

When Demographic Need Does Not Attract Migrants: Old-Age Dependency, Economic Conditions and the Limits of the Replacement Migration Assumption in the Eu-27

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Please cite this paper as:

Alexandrescu, A. (2026). When Demographic Need Does Not Attract Migrants: Old-Age Dependency, Economic Conditions and the Limits of the Replacement Migration Assumption in the Eu-27. In C. Vasiliu, D.-C. Dabija, A. Tziner, D. Pleșea, & V. Dinu (Eds.), *Proceedings of BASIQ International Conference on New Trends in Sustainable Business and Consumption, 12th Edition* (pp. 585-592). Editura ASE.

DOI 10.24818/BASIQ/2026/12/039

Abstract

This study tested whether demographic ageing independently influenced net migration in EU member states. Based on a balanced Eurostat dataset for all 27 member states from 2015 to 2024 and using pooled ordinary least squares regression with HC3 heteroskedasticity-robust standard errors, it was found that old-age dependency ratios negatively correlated with net migration in the bivariate specification, contrary to the expected outcome of the replacement migration hypothesis. Once GDP per capita and unemployment were introduced as additional explanatory variables, the signal conveyed by demographic indicators was reduced to irrelevance: the old-age dependency ratio lost its significance, whereas economic factors became the primary determinants of migration flows. Specifically, for each thousand euros increase in GDP per capita (in purchasing power standards), the number of net migrants increased by around 0.23 per thousand inhabitants. Each percentage point increase in unemployment led to an average decline in net migration of about 0.35 per thousand inhabitants. While the vast majority of empirical research on demographic ageing and migration focused on regions and pairs of countries, the present paper contributed as an empirical finding on the issue for all EU member states. The conclusion of the paper had important implications for family businesses located in member states with high dependency ratios: the micro and small businesses, which formed the overwhelming share of family business ownership in the EU, should not count on demographic push factors leading to labor supply adjustments through migration.

Keywords

Demographic ageing; net migration; old-age dependency ratio; replacement migration; family business; EU-27

DOI: 10.24818/BASIQ/2026/12/039

Introduction

Population ageing was a central structural challenge for Europe over the past two decades. According to Eurostat, the dependency ratio for those aged 65 or over stood at 33.9 percent in 2023 across EU-27 nations, compared to 26.0 percent in 2005 (2024b). There was significant variation within member states, as Italy, Finland, and Greece were currently above the mark of 35 percent, which could have been explained by low replacement fertility rates and long-term outmigration trends. In turn, Ireland and Luxembourg had ratios under 23 percent due to more youthful populations and high migration to Luxembourg. International migration was long proposed as an automatic correction to ageing. Immigrants usually joined the work force when they were at a workable age; increased the work force and hence provided taxes for expenditure related to age issues (Storesletten, 2000). In this regard, the concept of 'replacement migration' had been used by the UN Population Division (2001). In turn, the idea remained relevant for EU level policy-making about demographic sustainability issues. An essential element of the theory was the presumption that aging was considered to be a pull factor for immigrants.

This study tested that long-held assumption using Eurostat panel data on all 27 EU member states from 2015 to 2024. The question addressed in the study was: Are countries with high old-age dependency ratios characterized by large net migration levels when GDP per capita and unemployment were controlled for? The answer was negative. In other words, demographic need by itself could not be used to attract migrants; the economic attractiveness of a country was what matters.

These findings affected the family-enterprise sector directly, which formed the backbone of many EU regional economies. The European Commission's Expert Group on Family Business identified the prevalence of family ownership within the micro and small businesses, as well as the prevalence of small enterprises among family companies (European Commission, 2009). Such enterprises had an overrepresentation in regions with aging populations. As the European Parliament (2015) noted, family enterprises were characterized by their close ties to particular locations and made an important contribution to job creation in rural and underdeveloped territories undergoing population aging and decline. According to demographic trends, there would be decreases in working-age populations in 22 out of the 27 EU countries in 2050, with the greatest population declines occurring in the Eastern and Southern members (Bodnár et al., 2024). In this context, succession planning in family enterprises located in such regions depended on migration flows that could have resulted from population pressures.

Evidence from the past decade supports this point. During 2015-2024, the EU was faced with some significant migration waves, including the arrival of refugees in 2015-2016, continued intra-EU mobility on account of the economic differential between the eastern and western halves of the continent, and the readjustment in labor supply following the pandemic crisis. Notwithstanding these phenomena, the top recipient countries with regard to net migration flows—Luxembourg, Malta, Germany, and the Nordic countries—were not among those experiencing more rapid population ageing. At the same time, Bulgaria, Greece, Italy, and Portugal, the countries that faced the most severe ageing prospects, continued being net exporters of people or experienced minor inflows compared to demographic need.

1. Review of the scientific literature

The theoretical case for ageing as a migration push factor drew on Borjas's (1987) Roy-model framework, in which migration selects workers with high returns to skills at destination. In this perspective, dynamic rather than demographically needy destinations attracted migrants. For the latter type of destination, the United Nations Population Division (2001) estimated that stabilizing working-age population levels in member states of the EU would have required immigration levels that vastly exceeded historical precedents. The publication did not project how much immigration would actually arrive in response to ageing; it estimated only how much would be needed. The policy inference that ageing created its own attraction power exceeded the empirical evidence behind it. Bijak et al. (2007) showed this limit through multi-state demographic projections for 27 European countries: high migration rates did not compensate for low fertility and longevity gains.

Empirical analysis at the subnational level, as well as simulations, corroborated this disparity between the demand for immigrants as demographically needy and their supply as potentially attractive destinations for economic opportunities. Prenzel (2021), using fixed-effects panel estimation of 326 NUTS-3 German regions for 1997-2013, found that migration flows avoided older regions because they lacked economic dynamism and industrial expansion. Age structures without economic dynamism made no appeal to migrants. Marois et al. (2020) extended this point via a microsimulation exercise for all member states of the EU; they showed that the productivity and fiscal benefits of immigration depended on labour integration and selectivity, but not necessarily on migration volume per se. De Beer (2024) showed similar results for the Netherlands; again, immigration helps with demographic issues only partially.

Economic factors shaped migration behaviour. Zaiceva and Zimmermann (2008), in a cross-section of EU countries, found wage differentials, unemployment differentials, and social networks to be the main drivers of intra-EU migration. Mayda (2010), using a panel of 14 OECD destination countries, confirmed that origin-destination income differences were strong structural determinants of bilateral migration. The above results strongly motivated the inclusion of per-capita income and unemployment rates as control variables in this analysis. In their absence, the effect of old-age dependency ratio on net migration could have very well been driven by economic variables. The rationale of self-selection of Borjas (1987) applied in an economic framework; demographic factors mattered to migrants only insofar as they affected economic incentives.

The literature on the fiscal benefits associated with immigration added to this corrective story. For instance, Dustmann and Frattini (2014) found that EEA migrants to the UK over 1995-2011 made a positive net

fiscal contribution conditional on labour force participation. Dustmann et al. (2010) concluded the same thing regarding post-enlargement EU migrants over 2004 onwards; a net positive fiscal contribution conditional on being employed. Docquier et al. (2014) also found that immigration increases native wages and productivity through complementarities.

Despite these contributions, the empirical evidence on the EU-27 remained thin. Lobo and Falleiro (2024), using a cross-country sample of 72 nations, found that net migration played a minor role in altering the old-age dependency ratio relative to fertility and life expectancy. Dustmann et al. (2016) argued that the discrepancy between various immigration estimates is primarily due to specification errors and highlighted the need for proper control variables. The lack of demographic correction carries direct relevance for family enterprises, which represent the dominant organisational form across EU member states and tend to be concentrated in regions characterised by demographic decline and ageing (European Commission, 2009). According to the European Parliament (2015), family enterprises generate employment in rural and disadvantaged areas, yet overwhelming regional evidence suggests that migrants deliberately bypass such territories in favour of economically dynamic locations (Prenzel, 2021). If it can be shown empirically that demographic need does not independently drive migration even at the national level, this has direct implications for workforce succession planning in family firms located in high old-age dependency regions. However, no existing literature has yet attempted to empirically test the relationship between the old-age dependency ratio and net migration among all 27 EU members following 2015, a period characterised by record-breaking migration inflows.

Three research questions structured the empirical analysis: the baseline demographic prediction, the economic correction, and a robustness check. Research Question 1 concerned whether replacement migration works for the EU-27 member states based on Eurostat harmonized data for ten years. According to the literature, countries which faced higher old-age dependency ratios should have expected higher volumes of net migration inflows caused by labor shortages were visible to potential migrants from the economic point of view.

RQ1: Was the old-age dependency ratio positively associated with the net migration rate across the EU-27 member states?

H1 (demographic pull): the old-age dependency ratio was positively associated with the net migration rate across the EU-27, as predicted by United Nations Population Division (2001) and Storesletten (2000).

As noted above, a positive bivariate association could not have confirmed the influence of the aging factor on migration since EU-27 member states that enjoyed the lowest levels of dependency ratios also belonged to the richest countries of the bloc. In addition, they demonstrated the highest economic dynamics. Therefore, a correlation between dependency ratios and migration could have reflected not the influence of demography but economic attractiveness.

RQ2: Was there an association between old-age dependency and net migration rates after accounting for GDP per capita and unemployment rates?

Hypothesis 2 (economic mediation hypothesis): The old-age dependency ratio lost statistical significance as a predictor of migration when the economic variables mentioned in RQ2 were controlled. This followed Borjas's (1987) self-selection logic: migrants moved toward higher expected returns, so demographic factors had no independent effect once economic conditions were controlled for.

A further complication that arose at the stage of empirical analysis concerned the possibility of a structural outlier. Luxembourg combined the EU's highest GDP per capita, low dependency ratio, and finance-sector-driven net immigration from cross-border commuters and skilled professionals, with no comparable country in the panel.

RQ3: Was the empirical finding obtained in support of H2 statistically stable upon excluding Luxembourg from the analysis?

Hypothesis 3 (robustness hypothesis): The independent economic variables identified in RQ2 were not driven by an exceptional observation. This null hypothesis was tested using Cook's (1977) diagnostics and estimation based on the restricted sample in accordance with the requirements put forth by Dustmann et al. (2016). The three hypotheses played different roles: H1 was the literature-based baseline expected to be rejected; H2 was the substantive claim to be tested; H3 was a robustness check.

2. Research methodology

The analysis used a balanced panel dataset for all 27 EU member states over the period 2015-2024, with total observations at the country-year level amounting to 270. This 10-year time frame incorporated the recovery phase following the Great Recession of 2007-2008, the refugee wave of 2015-2016, the impact of the COVID-19 pandemic, and the subsequent rebound phase.

Ordinary least squares estimation with pooled panel data (POLS) was utilized, rather than a fixed effects panel model estimator. The hypothesis concerned cross-sectional differences in OADR across EU member states, whether older members attracted larger migration flows than younger ones. Fixed effects estimation would incorporate between-state differences in aging by means of demeaning, resulting in elimination of those very differences that underpin the hypothesis that was tested. By contrast, pooled estimation retained the cross-country variation, which, under the standard assumptions of linearity, exogeneity, and no perfect multicollinearity, resulted in Best Linear Unbiased Estimation (Wooldridge, 2010; Angrist & Pischke, 2009). A key identifying assumption of this approach is that time-invariant country characteristics—such as geography, language, and institutional history—are uncorrelated with the old-age dependency ratio after conditioning on GDP per capita and unemployment. While this assumption cannot be formally tested without instruments, the three-model robustness structure adopted here, including the exclusion of Luxembourg, provides indirect support for the stability of the estimates.

The dependent variable was the crude net migration rate per 1.000 population (Eurostat demo_gind, indicator CNMIGRATRT). It was calculated as the difference between the number of immigrants and the number of emigrants relative to the size of mid-year population. The main explanatory variable was the old age dependency ratio (OADR), measured as the number of persons aged 65 and over for every 100 persons aged 15-64 (Eurostat demo_pjanind). Two other variables were included as controls for the economic context: GDP per capita at constant prices in terms of purchasing power standards (PPS) (nama_10_pc) and annual unemployment rate (une_rt_a). GDP per capita represented the economic attractiveness of the country, as identified in the migration literature, whereas unemployment captured cyclical conditions in the labour market.

Descriptive statistics of the full sample were provided in Table no. 1 below. Net migration rates varied widely, from -20.3 to 42.1 per 1.000 population, with a pooled mean of 4.95 and a noticeable dispersion (SD=7.90). Old age dependency ratio values range from 19.7% to 38.4% for the same period, with a mean value of 30% and a steady upward tendency. GDP per capita spanned a wide range of 13,587 to 97,689 PPS, thus capturing the economic gradient across Europe. Unemployment rate had a mean value of 7.1%, but also exhibited significant variance, from 2.0% to 25%.

Table no. 1. Descriptive Statistics, EU-27 Panel, 2015-2024 (N = 270 country-year observations)

Variable	Mean	Std. Dev.	Min	Max
Net migration rate (‰)	4.95	7.90	-20.30	42.10
Old-age dependency ratio (%)	30.04	4.34	19.70	38.40
GDP per capita (PPS)	33,431	14,804	13,587	97,689
Unemployment rate (%)	7.09	3.67	2.00	25.00

The pooled OLS model was specified as:

$$\text{Net Migration Rate}_{it} = \beta_0 + \beta_1 \cdot \text{OADR}_{it} + \beta_2 \cdot \text{GDPpc}_{it} + \beta_3 \cdot \text{UNEMP}_{it} + \varepsilon_{it} \quad (1)$$

Where:

NMR_{it} = crude net migration rate per 1.000 inhabitants in country i at time t

β_0 = constant term (intercept)

β_1 = coefficient on the old-age dependency ratio

OADR_{it} = old-age dependency ratio, defined as persons aged 65 and over per 100 persons aged 15-64, in country i at time t

β_2 = coefficient on GDP per capita

GDPpc_{it} = GDP per capita in purchasing power standards (thousands), in country i at time t

β_3 = coefficient on the unemployment rate

UNEMP_{it} = annual unemployment rate (%), in country i at time t

ε_{it} = idiosyncratic error term for country i at time t

i = EU-27 member state index ($i = 1, \dots, 27$)

t = year index ($t = 2015, \dots, 2024$)

The estimation included three models: Model 1 (bivariate analysis, OADR only, N = 270), Model 2 (all control variables, N = 270), and Model 3 (all control variables, except for Luxembourg, N = 260). Model

I estimated the relationship between ageing and migration without any control variables; Model 2 included all the control variables mentioned in the theoretical review, which were considered the primary determinants of international migration by the literature. Model 3 corrected the potential leverage problem caused by Luxembourg, given that it was the country with the highest GDP per capita, lowest OADR, and highest net immigration in the EU.

Four diagnostic tests evaluated the regression model. Variance inflation factor (VIF) checks proved the absence of problematic multicollinearity with the maximum value less than 2.8. The Breusch-Pagan (1979) Lagrange multiplier test confirmed heteroscedasticity in the residuals, which justified using HC3 heteroscedasticity-consistent standard errors in all models. HC3 was chosen from simple heteroscedasticity correction methods due to its jackknife-based approach, which resulted in better inference in case of varying leverage among observations (MacKinnon & White, 1985). Cook's (1977) distance diagnostics with $4/N = 0.015$ ($N = 270$) proved that Luxembourg (2024) was an influential observation.

3. Results and discussion

These three models tested whether demographic composition, specifically the old-age dependency ratio, affected migration independently of economic factors, examined model by model.

Table no. 2. Pooled OLS Regression Results: Net Migration Rate (%) as Dependent Variable

Variable	Model 1 (Bivariate)	Model 2 (Full)	Model 3 (excl. LUX)
Old-age dep. ratio (OADR)	-0.322*** (0.099)	-0.014 (0.082)	-0.036 (0.090)
GDP per capita (thousand PPS)	-	0.227*** (0.025)	0.262*** (0.035)
Unemployment rate	-	-0.353*** (0.111)	-0.325*** (0.109)
Constant	14.706*** (3.161)	0.358 (3.595)	-0.227 (3.574)
Observations	270	270	260
R ²	0.031	0.249	0.203
Adj. R ²	0.028	0.240	0.194

Notes: HC3 robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Model 1 results in Table 2 challenged the pull-factor theory. In the bivariate model, the coefficient of OADR was negative and statistically significant: one percentage point rise in the old-age dependency ratio resulted in about 0.32 fewer net migrants per 1.000 inhabitants. In case aging countries pulled in migrants because they faced a shortage of workers, the coefficient should have been positive. However, the opposite relationship was observed: countries that had the highest levels of the old-age dependency ratio in the period from 2015 to 2024 (e.g., Bulgaria, Italy, Greece, and Portugal) were not the EU countries with the strongest attraction to migration. While it explained only 3.1% of the total variation in the panel data, the bivariate coefficient was statistically robust over 270 observations and matched Prenzel's (2021) finding that labour migration avoids demographically older regions, and the projection results of Bijak et al. (2007) showing no correlation between demographic need and migration. As a consequence, H1 is rejected.

The negative bivariate relationship reflected structural features of the EU migration system. Older members are countries that historically had large amounts of emigration, depleting the economically active part of the population and weakening the economic dynamics, and countries that encountered structural difficulties resulting in poor economic performance and persistent joblessness. For instance, Bulgaria and Greece showed an old-age dependency ratio either at a high level or increasing along with unfavorable conditions for workers.

With Model 2, the relationship was made explicit. As GDP per capita and the unemployment rate were added to the OADR, it completely lost statistical significance, becoming essentially zero in the coefficient and 0.86 in the p-value. The demographic effect became irrelevant once economic factors were controlled for. GDP per capita remained significant and positive: a 1.000 PPS rise in GDP per capita was associated with 0.23 extra net migrants per 1.000 people ($p < 0.01$), consistent with the wage-differential framework of Mayda (2010) and Zaiceva and Zimmermann (2008). The unemployment rate was significant and negative: one point increase in the unemployment rate was related to 0.35 fewer net migrants per 1.000 inhabitants. Migrants reacted to the labour market conditions: a high unemployment rate signaled an excess supply of workers, and migrants behaved accordingly. The adjusted R² rose to 0.240, indicating that economic factors, not demographic structure, drove net migration systematically. In this way, H2 received confirmation.

Because the panel covered ten years, the unemployment coefficient drew on both cross-sectional and time variation. While Germany saw the decline in its unemployment rate from 4.6% in 2015 to 3.0% in 2019, contributing to high net migration in the same period, Greece continued to have very high unemployment rates (over 15%) even after the 2009 financial crisis. In this regard, Greece was able to continue its position

as a net emigration country with growing demographic demand because of economic factors. These within-country dynamics could be observed only through a panel structure spanning at least ten years.

Model 3 addressed the leverage issue introduced by Luxembourg. Diagnostics flagged Luxembourg as a structurally unique observation: the EU's highest GDP per capita (97,689 PPS in 2024), lowest old-age dependency ratio (19.7-21.7%), and high net immigration throughout the sample. With an influential observation defined as having a country-year Cook's distance value exceeding the threshold ($4/N = 0.015$), one Luxembourg observation had been found. After the removal of all country-year observations from Luxembourg and re-estimating the equation with 260 remaining observations produced exactly the same result, where GDP per capita was still highly significant, unemployment rate remained significantly negative, while OADR was negative but insignificant. Adjusted R^2 declined modestly (from 0.240 to 0.194) without altering coefficient signs or significance. Hypothesis H3 was thus supported.

Ageing did not draw migrants by itself. It seemed to have a negative correlation with net migration only due to the economic problems associated with high structural aging levels. By controlling for economic factors, one nullified the demographic effect completely. Migrants reacted to income, high per capita GDP, economic opportunities, low unemployment rate and availability of jobs. Without economic advantages, demographic need did not enter migrants' decisions. Family firms in high-dependency member states cannot expect ageing-induced workforce shrinkage to be offset by migration unless economic conditions also improve.

Conclusions

EU demographic policy commonly assumed that ageing societies attract immigrants through labour-shortage signals. The present results challenged that assumption. Using panel data from Eurostat on all 27 EU countries from 2015 to 2024, consistent findings are obtained regardless of model specification. The old-age dependency ratio does not affect net migration independently, because its effect disappears once economic factors are controlled for. While a negative bivariate correlation exists between the old-age dependency ratio and net migration, this variable loses significance entirely when GDP per capita and unemployment rates are included as controls.

Italy, Greece, Bulgaria, and Germany face among the most acute demographic challenges in the EU. With increasingly ageing demographics, these countries will come under pressure on their pension systems, healthcare expenses, and fiscal resources. Relying on migration policy as a way to respond to demographic pressure based on demographic necessity is unlikely to produce beneficial effects. Migration responds to economic opportunities, namely the availability of a productive economy that can offer jobs. Where high dependency ratios coexist with economic stagnation or elevated unemployment, the problem cannot be addressed through migration policy alone, but requires accompanying economic reform.

The Pact on Migration and Asylum adopted in 2024 and the EU Talent Pool initiative both rest on the assumption that legal migration channels can compensate for labour shortages produced by demographic ageing in member states. The present results qualified that assumption: migrant inflows responded to economic opportunity, not to demographic deficit, so EU-level mobility instruments cannot redirect flows toward high-dependency regions in the South and East. In a microsimulation across 31 European countries, Marois, Potančoková and González-Leonardo (2023) found that the demographic and labour-force impact of immigration depended on origin composition and regional destination rather than on aggregate volume. EU cohesion and regional-development instruments therefore need to complement migration policy by raising the economic attractiveness of demographically declining regions before any migration-based workforce strategy can take hold.

While migration can play an important role in ensuring demographic sustainability, it should be understood as just one tool within a broader set of economic and labour market policies. As shown by Marois et al. (2020), the positive impact of immigration on productivity depends on the degree of skill matching and integration quality. De Beer (2024) finds that immigration for labour purposes provides only limited demographic benefits when integration processes are poor. Dustmann & Frattini (2014) confirm that the fiscal and demographic contribution of immigration is conditional on labour force participation, which in turn depends on labour market conditions.

The results obtained have clear implications for family businesses located in aging demography areas of the European Union. Micro and small businesses represent the overwhelming majority of all family enterprises and provide around one-half of employment in business activities in the European Union (European Commission, 2009). These family enterprises were highly prevalent in the member states with elevated dependency ratios, which the present paper has shown are unlikely to draw migrant workers. As

stated by the European Parliament (2015), family businesses generate employment opportunities in rural and disadvantaged regions suffering from aging and population decline, and empirical studies confirm that migrants avoid such regions whenever economic conditions become poor (Prenzel, 2021). Thus, family enterprises in Bulgaria, Greece, Italy, Portugal, and Romania are unable to rely on demography-driven migration as a remedy for their workforce succession problem. Creating the economic conditions considered in the present study as drivers of migration, namely higher income levels, dynamic labor market, and accessible labor conditions, becomes a necessary precondition for any migration-based approach to solving workforce issues.

Two limitations applied. Pooled OLS could not control for time-invariant country-level fixed effects and other latent variables affecting both demographic trends and migration flows, such as geographical location, existing migration networks, languages, and institutional environment. The possible correlations between those latent factors and the independent variable, the old-age dependency ratio (OADR), would cause the biased estimation of coefficients. Moreover, the research design did not permit causality testing, since the reverse causality effect, where migration influenced demographic trends and economic dynamics by selective inward migration, could not be ruled out without using instrumental variables. For instance, the recent return migration to Romania starting in 2022 shows that migration is both the outcome and driving factor of demographic and economic development.

Future research should consider the above-mentioned limitations in their design by implementing fixed-effects panel regression models to analyze only within-country variations in the dependent variable, the OADR. At the same time, the regional version of the model (based on NUTS-2) following Prenzel (2021) needs further investigation. To deal with endogeneity and omitted variables problems, researchers should employ the instrumental variables strategy utilizing historical demographic data as instruments or distance-based shift-share regressions. It is essential to extend the model to bilateral migration data, which will make it possible to estimate the contributions of individual sending regions to the net migration flow into high-OADR countries independently of overall economic conditions.

Acknowledgement(s):

Generative Artificial Intelligence (GenAI) usage statement:

Claude Opus (version 4.5) was responsibly used for language improvement. After this process, the author reviewed and edited the content as needed and takes full responsibility for the content of the present article.

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