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Modeling The Role of Freedom of Movement of Workers in Shaping Migration Patterns in the EU+: the Case of Poland

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Abstract

We developed a hierarchical Bayesian model to quantify international migration in 31 European countries from 2002 to 2018. The approach consistently addresses data quality issues, harmonizes migration definitions, and merges administrative and EU Labor Force Survey data. We then used the model outcomes to assess the impact of freedom of movement and labor market access in destination countries. Our primary focus is on Poland, a key country among the A-8 countries that joined the EU in 2004. The evidence suggests that the main emigration flows from Poland shifted from Germany to the UK and other countries following Poland's 2004 EU accession. However, in 2011, the pattern reversed when Germany opened its labor market to A-8 country workers, resulting in a significant increase in immigration. As we refine our analyses, we expect to be able to provide more details about the role of migration policy on European migration dynamics.

Introduction

Free Movement of Workers After 2004 EU Enlargement

Freedom of movement for workers is a core principle of the European Union (EU) included in Article 45 of the Treaty on the Functioning of the European Union. This principle grants EU citizens the following rights: (1) seek employment in another EU country, (2) work in that country without requiring a work permit, (3) reside there for employment purposes, (4) stay even after their employment ends, and (5) enjoy equal treatment with nationals regarding employment access, working conditions, and social and tax benefits [11; 10].

In May 2004, the European Union witnessed its largest-ever expansion. Ten new Member States joined, including eight nations (A-8) from the former Eastern Bloc: Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia. Cyprus and Malta also became part of the union. In 2004, disparities in unemployment rates and salaries were persisting among member states, leading individuals from regions with lower wages to seek employment in more prosperous countries. This expansion raised concerns about the potential for unrestricted labor migration from the A-8 countries, which could have posed significant challenges to the labor markets of the EU-15 countries, as well as non-EU European Economic Area (EEA) and European Free Trade Association (EFTA) countries such as Iceland, Liechtenstein, Norway, and Switzerland. To address these concerns, a transitional period of seven years (2+3+2) was established to gradually open their borders to workers from the new member countries [10; 12; 13].

Sweden, and in practice also the United Kingdom and Ireland, opened their labor markets from day one [8; 9]. Unlike Sweden, other Nordic countries, namely Denmark, Finland, Iceland, and

Norway, introduced transitional solutions for the movement of workers from the A-8 in 2004 [13; 9]. Although Norway is not part of the EU, it is associated with it through the EEA and has adopted the rules of the single market like every other EU member state. Despite transitional arrangements for enlargement in 2004, Norway was generally perceived as quite open in its approach compared to other Nordic countries. This was because there was no minimum wage in Norway, general tariffs were not yet in force, and the preliminary condition for granting permits was full-time employment at the Norwegian salary level [13]. Denmark also slightly relaxed its rules in the first years after its accession in 2004 and allowed pre-approval of companies with collective wage agreements [9].

Although 70 percent of migrants from the A-8 chose Ireland and the United Kingdom[3], it's worth noting that in the years 2004-2006, over two-thirds of work permits among Scandinavian countries were granted to Norway, of which two-thirds of Norwegian work permits were issued to Polish citizens [13; 8]. It's also important to mention that a significant portion of the permits were for short-term employment. The number of all permits increased over the following years. While permits issued in 2005 represented only 0.4 percent of the total Nordic labor force, permits issued in Norway in 2006 most likely exceeded 2 percent of the labor force [8]. In Iceland, this percentage was much higher, placing these countries alongside Ireland in terms of labor migration from the A-8 [8].

Finland, Iceland, Greece, Portugal, and Spain abolished the transitional arrangements on 1 May 2006, and Italy followed suit on 27 July of the same year. The Netherlands (with prior limit of 22k workers per year) and Luxembourg repealed these rules in 2007 (on May 1 and November 1, respectively), and France on July 1, 2008. Belgium, Denmark, and Norway maintained restrictions or partial restrictions until the end of the second phase of transitional period, i.e. until May 1, 2009. The last countries to repeal restrictions, using the complete transitional period (May 1, 2011), were Austria, Germany, and Switzerland. However, Switzerland reintroduced restrictions for A-8 countries from May 1, 2012, to April 30, 2014 [20; 21; 2; 3; 4].

In 2001, visa restrictions for citizens of A-8 countries intending to travel to the EU-15 were removed for stays of no more than three months in all [19; 12]. Therefore, labor mobility occurred de facto well before the official accession of the A-8 countries to the European Union and obviously, ahead of the conclusion of the transition periods. This can be observed in the UK Worker Registration System that monitors migrants after the enlargement. During the first six months after the enlargement on May 1, 2004, approximately 30 percent of applications to the program were submitted by workers who had already established residence in the UK prior to the enlargement [12]. Additionally, for some of these countries, students, researchers, and, more rarely, self-employed and service providers were exempt from the restrictions.

Assessing the Impact of Freedom of Movement of Workers on Migration Flows

Freedom of movement has played a significant role in accelerating migration from new EU countries to Western Europe, while also contributing to returning migration flows in subsequent years. Unfortunately, officially available migration data suffer from inconsistencies in definitions, incompleteness, and varying data quality. Although official sources contain migration-related data, they are not designed for precise migration measurement, resulting in divergent figures. To improve our understanding of international population migration flows, we address these data limitations within a Bayesian statistical framework. Furthermore, within this framework, we integrate data from various sources, enhancing the accuracy of our estimates.

In this paper, we present preliminary results of Bayesian migration models for selected flows to and from Poland during the period 2002-2018, which covers the accession year 2004. We compare models that incorporate the variables related to accession with models that do not account for them as well as older model (IMEM; [18]). Our models, by addressing the challenges related to data limitations, offer reliable insights into the complexities of migration patterns between Poland and other European countries.

Data Sources

Migration flow data in Europe can be obtained from various sources, including official statistics provided by National Statistical Institutes, the UN, and Eurostat (administrative data), as well as various surveys conducted by countries. We primarily rely on administrative data as the main source and use the Labour Force Survey as additional information on migration flows. Each source has its unique characteristics and potential limitations [6; 14]:

- **Administrative Data**: These data sources, such as population registers or foreign resident permits, record residence changes as they occur or are declared. However, comparing administrative data across different countries can be challenging for several reasons. First, countries may have varying duration criteria to define international migrants, leading to differences in how migrants are identified. Second, undercounting may occur when individuals choose not to register upon immigration or fail to deregister when emigrating. Third, coverage bias in data collection processes may exclude specific population segments, such as national return migrants or foreigners not being counted in the official immigration and emigration counts, respectively. Moreover, subpopulations such as asylum seekers, nomad populations, military personnel, homeless people, as well as some geographic areas may not be included in the migration data. Finally, accuracy issues in data collection can result in random errors during registration or deregistration.
- **Labour Force Surveys (LFS)**: These national household surveys, primarily designed to measure labor migration, may also capture other forms of migration as they collect immigration information for all household members. However, LFS data come with their own challenges. First, due to the small proportion of migrants in the total population, LFS surveys may lack statistical precision. Second, statistical bias can arise from the frequency of survey sample updates and its ability to capture new migrants over time. Third, if the survey only covers individual households and excludes collective accommodations, it may underestimate the size of certain migrant subgroups. Finally, in countries where survey participation is not mandatory, high non-response rates can occur due to reasons like lack of interest in the survey, language barriers, or privacy concerns, especially among undocumented migrants.

Methods

We develop a hierarchical Bayesian model (JAGS, R software) to estimate the latent bilateral migration flows, denoted as Y_{ijt}, from country i to country j in year t. This estimation is conditioned on the definition of long-term migration, which requires relocation followed by a minimum stay of 12 months. To address inconsistencies among countries and data sources, we incorporate a measurement error model. Additionally, we tackle data incompleteness using a united migration model to estimate missing data. Our proposed statistical model builds upon and extends methodologies previously developed by [17; 18; 22; 7].

The specification of the measurement error model varies depending on the data sources to account for their unique characteristics and limitations. We assume that the number of observed migration events, denoted as $y_{ijt}^{(k)}$ for data source k, follows a Poisson distribution with parameter $\lambda_{ijt}^{(k)}$. Here, k can take one of three values: (i) $k = IR$ represents immigration from administrative sources based on the country of previous residence, (ii) $k = ER$ represents emigration from administrative sources based on the country of next residence, and (iii) $k = IS$ represents immigration from the Labor Force Survey (LFS). The parameters $\lambda_{ijt}^{(k)}$ are modeled as follows:

$$
\begin{aligned}
\log \lambda_{ijt}^{IR} &\sim \mathcal{N}\left(\log R_{ijt} - \mu_{*,j,t} + d_j^m + \delta_{ijt} + \log v_{jt}^{IR} - \log\left(1 + \exp(-\kappa_j^{IR})\right), \tau_{jt}^{IR}\right), \\
\log \lambda_{ijt}^{ER} &\sim \mathcal{N}\left(\log R_{ijt} - \mu_{*,j,t} + d_j^m + \delta_{ijt} \log v_{it}^{ER} - \log\left(1 + \exp(-\kappa_i^{ER})\right), \tau_{it}^{ER}\right), \\
\log \lambda_{ijt}^{IS} &\sim \mathcal{N}\left(\log R_{ijt} + \log\left(1 - \exp\left(-2\mu_{*,j,t}\right)\right) - \log\left(2\mu_{*,j,t}\right) + \right. \\
&\qquad \left. \log v_{jt}^{IS} - \log\left(1 + \exp(-\kappa_j^{IS})\right), \tau_j^{IS}\right).
\end{aligned}
\tag{1}
$$

Here, R_{ijt} represents the number of relocations, where a relocation is considered a migration event if a person remains in country j for at least the minimum duration of stay $d_m^{(j)}$. μ_{ijt} denotes the true relocation rate and $\mu_{*,j,t} = \sum_{i;i\neq j} \mu_{jit}$.

The factor d_j^m is expressed in years, and can be equal to 0 (as there is no time limit, each relocation is considered a migration), 0.083 years (1 month), 0.25 years (3 months), 0.333 (4 months), 0.5 years (6 months), 0.667 (8 months), 1 year (12 months - the reference period adopted in the EU), or 5 years (for permanent residence) [15].

The duration of stay is parameterized using δ parameter and includes 5 categories: "no time limitδ_1 if the criterion is "no time limit" or lower than 3 months, δ_2 if the criterion is 3 months, δ_3 if the criterion is 4-6 months, 0 if the criterion is 8-12 months, and δ_4 if the criterion is "permanent residence" (5 years).

To account data quality biases, we classify countries into groups based on their undercounting υ (5 groups for administrative data sources; 2 groups for LFS), coverage bias κ (two groups), and and accuracy τ defined as random error in data sources (3 categories for administrative data sources, 2 categories for LFS).

We use a unified migration model to estimate the latent number of relocations (R_{ijt}) across multiple data sources. In this model, the number of relocations R_{ijt} is log-normally distributed and defined as:

$$\log R_{ijt} \sim \mathcal{N}\Big(\beta_1 + \beta_2 A_{ijt} I_{i,j}^{E\to W} + \beta_3 A_{ji(t-1)} I_{i,j}^{W\to E} + \sum_{k=1}^{10} b_{k,i,j} Z_{t,k} + \gamma_{ij}, \omega_R\Big), \tag{2}$$

- β_1 is an intercept
- A_{ijt} is an indicator variable representing freedom of movement for workers from country i to j in year t. The indicator can take fractional values if freedom of workers was granted after January 1st or if the restrictions were gradually relaxed (e.g., Norway).
- $\beta_2 A_{ijt} I_{i,j}^{E\to W}$ accounts for specific flow patterns, namely flows from new European countries (A-8, BG, RO, HR) to old European countries (EU-15, CH, and NO).
- $\beta_3 A_{ji(t-1)} I_{i,j}^{W\to E}$ accounts for specific flow patterns, including returning flows from old EU countries to new EU countries.
- $I_{i,j}^{E\to W}$ and $I_{i,j}^{W\to E}$ are indicators for flow directions between new and old EU countries.
- γ_{ij} represents corridor-specific random intercepts.
- Cubic B-splines ($b_{k,i,j} Z_{t,k}$) model temporal effects, where Z is a B-spline basis.

Model coefficients (β) are given a heavy-tail t prior distribution and ω_R is the precision parameter with a weakly-informative prior.

This unified model allows us to estimate relocations consistently across data sources and account for various migration dynamics. The true migration flows, conditional on a minimum duration of stay of 12 months, are obtained as $Y_{ijt} = R_{ijt} \exp(-\mu_{*,j,t} d_j^m)$ based on a theoretical relationship between relocations and transitions (LFS data) [16; 17].

We explore two primary models, one incorporating LFS (Labour Force Survey) data and another without it. The model utilizing LFS data is useful for estimating flows in cases where only limited or lower-quality administrative data are available. For instance, it can be particularly helpful for estimating migration between Greece and Cyprus (although not covered in this paper) or migration between the UK and Poland (as presented below), where it serves as additional source of information for UK reported flows. We also examine a separate model that excludes the freedom of movement variable, which is use for comparative purposes.

Preliminary Results

We present initial findings and are actively enhancing data quality assessment and refining our models. These early results are promising and indicate that ongoing improvements will lead to more accurate insights into international migration flows.

Our models reveal a dynamic shift in the destination preferences of Polish emigrants over time (Fig. 1). Prior to Poland's accession to the EU in May 2004, the majority of emigration flows were directed towards Germany. However, since 2004, we observed a significant shift in destination preferences. The share of emigrants heading to Germany decreased, making way for increased emigration to the United Kingdom, Italy, Ireland, Norway, France, and several other countries. These nations, upon opening their labor markets to Polish and other A-8 nationals, became attractive destinations.

A significant turning point occurred in May 2011 when Germany, granted freedom of movement to A-8 citizens. This policy change resulted in a rapid reversal in the distribution of Polish emigrants' destinations, which resembled the patterns observed in the pre-accession years, where Germany regained its status as a prominent destination.

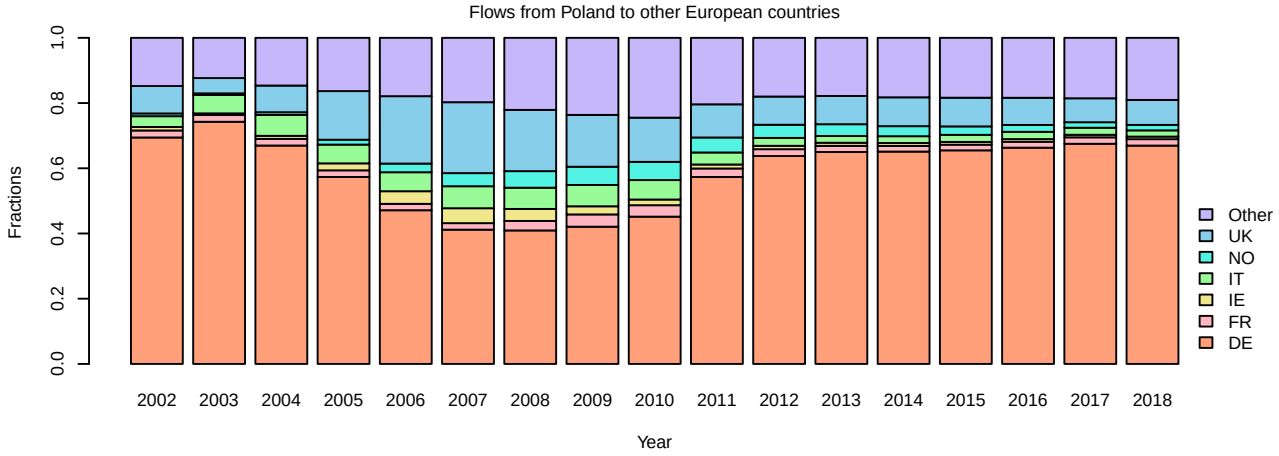

Figure 1: Fraction of migration flows from Poland to different European countries. Results of the model excluding LFS data.

The number of Polish emigrants to the old EU (EU-15), Switzerland (CH), and Norway (NO) exhibited dynamic changes over time, reflecting a fluctuating pattern similarly as observed in Fig. 1 (Result of the model without LFS data). Emigration levels started at around 100,000 in 2002 and gradually increased to approximately 200,000 by 2007. In 2008, two significant events occurred: Poland's accession to the Schengen Agreement in December 2007 and the global economic crisis in mid-2008. While the impact of co-occurring these events on emigration flows is difficult, we observed a decrease in Polish emigration flows, which declined to approximately 150,000. However, a significant shift occurred in 2011 when Germany granted freedom of movement to A-8 citizens, including Poles. This policy change led to a rapid "recovery" in emigration flows, which reached around 250,000 by 2013. Subsequently, the pace of growth decelerated, but emigration continued to rise, reaching nearly 300,000 by 2018 (not shown).

In Figure 2, we present year-specific migration flow patterns for four exemplary cases (panels a to d: PL to DE, DE to PL, PL to NO, and PL to UK). Each panel displays the results of three distinct models: one with the freedom of movement of workers variable, another without this variable, and the IMEM model [18] (results of this model are only available for the years 2002-2008). The shape, size, and transparency of the data points reflect data quality issues and variations in migration definitions among the considered countries. Our model successfully addressed these challenges, including data availability, to generate reasonable predicted migration flows.

The first panel (Fig. 2a) illustrates the flows from Poland to Germany. Germany reports flows based on a very short duration of stay definition of a migrant (less than 1.5 months, varying by Federal State (Bundesland)), while Poland defines migrants based on a permanent stay definition, leading to significant undercounting for specific years. Both countries face reduced accuracy due to

various problems with their registration systems. Until 2011, all models produce similar predicted flows, as expected, falling between the overcounted German and undercounted Polish data. In 2011, the model incorporating freedom of movement demonstrates its advantage. While the model without freedom of movement smooths the estimates, the more complex model readily captures the spike in migration flows associated with Germany's granting of freedom of movement to workers in May 2011.

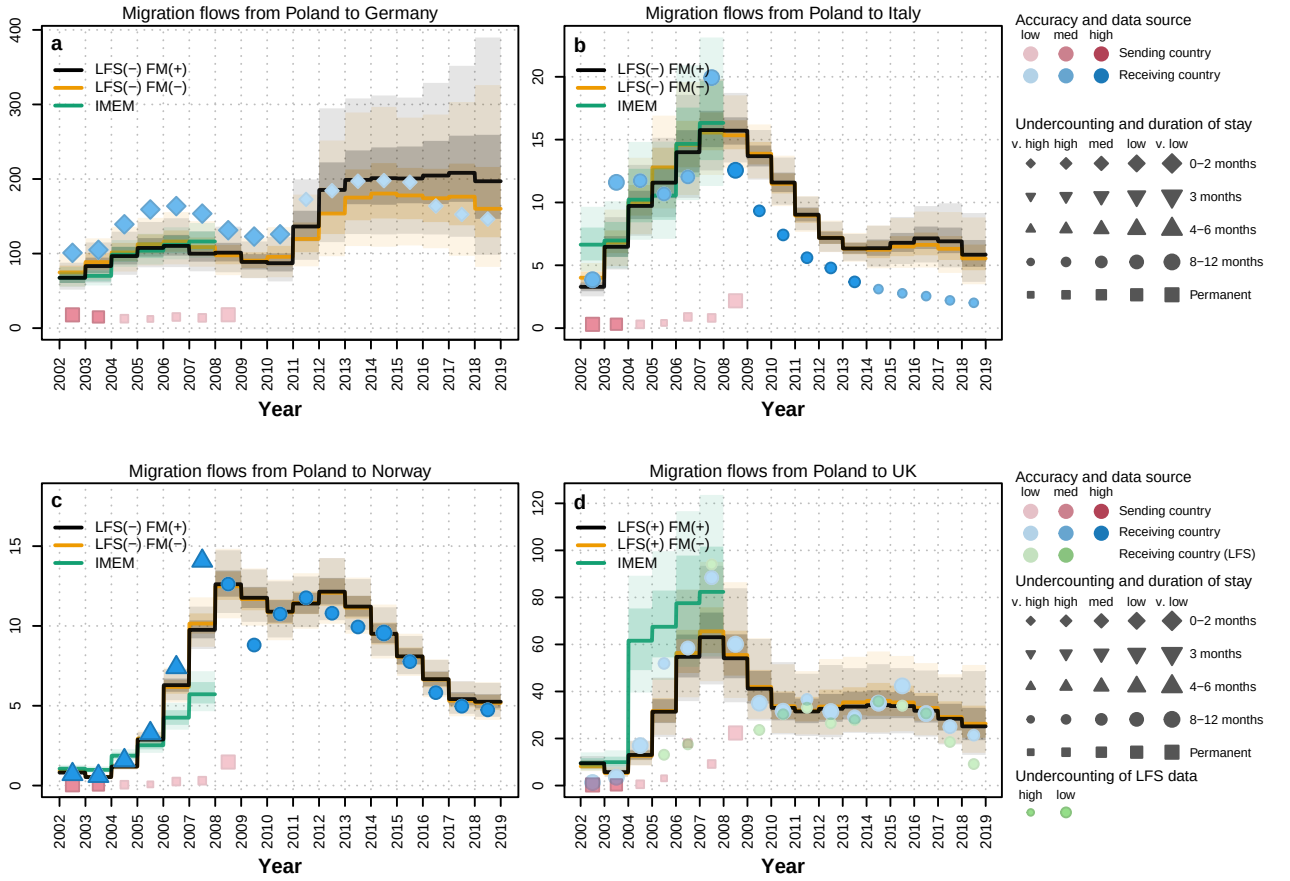

Figure 2: Selected migration flows related to Poland. The black lines represent the results of the fitted model including the freedom of movement variable, the orange lines show results of the model without this variable, and the green line shows results of the IMEM model. The shaded areas represent the 50% and 95% confidence intervals. The size of the data points indicates the level of undercounting, with smaller points indicating higher undercounting. Administrative data is classified into five levels of undercounting, while LFS data have two levels (panel d only). The transparency of the points indicates the level of accuracy, with more transparent points representing higher accuracy. Administrative data accuracy can take one of three levels. The shape of the data points describes the duration of stay in months. For more details, refer to the legends.

The second panel (Fig. 2b) illustrates flows from Poland to Italy. Italy provides data based on a 12-month definition of the duration of stay; however, these data suffer from significant undercounting issues. Conversely, Polish data are of poor quality and substantially underreport migration flows. Notably, the freedom of movement for Polish workers was granted end of July 2006, resulting in a noticeable spike in migration flows in 2007. However, due to the average accuracy of these data, it represents a relatively weak signal for the model to be captured perfectly. Our results closely align with those of the IMEM model, with the exception of the year 2002.

The third panel (Fig. 2c) displays flows from Poland to Norway. Norwegian migration data exhibit higher quality than Polish data but still experience minor issues, such as a 6-month stay definition until 2007 and some undercounting problems according to our bilateral flows ratio model [5; 6] and expert opinions [1]. As anticipated, the fit of all models closely aligns with Norwegian data rather than Polish data. The IMEM model does not capture the freedom of movement because full relaxation of restrictions for Polish workers in Norway occurred in 2009. Similarly, our model,

including the freedom of movement variable, does not indicate a rapid increase in migration flows, as the relaxation of movement restrictions in Norway was gradual (see introduction for details).

The fourth panel (Fig. 2d) portrays flows from Poland to the UK. This panel also includes LFS data points reported by the UK, as we incorporate these data into our model. While the UK granted freedom of movement immediately after Poland's accession to the EU in May 2004, the increase in immigration flows was not immediate and took time, likely due to the geographical distance between PL and the UK, which could delayed the decision of migration. Both of our models capture this gradual shift, whereas the IMEM model predicts a rapid increase in migration immediately after Poland's accession to the EU in 2004, which suggests that our model is more robust in the estimation of flows compared to the IMEM model.

Conclusions

We extended and refined a hierarchical Bayesian model, based on earlier models [18; 7], to estimate international migration flows from 2002 to 2018 among 31 European countries. Our model incorporates data from administrative sources and the EU Labour Force Surveys. To address data inconsistencies and measurement errors, we applied a harmonization method. Additionally, our unified migration model based on smooths and migration shock variables, i.e., freedom of movement and accession to Schengen, allows us to estimate migration flows even for countries with limited data availability.

Our analysis revealed dynamic shifts in Polish emigration patterns over the years, likely influenced by various factors including EU accession, the granting of freedom of movement, and economic events. Prior to Poland's EU accession in 2004, Germany was the primary destination for emigrants. However, during post-accession period, we observed a redistribution of emigration to other European countries, particularly the United Kingdom, Italy, Ireland, Norway, and France. The granting of freedom of movement to A-8 workers by Germany in 2011 was a significant turning point, which led to increased emigration to Germany, returning to the pre-accession patterns. Indeed, these turning points highlight the impact of EU policy changes on migration trends. Our models effectively captured the effect of these policy changes while older model seemed to face problems due to more general approach to modeling the freedom of movement variable.

These are early findings, and we are in the process of refining our data quality assessment and models. These initial results show promise to quantify the impact of policy changes on migration flows in Europe. As we continue to work and develop our analyses we expect to be able to expand the results and related insights.

Our research contributes to a deeper understanding of European migration dynamics and the role of policy changes in shaping emigration patterns. Our refined Bayesian model, capable of handling data inconsistencies and limited availability, offers a robust tool for estimating migration flows and can support policymakers and researchers in analyzing and anticipating migration trends in Europe.

References

[1] Aristotelous, G., Smith, P. W. F. and Bijak, J. [2022], *Technical report: Estimation methodology. QuantMig Project Deliverable 6.3.*, The Hague: Netherlands Interdisciplinary, Demographic Institute (NIDI-KNAW)/University of Groningen.
URL: http://quantmig.eu/res/files/QuantMig%20deliverable_6_3.pdf#page=11

[2] Barker, E. R. [2021], The expansion of the european labour market, Technical Report QuantMig D9.5, Netherlands Interdisciplinary Demographic Institute (NIDI-KNAW)/University of Groningen, The Hague, Netherlands.
URL: http://www.quantmig.eu/res/files/QuantMigD9.5ELMExpansionV116Dec2021.pdf

[3] Barker, E. R. [2023], 'A timeline of freedom of movement in the european economic area', *Open Research Europe* **2**(133). Last updated: 11 Sep 2023.
URL: https://open-research-europe.ec.europa.eu/articles/2-133

[4] Cassis, I. [2012], 'Free movement of workers and schengen, Report ref. 1116899'. European Free Trade Association. **URL:** https://www.efta.int/sites/default/files/documents/advisory-bodies/parliamentary-committee/pc-reports/14-84773121112_Report_Free_Movement_Workers592473_557211_0.pdf.

[5] Dańko, M. J. [2022], 'Undercountmigscores v0.7.5. assessing the level of undercounting in the internationalmigration flows reported by Eurostat', *GitHub repository* . **URL:** https://github.com/MaciejDanko/UndercountMigScores.

[6] Dańko, M. J., Wiśniowski, A., Jasilionis, D., Jdanov, D. A. and Zagheni, E. [2023], Assessing the quality of data on international migration flows in europe: the case of undercounting. MPIDR Working Paper WP-2023-026, 17 pages, Max Planck Institute for Demographic Research, Rostock, **URL:** https://www.demogr.mpg.de/en/publications_databases_6118/publications_1904/mpidr_working_papers/assessing_the_quality_of_data_on_international_migration_flows_in_europe_the_case_of_undercounting_7791/.

[7] Del Fava, E., Wiśniowski, A. and Zagheni, E. [2019], 'Modelling international migration flows by integrating multiple data sources', *SocArXiv* .
URL: osf.io/preprints/socarxiv/cma5h

[8] Dølvik, J. E. and Eldring, L. [2006*a*], 'EU enlargement two years on: what challenges to the Nordic labour market? ', *Nordic Labour Journal* .
URL: http://www.nordiclabourjournal.org/artikler/forskning/research-2006/eu-enlargement-two-years-on-what-challenges-to-the-nordic-labour-market

[9] Dølvik, J. E. and Eldring, L. [2006*b*], 'The Nordic Labour Market two years after the EU enlargement. Mobility, effects and challenges', *TemaNord* **558**.

[10] European Commision [2023], 'Free movement - EU nationals'. Accessed: 2023-09-15.
URL: https://ec.europa.eu/social/main.jsp?catId=457

[11] Kennedy, A. and Fiorucci, L. [2023], 'Free movement of workers', *European Parliament: Fact Sheets on the European Union* . Accessed: 2023-09-15.
URL: https://www.europarl.europa.eu/factsheets/en/sheet/41/free-movement-of-workers

[12] Koikkalainen, S. [2011], 'Free Movement in Europe: Past and Present', *Migration Policy Institute: Migration Information Source* . Accessed: 2023-09-15.
URL: https://www.migrationpolicy.org/article/free-movement-europe-past-and-present

[13] Lazarowicz, A. [2015], 'Governance of the Free Movement of EU Citizens: Weathering the Storm of Politicisation', *PISM Policy Papers* **105**, 1–9.

[14] Mooyaart, J. E., Dańko, M. J., Costa, R. and Boissonneault, M. [2021], Quality assessment of European migration data, Technical Report QuantMig D6.2, Netherlands Interdisciplinary Demographic Institute (NIDI-KNAW)/University of Groningen, The Hague, Netherlands.

[15] Nowok, B. [2007], Evolution of International Migration Statistics in Selected Central European Countries, *in* J. Raymer and F. Willekens, eds, 'International Migration in Europe', John Wiley & Sons, Ltd, Chichester, UK, pp. 73–87.

[16] Nowok, B. [2010], Harmonization by simulation: a contribution to comparable international migration statistics in Europe, PhD thesis, University of Groningen, Groningen, Netherlands. OCLC: 955134815.

[17] Nowok, B. and Willekens, F. [2011], 'A probabilistic framework for harmonisation of migration statistics: Harmonisation of Migration Statistics', *Popul. Space Place* **17**, 521–533.

[18] Raymer, J., Wiśniowski, A., Forster, J. J., Smith, P. W. F. and Bijak, J. [2013], 'Integrated Modeling of European Migration', *J. Am. Stat. Assoc.* **108**, 801–819.

[19] The European Parliament and the Council of the European Union [2001], 'Council Regulation (EC) No 539/2001 of 15 March 2001'. Listing the third countries whose nationals must be in possession of visas when crossing the external borders and those whose nationals are exempt from that requirement.
URL: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32001R0539

[20] Traser, J. S. [2007], *The Polish Experience of Free Movement of Workers After EU Accession*, Biuletyn Informacji Publicznej RPO. Accessed: 2023-09-15.
URL: https://bip.brpo.gov.pl/pliki/1190979632

[21] *Wikipedia: Swobodny przepływ osób* [2023]. Accessed: 2023-09-15.
URL: https://pl.wikipedia.org/wiki/Swobodny_przep%C5%82yw_os%C3%B3b

[22] Wiśniowski, A. [2017], 'Combining Labour Force Survey data to estimate migration flows: the case of migration from Poland to the UK', *J. R. Stat. Soc. Ser. A. Stat. Soc.* **180**, 185–202.