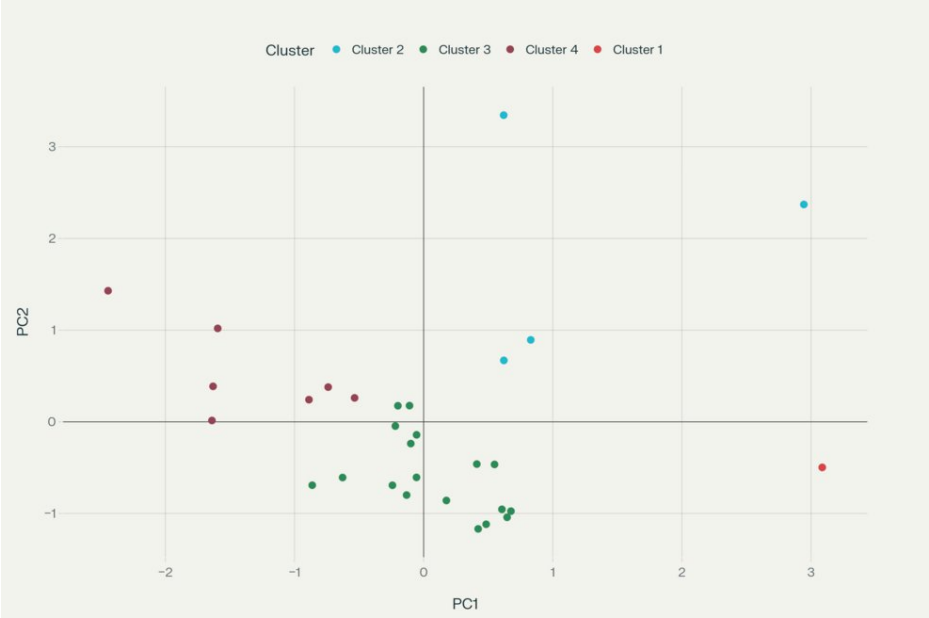

FIGURE 1: PCA scatter plot of European countries colored by K-means clusters (four clusters)

This scatter plot shows the projection of European countries onto the first two principal components (PC) based on average GDP per capita, immigration, and unemployment rates for 2015–2023. Countries are colored according to their cluster membership defined by K-means clustering, illustrating distinct socioeconomic and migratory profiles.

Source: Author

PCA, Principal Component Analysis

The factorial map displays the results of the PCA on the six standardized variables (mean and standard deviation of annual immigration inflow, real GDP per capita, and unemployment rate), followed by K-means classification. Each point corresponds to a country positioned according to its composite economic and migratory profile, with colors indicating cluster membership.

The examination of this map highlights a marked separation along the first horizontal axis, opposing countries with high GDP and strong immigration inflows from those with lower GDP and reduced immigration. The second vertical axis appears to mainly reflect the combination of unemployment variability and migration flow volatility. Our analysis identified four distinct national profiles, detailed in Table *3*.

Cluster	Characterization	Countries
1	High GDP, very high immigration, low UNEM	Germany, Austria, Belgium, Denmark, Ireland, Luxembourg, Netherlands, Sweden, Norway, Switzerland, Iceland
2	Medium GDP, medium immigration, high UNEM	France, Spain, Italy, Greece, Portugal, Finland
3	Low GDP, low immigration, moderate UNEM	Bulgaria, Romania, Croatia, Latvia, Lithuania, Hungary, Poland, Slovakia
4	Very high GDP, moderate immigration, very low UNEM	Estonia, Czechia, Malta, Cyprus, Slovenia

TABLE 3: Country assignment to clusters (K-means, k = 4)

UNEM refers to the total unemployment rate (%).

Source: Author

Cluster 1 groups 11 countries that combine excellent economic performance with strong migration attractiveness and some of the lowest unemployment rates in Europe. This group notably includes Germany, Nordic countries, and several high value-added economies.

Cluster 2 comprises six developed countries with GDP per capita lower than the first group. Despite important migration flows, these countries face more challenging employment situations, with unemployment rates often above the European average.

Cluster 3, mainly made up of Central and Eastern European countries, is characterized by lower economic development levels, reduced migration flows, and variable but generally moderate unemployment rates.

Finally, Cluster 4 includes five small- or medium-sized economies that, despite a good GDP per capita level, register moderate immigration and maintain relatively low and stable unemployment rates.

Table *4* presents the average characteristics for each group, empirically confirming the contrasts observed in the graphic representation.

Cluster	IMMI (Average)	RGDP (Average) (€)	UNEM (Average) (%)	Group size
1	295,746	59,874	4.5	11
2	314,243	34,661	12.0	6
3	89,828	13,396	5.7	8
4	51,770	22,782	5.0	5

TABLE 4: Average profiles per cluster from K-means classification

IMMI, RGDP, and UNEM refer to annual immigration inflow, real GDP per capita (€), and total unemployment rate (%), respectively.

Source: Author

These data reveal substantial differences across groups. Cluster 1 has an average GDP per capita exceeding €59,000, combined with immigration inflows approaching 300,000 people annually and an unemployment rate of only 4.5%. Conversely, Cluster 3 features a GDP per capita around €13,400, migration flows below 90,000 annually, and a moderate unemployment rate of 5.7%.

It is noteworthy that Cluster 2, despite exhibiting the highest average immigration flows (314,243), stands out with a particularly high unemployment rate (12%), suggesting that migration attractiveness is not determined solely by labor market performance but may also be influenced by other factors such as migration policies, diaspora networks, or geographical proximity.

Panel Data Econometric Modeling

Table 5 summarizes the estimated coefficients along with their standard errors, t-statistics, and p-values.

Variable	Coefficient	Std. Error	t-Stat	p-Value
Real GDP per capita (€) (RGDP)	12,450	3,920	3.18	0.0015**
Unemployment Rate (%) (UNEM)	–25,431	7,854	–3.24	0.0013**
COVID-19 Dummy (2020–2021) (COVID)	–54,892	21,470	–2.56	0.0106*
Ukraine War Dummy (2022–2023) (UKRW)	+132,517	34,908	3.80	0.0002**
Constant	–210,453	87,920	–2.39	0.0171*

TABLE 5: Estimation results (fixed effects panel 2015–2023)

Source: Author

Number of observations: 315; Number of countries: 35; R^2 (within): 0.684; R^2 (between): 0.521; Overall R^2: 0.602

F-test (overall model): $p < 0.001$

*$p < 0.05$ and **$p < 0.01$

Country fixed effects and time fixed effects are included in the model. The total number of observations is 315, covering 35 countries. The within R^2 is 0.684, the between R^2 is 0.521, and the overall R^2 is 0.602. The overall F-test for the model is highly significant ($p < 0.001$).

The model fit is satisfactory, with the within R^2 showing that about 68% of the variation in migration flows within countries over time is explained by the model. The F-test confirms the overall statistical significance. Econometric diagnostics (found in Appendix 1) support this approach, with the Hausman test ($p < 0.05$) favoring fixed-effects over random-effects specification. However, the Wooldridge test ($p < 0.05$) and the Modified Wald test ($p < 0.05$) indicate the presence of autocorrelation and heteroskedasticity, respectively, prompting the use of robust standard errors clustered at the country level.

The analysis of coefficients reveals several statistically significant relationships. The coefficient for real GDP per capita (RGDP) is positive and highly significant ($p < 0.01$), implying that a €1,000 increase in GDP per capita corresponds on average to an increase of 12,450 immigrants annually, holding other factors constant. This finding supports the role of economic attractiveness in migration.

The unemployment rate (UNEM) has a significant negative effect ($p < 0.01$) on migration flows. Specifically, each additional percentage point increase in unemployment is associated with a decrease of 25,431 immigrants per year, underscoring the importance of labor market conditions in migration decisions.

Regarding crisis variables, contrasting effects are observed. The Ukraine War dummy (UKRW) shows a substantial positive effect, with approximately 132,500 additional immigrants per year during 2022-2023, likely driven by refugee inflows. Conversely, the COVID-19 dummy (COVID) has a significant negative effect, indicating a reduction of around 55,000 immigrants per year during 2020-2021, reflecting pandemic-related restrictions and economic impacts. Overall, the fixed-effects panel model results for the years 2015-2023 align well with the study's initial hypotheses.

Figure 2 graphically illustrates the relative magnitude of these estimated effects, enabling visual comparison of coefficient sizes.

FIGURE 2: Impact of economic and crisis variables on migration flows

This bar chart presents the estimated coefficients from the fixed effects panel model (2015–2023) on migration flows, with green bars indicating positive impacts and red bars indicating negative impacts. It highlights the economic attractiveness of higher GDP per capita, the deterrent effect of unemployment, the reduction in flows during COVID-19, and the substantial increase linked to the Ukraine war.

Source: Author

The chart underscores the moderate but significant positive effect of real GDP per capita on migration flows (+12,450), consistent with the role of economic pull factors, while also illustrating the pronounced impact of the Ukraine War, which is associated with a substantial increase in immigration (+132,517), likely driven by refugee movements. In contrast, the unemployment rate exerts a negative influence (-25,431), reflecting its deterrent role, and the COVID-19 crisis is linked to a marked reduction in migration flows (-54,892).

Discussion

The results from our combined cluster analysis and panel modeling reveal complex but coherent dynamics of intra-European migration flows over the recent period (2015-2023). These findings broadly support classical theoretical frameworks while providing a better understanding of current specificities and the role of exceptional crises.

First, the strong and significant positive relationship between real GDP per capita (RGDP) and incoming migration flows (H1) illustrates the robust application of the economic "pull" paradigm originally formulated by (Lee, 1966). This result aligns with international empirical evidence demonstrating that economic prosperity attracts migrants seeking better opportunities (De et al., 2015) (Boubtane et al., 2016). The economic divide among European countries remains a primary driver of migration, consistent with (Caselli et al., 2024) findings that two-thirds of the jobs created in the EU between 2019 and 2023 were filled by non-EU citizens, highlighting both the strength of economic attraction and the complexity of labor market complementarities. Our cluster analysis confirms a clear segmentation, with Western and Nordic European countries concentrating the largest migration inflows. Moreover, (Borjas, 2014) emphasizes the selective nature of migration, favoring high-skilled migrants towards rich countries, which reinforces socio-economic inequalities. Recent Eurostat data corroborate this by showing that Germany and France accounted for 58% of EU authorizations for study and research permits in 2023, indicating a geographic concentration of skilled migration.

Second, the negative impact of the unemployment rate (UNEM) (H2) underscores labor market conditions as a push factor or barrier to migration, consistent with classical migration models (Todaro, 1969) and recent European empirical studies (Dustmann et al., 2016) (Dritsaki and Dritsaki, 2024). High unemployment increases integration costs and reduces rapid employment insertion, potentially influencing national migration policies (Borjas, 2014). The observed clustering pattern - with southern and eastern European countries experiencing higher unemployment and lower migration inflows - reflects this structural relation. While this suggests that reducing unemployment may enhance migration

attractiveness, the historically low unemployment among EU citizens amid recent migration raises questions on the substitutability between native and immigrant labor, pointing instead toward sectoral and qualitative complementarity confirmed by OECD's International Migration Outlook (OECD, 2024).

Third, the identification of homogeneous country groups (H3) illustrates that European heterogeneity cannot be reduced to a simple economic continuum but takes the form of typologies with differentiated mechanisms. This segmentation, supported by statistical methods (Bertoli and Fernández-Huertas Moraga, 2013) (QuantMig, 2023), incorporates institutional, migration policy, historical, and cultural factors modulating economic-migration relationships. A study (Fasani, 2024) shows that employer attitudes within European firms reflect significant institutional heterogeneity, with migration preferences differing markedly even between similar economic contexts. This multidimensional perspective calls for moving beyond purely economic approaches to the study of intra-European migration. Moreover, conventional typologies can conceal rapid shifts, such as the transition of some Central European countries from emigration to immigration destinations.

Finally, the impact of crises (H4) offers crucial insights on migration flows' temporality and contingency. The drastic fall in migration during the COVID-19 pandemic (European Commission, 2024) demonstrates how political and sanitary constraints can supersede long-term economic determinants. Conversely, the surge linked to the Ukraine war (People in Need, 2025) reflects a sudden humanitarian displacement, fundamentally reshaping Europe's migration landscape. However, it is important to acknowledge that our econometric framework, designed primarily for economic migration, may not fully capture the distinct mechanisms underlying forced migration. Ukrainian refugees, driven by immediate security concerns rather than economic optimization, represent a qualitatively different population from traditional economic migrants. This humanitarian influx operates outside conventional push-pull economic logic, as destination choices are often determined by geographic proximity, existing diaspora networks, and government reception policies rather than GDP differentials or unemployment rates. While our model captures the aggregate statistical effect, the underlying behavioral mechanisms differ substantially from those governing voluntary economic migration. These crises exemplify the "exogenous shocks" concept in migration economics (Marchiori et al., 2012), highlighting the need to model such disruptions. Notably, Ukrainian refugees have integrated faster into labor markets than prior refugee waves, indicating crisis type and displaced populations' characteristics significantly influence integration policies.

This context situates the economy-migration nexus in a dynamic, nonlinear framework shaped by European institutional diversity and global events. The country and time fixed effects in our econometric model underscore how national specificities and macroeconomic trends affect migration simultaneously. Authors (Caselli et al., 2024) estimate a 0.2% to 0.7% increase in potential output by 2030 due to migration, mitigating economic fears often raised publicly. Still, initial fiscal costs and public service congestion caution that migration impacts extend beyond macroeconomic metrics.

In conclusion, our study validates classical theories while enriching the contemporary understanding of European migration through an updated, multidimensional lens. Migration policies should be nuanced to economic profiles and crisis impacts to better anticipate flows and ensure societal cohesion. Furthermore, incorporating sectoral specializations and qualitative labor complementarities could substantially improve migration flow predictability in Europe.

From a theoretical standpoint, our results validate the robustness of the push-pull paradigm in the current European context while also revealing important nuances. The confirmation of the attractive effect of real GDP per capita (RGDP) and the deterrent effect of unemployment (UNEM) provides empirical grounding for neoclassical migration theories within today's European reality. However, the identification of country clusters shows that these mechanisms do not apply uniformly; rather, they operate within distinct "migration regimes" that reflect Europe's institutional and historical heterogeneity. Even more significantly, the analysis of exogenous shocks - COVID-19 and the Ukrainian conflict - demonstrates how extra-economic factors can disrupt economic determinants, suggesting a migration theory that is more contingent and less mechanistic than traditional models sometimes portray.

From an operational perspective, these findings offer useful, albeit improvable, frameworks for policymakers. The identification of differentiated national profiles supports the case for migration policies tailored to specific local economic contexts rather than for a uniform EU-wide approach. The disruptive impact of crises also underlines the importance of integrating adaptive mechanisms into migration policy design, enabling rapid responses to shifts in geopolitical or health contexts. Furthermore, quantifying economy-migration relationships helps inform the often polarized public debate by providing empirically grounded orders of magnitude.

Conclusions

This research set out to decipher the economic mechanisms underlying intra-European migration flows between 2015 and 2023 by combining a clustering approach with panel data modeling. The resulting insights shed light both on the persistence of classical economic logics and on the contemporary

reconfigurations of these dynamics.

It is nevertheless important to acknowledge the inherent limitations of this approach. While instructive, macroeconomic analysis inevitably masks the heterogeneity of individual migrant profiles - a skilled worker and an asylum seeker do not respond to the same incentives, even when facing the same national economic conditions. The observation period, while capturing crucial recent dynamics, remains relatively short for fully grasping long-term structural transformations. Data availability constraints, particularly for institutional variables and migration policy indicators, also limit the granularity of certain analyses. Finally, the linear models used, though suitable for identifying general trends, struggle to capture complex interactions or threshold effects that are likely to characterize these phenomena.

These limitations open several promising avenues for future research. Combining macro- and micro-level data would greatly enrich the understanding of migration behavior by accounting for individual profiles while retaining the structural perspective. More systematic integration of institutional variables - government quality, integration policies, social capital - could explain a substantial share of the variance not captured by purely economic indicators. Additionally, future studies should develop more nuanced crisis indicators: rather than binary dummies, continuous indices measuring the intensity of COVID-19 restrictions by country or specific volumes of refugee inflows would better capture the heterogeneous impact of exogenous shocks across European nations. Longitudinal analysis of the Ukrainian war's effects on European migration systems also represents an essential research path for understanding ongoing geopolitical transformations. Methodologically, exploring non-linear approaches or applying machine learning techniques could reveal subtler patterns in these complex relationships.

From an operational perspective, these findings offer useful, albeit improvable, frameworks for policymakers. The identification of differentiated national profiles supports the case for migration policies tailored to specific local economic contexts rather than for a uniform EU-wide approach. The disruptive impact of crises also underlines the importance of integrating adaptive mechanisms into migration policy design, enabling rapid responses to shifts in geopolitical or health contexts. Furthermore, quantifying economy-migration relationships helps inform the often polarized public debate by providing empirically grounded orders of magnitude.

Our cluster analysis suggests differentiated policy approaches for each country group. Cluster 1 countries (high GDP, high immigration, low unemployment) such as Germany and Nordic nations should focus on integration capacity building and skills recognition systems to maximize the economic benefits of sustained high immigration. Cluster 2 countries (medium GDP, high immigration, high unemployment) like France, Spain, and Italy face the dual challenge of managing substantial inflows while addressing labor market inefficiencies-targeted sectoral programs linking immigration to specific skill shortages could optimize outcomes. Cluster 3 countries (low GDP, low immigration) in Central and Eastern Europe might benefit from selective attraction policies for specific skills while developing retention strategies for their own populations. Finally, Cluster 4 countries (high GDP, moderate immigration, low unemployment) such as Estonia and Slovenia have optimal conditions to implement quality-focused immigration policies, attracting high-skilled migrants without labor market disruption. These differentiated approaches acknowledge that one-size-fits-all EU migration policies may not account for the structural economic differences our analysis reveals.

Beyond its specific contributions, this study illustrates the value of an integrated approach to European migration, one that combines methodological rigor with sensitivity to national contexts. It suggests that understanding contemporary migration requires moving beyond traditional disciplinary divides, articulating economic analysis with institutional considerations and geopolitical dynamics. In a European context marked by rapid transformations - demographic challenges, economic transitions, and geopolitical instability - such an integrated perspective appears all the more necessary to anticipate and manage future migration developments.

Appendices

Test	Null hypothesis (H_0)	Statistic	df	p-value	Decision ($\alpha = 5\%$)	Interpretation and consequence for the model
Hausman	No systematic difference between FE and RE (RE appropriate)	$\chi^2 = 14.87$	4	0.0049	Reject H_0	FE are preferred over RE. The FE model is retained to avoid endogeneity bias due to correlation between individual effects and regressors.
Wooldridge	No first-order autocorrelation in panel residuals	$F(1, 34) = 11.42$	—	0.0018	Reject H_0	Presence of autocorrelation in the errors. → Robust standard errors clustered by country are used to correct the bias in standard errors.
Modified Wald[1]	Homoscedasticity across panels	$\chi^2 = 168.52$	35	<0.0001	Reject H_0	Presence of heteroskedasticity across countries. → Robust standard errors are used to ensure valid inference.

TABLE 6: Appendix 1 – Detailed robustness test results

Source: Author

[1] Applicable to FE models

df, Degrees of Freedom; FE, Fixed Effects; RE, Random Effects

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Zyed Achour

Acquisition, analysis, or interpretation of data: Zyed Achour

Drafting of the manuscript: Zyed Achour

Critical review of the manuscript for important intellectual content: Zyed Achour

Supervision: Zyed Achour

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References

1. Achour Z: Multidimensional determinants of Tunisian migration flows: An integrated econometric analysis. Journal of Emerging Markets and Management. 2025, 1:56-67. 10.63385/jemm.v1i1.86

2. Arango J: Explaining migration: A critical view. International Social Science Journal. 2000, 52:283-296. 10.1111/1468-2451.00259
3. Becker GS: Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education, First Edition. National Bureau of Economic Research, New York; 1964.
4. Bertoli S, Fernández-Huertas Moraga J: Multilateral resistance to migration. Journal of Development Economics. 2013, 102:79-100. 10.1016/j.jdeveco.2012.12.001
5. Borjas GJ: Self-Selection and the Earnings of Immigrants. National Bureau of Economic Research, Cambridge, MA; 1987.
6. Borjas GJ: Friends or Strangers: The Impact of Immigrants on the U.S. Economy. Basic Books, New York; 1990.
7. Borjas GJ: Immigration Economics. Harvard University Press, Cambridge, MA; 2014.
8. Boubtane E, Dumont JC, Rault C: Immigration and economic growth in the OECD countries 1986-2006. Oxford Economic Papers. 2016, 68:340-360. 10.1093/oep/gpw001
9. Caselli F, Lin H, Toscani FG, Yao J: Migration into the EU: Stocktaking of Recent Developments and Macroeconomic Implications. IMF Working Papers. 2024, 211 :1-44. 10.5089/9798400289552.001
10. Castles S, Miller MJ: The Age of Migration: International Population Movements in the Modern World. Palgrave MacMillan, Basingstoke; 2009.
11. de Haas H: The internal dynamics of migration processes: A theoretical inquiry. Journal of Ethnic and Migration Studies. 2010, 36:1587-1617. 10.1080/1369183x.2010.489361
12. de Haas H: A theory of migration: the aspirations-capabilities framework. Comparative Migration Studies. 2021, 9:1-358. 10.1186/s40878-020-00210-4
13. De S, Kim EJ, Plaza S, Ratha DK, Seshan GK, Shaw W, Yameogo ND: Leveraging Economic Migration for Development: A Briefing for the World Bank Board. World Bank Group, Washington D.C.; 2015.
14. Dritsaki M, Dritsaki C: Immigration, growth and unemployment: Panel VAR evidence from E.U. countries. Journal of the Knowledge Economy. 2024, 15:19928-19963. 10.1007/s13132-024-01909-w
15. Dustmann C, Schönberg U, Stuhler J: Labor supply shocks, native wages, and the adjustment of local employment. The Quarterly Journal of Economics. 2016, 132:435-483. 10.1093/qje/qjw032
16. European Commission. (2024). https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/understanding-reasons-behind-migration-interplay-migr....
17. Eurostat GDP per capita in PPS. (2025). https://ec.europa.eu/eurostat/databrowser/view/tec00114/default/table?lang=en.
18. Eurostat Labour Force Survey. (2025). https://ec.europa.eu/eurostat/databrowser/view/une_rt_m/default/table?lang=en.
19. Eurostat Migration and Asylum Statistics. (2025). https://ec.europa.eu/eurostat/web/migration-asylum/international-migration-citizenship/database?utm.
20. Fasani F: New Approaches to Labour Market Integration of Migrants and Refugees. European Parliament, Luxembourg; 2024.
21. Fasani F, Mazza J: Being on the frontline? Immigrant workers in Europe and the COVID-19 pandemic. ILR Review. 2023, 76:890-918. 10.1177/00197939231173676
22. Harris JR, Todaro MP: Migration, unemployment and development: A two-sector analysis. American Economic Review. 1970, 60:126-142.
23. Hunter LM, Luna JK, Norton RM: Environmental dimensions of migration . Annual Review of Sociology. 2015, 41:377-397. 10.1146/annurev-soc-073014-112223
24. Joint Research Centre. (2020). https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/how-coronavirus-reshaping-migration-worldwide-2020-12....
25. Lee ES: A theory of migration. Demography. 1966, 3:47-57. 10.2307/2060063
26. Marchiori L, Maystadt JF, Schumacher I: The impact of weather anomalies on migration in sub-Saharan Africa. Journal of Environmental Economics and Management. 2012, 63:355-374. 10.1016/j.jeem.2012.02.001
27. Mortensen DT: Job search and labor market analysis. Handbook of Labor Economics. Ashenfelter OC, Layard R (ed): Elsevier, Amsterdam; 1986. 2:849-919.
28. OECD: International Migration Outlook 2024. OECD Publishing, Paris; 2024. 10.1787/50b0353e-en
29. People in Need. (2025). https://www.peopleinneed.net/the-ukrainian-refugee-crisis-current-situation-9539gp.
30. Pissarides CA: Equilibrium Unemployment Theory. MIT Press, Cambridge, MA; 2000.
31. QuantMig: Quantitative migration scenarios for Europe: Final project report. European Union Horizon 2020, 2023.
32. Richmond AH: Reactive migration: Sociological perspectives on refugee movements. Journal of Refugee Studies. 1993, 6:7-24. 10.1093/jrs/6.1.7
33. Roy AD: Some thoughts on the distribution of earnings. Oxford Economic Papers. 1951, 3:135-146. 10.1093/oxfordjournals.oep.a041827
34. Todaro MP: A model of labor migration and urban unemployment in less developed countries. American Economic Review. 1969, 59:138-148.
35. Triandafyllidou A, Gropas R : European immigration: A Sourcebook (2nd Edition). Routledge, London; 2007. 10.4324/9781315580920
36. Vertovec S: Transnationalism. Routledge, London; 2009.
37. Wisner B: Changes in capitalism and global shifts in the distribution of hazard and vulnerability. Natural Disaster and Development in a Globalizing World. Routledge, London; 2003. 43-56.
38. Zolberg AR, Suhrke A, Aguayo S: Escape from Violence. Conflict and the Refugee Crisis in the Developing World. Oxford University Press, Oxford; 1989.