# A panel VAR analysis of migration in Europe*

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**Abstract**

Migration flows for European countries are an important factor to the economy, whether net receivers or senders of migrants. With such differing migratory and macroeconomic profiles within Europe, one migration model can't fit all. To examine the effects of migration shocks, we empirically analyse the effects of net migration on the macroeconomy, government finances, and the labour market in panel VAR models using mixed frequency data across Europe. We group the selected European countries into four categories based on macroeconomic and migration characteristics enabling a larger number of countries to be included in the analysis. The results show that net (e)migration matters for an economy with different countries better able to absorb the shocks. The fiscal policy implications are extended to assess the flows of migration, including push and pull factors from the labour market.

**Keywords:** Migration, Panel VAR, Bayesian Econometrics, Public Finances
**JEL Classification:** C33, E62, F22, J11

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# 1 Introduction

The common labour market of Europe is one of the largest, and arguably unique, in the world but what are the effects of being in a labour market with such differences between members? Since 2004, the market has accepted 13 new countries, and lost one. With official candidate (CC) and potential candidate countries (PCC), the expansion of the European Union is inevitable. The CC and PCC are all Eastern European and Turkey. The real GDP per capita of Montenegro, North Macedonia, Serbia, Bosnia and Herzegovina, and Kosovo for 2019 was less than 25% of that of the EU-15, with Turkey at 37% which provides a distinct economic pull factor.[1] With expansions, come increases to net immigration for (the majority of) existing member states but what are the effects of increases to net immigration, and conversely net *emigration*? The topic of migration is evolving as countries and economies develop, in addition to the post COVID-19 economic recovery. The geography and common labour market of Europe meant that the reduction in migration flows of 17% of intra-EU flows (which accounts for a significant proportion of total migration) was relatively low compared to an average reduction of more than 30% of total permanent migration flows for OECD countries (OECD, 2021) during 2020. This drop leads to the prospect of immigration and emigration shocks occurring once economies recover from the pandemic and borders open up fully. However, the time series empirics of migration are relatively unexplored due to lack of lengthy migration data. In this paper, we examine the effects of net immigration for countries who are net receivers of immigrants, and net emigration shocks for countries who are net senders of migrants on (i) the macroeconomy, (ii) the fiscal budget, (iii) the labour market, and (iv) drivers of net migration.

**Existing Literature** We build on the panel VARs presented in Boubtane et al. (2013); d'Albis et al. (2019) which examine increases to net migration on 22 and 19 OECD countries respectively, over the periods 1987-2009 and 1980-2015 on GDP, unemployment and

[1] Source: Own calculations using Eurostat tables nama_10_gdp and demo_pjangroup.

employment and where d'Albis et al. (2019) assess the impacts of migration on fiscal finances. Morley (2006) showed long-run relationship between per capita GDP and immigration but none for immigration and per capita GDP using annual data for Australia, Canada and the USA for 1930-2002. Pope and Withers (1993) find that immigrants in Australia do not increase the unemployment rate, rather the arrival of immigrants results in at least as many jobs created as immigrants taking up employment. Recent work by Furlanetto and Robstad (2019) and Smith and Thoenissen (2019) examine the effects of migration on the macroeconomy of the Norway and New Zealand respectively. While d'Albis et al. (2016) use a constructed data series using immigration permits for France, and Kiguchi and Mountford (2017) and Weiske (2019) for the United States. Barker (2020) focused on the macroeconomy with inclusion of government investment, tax revenues, and debt for Canada and Germany. Results for both countries showed statistically insignificant responses for government investment and a reduction in government consumption. There was an insignificant response to government debt for Germany and a decrease in net liabilities Canada. Additionally, Maffei-Faccioli and Vella (2021) for the labour market of Germany.

Our paper differs from Boubtane et al. (2013); d'Albis et al. (2019) in a number of ways, namely the use of countries, methodology and areas of the macroeconomy under analysis. Firstly, we have a focus on Europe, such that there are more countries, including ones that have net emigration or not yet introduced into the wider macroeconomic migration literature, and are put into further groups to aid analysis. We employ Bayesian techniques and sign restrictions, which helps isolate the labour supply shock. Existing papers have a narrow focus, thus we use a larger data set and a timeline which is quarterly rather than annual and more recent. Since the levels of international migration have increased significantly since 1990 to 2010s, it enables a more up-to-date view of migration. For European countries in particular, this period covers in more detail the effects of the Eastern Expansion of the common labour market. In the examination of migration drivers we include variables to aid explanation of the links between European

and a set of independent variables which help explain the role of freedom of movement within Europe.

**Methodology** We use 26 countries from the European Union, European Free Trade Agreement and the United Kingdom. In our panel VAR, we model four groups of countries: high-income and high-net immigration Western European countries (Group 1); lower-high-income low-net immigration Western European Countries (Group 2); Central and Eastern European (CEE) countries with positive net immigration (Group 3), and CEE countries with negative net immigration (Group 4). The inclusion of a group of countries with *negative net immigration* in a macroeconomic context is novel, as such migration has not been investigated before in detail across a number of countries.

We group the countries in the analysis to overcome problems arising from the short time period covered by the data. Using a panel VAR with eleven, five, four, and six countries in Groups 1–4 respectively, increases the number of observations (the sample size) used to estimate the parameters, while allowing to take the advantage from the similarities in macroeconomic and migration patterns between the countries in each group. The list of countries and a data snapshot is provided in Table 1. [2] We employ sign restrictions to isolate migration shocks from business cycles as per Furlanetto and Robstad (2019). A focus on Europe enables us to use a dataset where definitions are converged and reported to the same statistics body with countries that are net migration senders or receivers and to what level, and macroeconomy status. We employ three groups for those with net immigration, because it is not appropriate to analyse economies that have low net immigration rates with those who have high, and similarly those with high GDP per capita with those with low. The results show that shocks to net immigration are expansionary for the macroeconomy, to differing degrees, and contractionary for net emigration shocks.

The remainder of this paper is as follows: Section 2 details the data used in the

[2]Croatia, Cyprus, Iceland, Liechtenstein, and Malta are excluded from the analysis due to data limitations and the Netherlands is excluded due to problems with data uncertainty.

analysis; Section 3 describes the methodology employed, Section 4 presents the results; Section 5 provides a discussion on the results and its implications, and Section 6 concludes.

## 2 Data

In table 1 we present a series of summary statistics from the dataset and related information over the sample period 2002 to 2019.[3] The dataset features annual and quarterly data where the models are analysed using toolboxes by Canova and Ferroni (2020) and Dieppe et al. (2016).[4] Advanced modelling techniques and the use of mixed-frequency data enables a sample where more countries can be analysed so we can obtain a greater understanding of countries, and a panel VAR helps to overcome some of the limitations of the short sample. From the national accounts we use GDP, private consumption, investment, exports, and imports sourced from the OECD. For the government final consumption, fixed capital formation, social security benefits paid and received, taxes on production and imports, other current receipts, total direct taxes, property income paid and received, other current outlays, and net financial liabilities. For national accounts and government accounts the variables are expressed in real terms and logged. For population and labour market, unemployment rate, total employment, and population are sourced from the OECD with the percentage of the population aged 15-64 from the World Bank's World Development Indicators. Net financial liabilities is expressed as a percentage of GDP. Migration data is sourced from Eurostat, IMEM (2013) project (Raymer et al., 2013), or national statistics authorities.

There are independent variables which identify whether the CEE countries have joined the common labour market. We use the matrix by Barker (2021*b*) to generate the size of the common labour market, logged and in per capita terms.[5]

[3]The annual migration data for 2020 is unpublished at time of research. Further work will assess the implications of coronavirus and migration flows. It has yet to be seen whether the migration process has been postponed or a process which will not occur at all.

[4]Details of the data used and transformations are available in the appendix.

[5]Annual change is used rather than previous quarter due to the migration process using expectations and labour market frictions.

We group the countries in the analysis to overcome problems arising from the short time period covered by the data. Using a panel VAR with eleven, five, four, and six countries in Groups 1–4 respectively, increases the number of observations (the sample size) used to estimate the parameters, while allowing to take the advantage from the similarities in macroeconomic and migration patterns between the countries in each group. The list of countries and a data snapshot is provided in Table 1. The last two columns of the Table detail the percentage of Foreign-born population to show the relative concentration of foreign born residents is in each country.[6]

Table 1: Summary Statistics

| **Country** | **Net Mig. Rate** | **Real GDP PC (€)** | **Unemp. Rate** | **Wage Pre. to EU15** | **Fisc. Bal. to GDP %** | **Foreign-Born Pop. % 2011** | **2020** |
|---|---|---|---|---|---|---|---|
| *Group 1: Western Europe Countries - high net immigration and wage premiums* | | | | | | | |
| AUT | 7.35 | 58,273 | 5.05 | 1.18 | -3.36 | 15.45 | 19.78 |
| BEL | 6.38 | 55,158 | 7.67 | 1.07 | -4.34 | 14.81 | 17.59 |
| DNK | 3.55 | 69,385 | 5.77 | 1.83 | -2.10 | 9.30 | 12.30 |
| FIN | 3.72 | 53,961 | 8.12 | 1.23 | -4.02 | 4.52 | 7.12 |
| DEU | 5.27 | 53,464 | 6.81 | 1.17 | -2.12 | 11.14 | 18.09 |
| IRL | 7.39 | 72,600 | 8.62 | 1.14 | -4.24 | 16.13 | 17.64 |
| LUX | 22.39 | 116,251 | 5.07 | 2.89 | -0.27 | 32.49 | 48.18 |
| NOR | 9.37 | 109,214 | 3.63 | 2.02 | 6.76 | 11.55 | 16.17 |
| SWE | 9.23 | 68,302 | 7.07 | 1.32 | -5.12 | 14.70 | 19.54 |
| CHE | 9.20 | 92,371 | 4.61 | 2.34 | -1.78 | 24.65 | 29.16 |
| UK | 5.09 | 55,583 | 5.73 | 1.19 | -5.05 | 11.65 | 14.23** |
| *Group 2: Western Europe Countries - low net immigration and wage premiums* | | | | | | | |
| FRA | 1.84 | 50,468 | 9.09 | 1.02 | -6.49 | 11.29 | 12.66 |
| GRC | 0.11 | 27,849 | 16.19 | 0.41 | -8.34 | 11.91 | 12.58 |
| ITA | 6.79 | 44,044 | 9.37 | 0.66 | -4.49 | 9.70 | 10.33 |
| PRT | 0.62 | 25,676 | 9.76 | 0.48 | -6.08 | 7.15 | 10.63 |
| ESP | 8.00 | 34,320 | 16.32 | 0.66 | -5.71 | 13.46 | 14.78 |
| *Group 3: CEE Countries - net receiver of migrants* | | | | | | | |
| CZE | 2.75 | 20,567 | 5.84 | 0.37 | -6.39 | 3.70 | 4.99 |
| HUN | 2.87 | 12,348 | 7.33 | 0.32 | -6.01 | 4.44 | 6.08 |
| SVK | 0.98 | 19,519 | 12.65 | 0.28 | -7.32 | 1.26 | 3.64 |
| SVN | 3.87 | 25,077 | 6.91 | 0.59 | -5.21 | 11.15 | 13.44 |
| *Group 4: CEE Countries - net sender of migrants* | | | | | | | |
| BGR | -3.08 | 8,688 | 9.61 | 0.14 | -3.93 | 1.07 | 2.71 |
| EST | -0.21 | 22,036 | 8.49 | 0.40 | -3.10 | 16.00 | 14.92 |
| LVA | -9.78 | 16,430 | 11.10 | 0.32 | -7.78 | 1.26 | 3.64 |
| LTU | -11.90 | 16,675 | 10.05 | 0.29 | -6.27 | 4.90 | 5.46 |
| POL | -1.11 | 14,073 | 10.54 | 0.25 | -6.69 | 1.67 | 2.24 |
| ROU | -5.15 | 9,871 | 6.53 | 0.18 | -4.93 | 0.91* | 3.75 |

Average values 2002:2019. Source: Authors' calculations using data from Eurostat, IMEM database, OECD, and national statistics institute.
*Romania's foreign-born population from 2013 as data unavailable for 2011.
*The 2020 UK foreign-born population is taken from the ONS.

[6]Data is unavailable prior to 2009.

# 3 Econometrics Methodology

To formulate and estimate the forecasting models, we use toolboxes by Canova and Ferroni (2020) and Dieppe et al. (2016) for mixed-frequency data transformation and Bayesian panel VAR respectively (the latter via the BEAR toolbox: Bayesian Estimation, Analysis and Regression). We employ the approach of Canova and Ferroni (2020) relying on mixed-frequency VAR (MF-VAR), based on both annual and quarterly data from the national accounts, government accounts, unemployment and migration statistics. The Gibbs sampler is used in the reduced-form VAR, to estimate the quarterly observations of the variables (Canova and Ferroni, 2020, p 54). The BEAR (Dieppe et al., 2016) toolbox is used for the panel VAR modelling. The analysis contains $N$ countries, $n$ variables, $p$ lags, and covers $T$ quarters. The element of the panel VAR model related to country $i$ $(i \in 1, 2...N)$ is specified as:

$$y_{i,t} = \sum_{j=1}^{N} \sum_{k=1}^{p} \Psi_{ij,t}^{k} y_{j,t-k} + \epsilon_{i,t} \tag{3.1}$$

where $y_{i,t}$ is a $n$ x 1 vector of $n$ endogenous variables for country $i$ at time $t$. The matrix of coefficients is given by $\Psi_{ij,t}$, of size $n$ x $n$, and $\epsilon_{i,t}$ is a vector of $n$ x 1 vector white noise error terms with $\epsilon_{i,t} \sim N(0, \Sigma_t)$ as specified by Dieppe et al. (2016). The model is estimated with four lags, $p = 4$, corresponding to one year. The contemporaneous mutual impacts of different variables for each country are introduced through the covariance matrix $\Sigma_t$, allowing for reverse (reinforcing or dampening) feedback effects to occur simultaneously in the same period. To take advantage of the panel structure, the borrowing of strength between different countries occurs not only through $\Sigma_t$, but also via the matrices of vector autoregressive parameters $\Psi_{ij,t}$.

As we are using Bayesian methods, we need to make a number of prior assumptions. The approach relies on a pooled estimator, with data for all countries pooled together to estimate a single, homogenous VAR model, with four lags and no constant in each model, with estimation based on 5000 iteration runs of the Gibbs sampler (following a

burn-in of 500 iterations). The parameters and hyperparameters follow standard values from macroeconomic literature encoded in the BEAR package with the conjugate multivariate normal-inverse Wishart model structure: the normal priors for the autoregressive parameters are centred around 0.8, indicating a belief *a priori* in relatively large autocorrelations, whereas the marginal priors for the residual and factor variances are assumed to follow (tightening) inverse Gamma distributions with the shape parameter 1000 and scale parameter 1, to prevent the forecasts from exploding too fast (Dieppe et al., 2021).

# 4 Results

To analyse the effects of a possible increase (shock) to net migration at a macroeconomic level, we can also use a panel VAR in the spirit of d'Albis et al. (2019)[7] to consider the effects of net immigration into and net emigration out of European countries. We consider four models, where the central focus for each is the macroeconomy, fiscal budget, labour market, and drivers of migration.

The IRFs presented in this section are shown together with their 67-per cent confidence (*credible*) intervals, demonstrating the uncertainty of the responses of individual variables to migration shocks in a particular scenario. The shocks are of the magnitude of one standard deviation estimated for the observed series, but of course for a policy analysis, this parameter can be arbitrarily changed, depending on the user needs. As is standard in the macroeconomic literature, we look at one-time shocks in the first period under study. As before, default priors are used for estimating the Bayesian panel VAR models.

[7] d'Albis et al. (2019) examines OECD countries. In comparison, we drop the OECD Pacific (Australia, Japan, New Zealand, and South Korea), Canada and the United States. We continue with 13 of the 15 OECD European countries and add 13 other European countries.

### Model 1: The Macroeconomy

In the first model, besides migration, we look at the variables from the national accounts (expenditure approach), such as the GDP, investment and consumption, with the vector of endogenous variables in Model 1 defined as follows (all variables are listed in Table 2):

$$y_t = [\mathrm{NM_t}, \mathrm{C_t}, \mathrm{X_t}, \mathrm{GDP_t}]'$$

The IRFs for Model 1 are shown in Figure 1. The axes are normalised so that we can see the relative scale of the effects on each of the four groups of countries. The responses to the net emigration shock in Group 4 are inverted to aid comparison of responses between different groups of countries. One period is equal to one quarter. At $t = 0$ there is a shock, or rather increase, to net immigration (emigration for Group 4). The IRFs show the responses to each of the variables listed in the vector of endogenous variables.

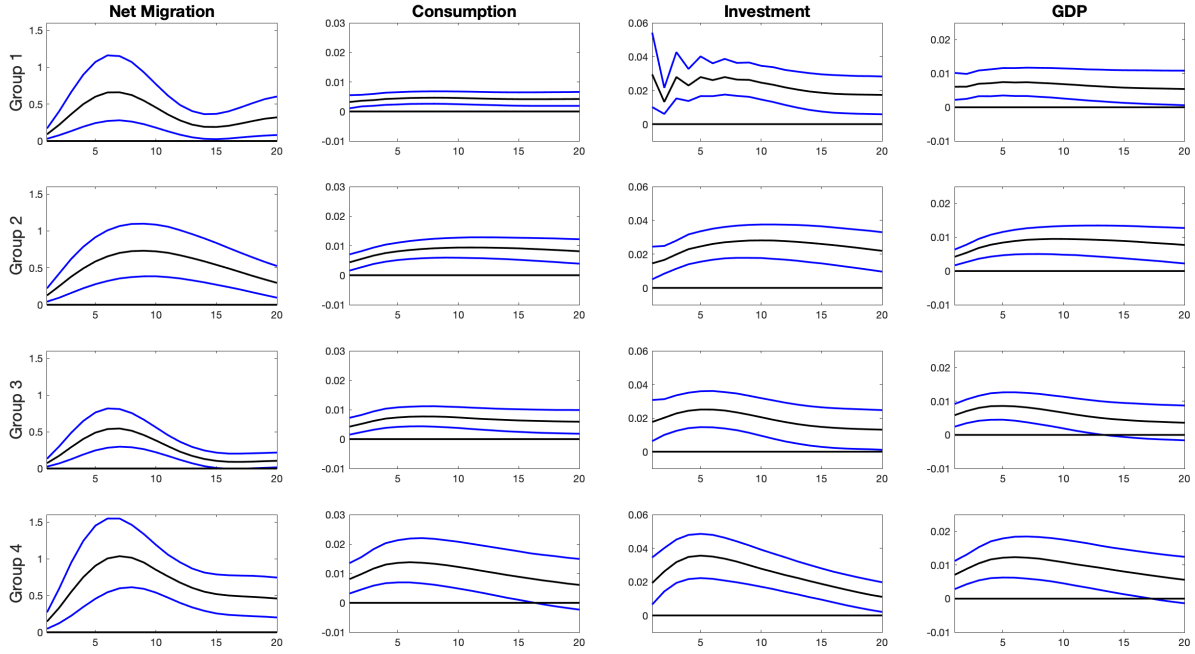


Figure 1: Impulse Responses for a Net Migration Shock in Model 1

The responses to a one standard deviation net immigration shock for Groups 1-3 and a net emigration shock for Group 4. The vertical axis identifies the responses in percentage deviations from trend. The horizontal axis identifies the quarter after the shock, up to five years (20 quarters). The column identifies the response of a variable which is in the column heading, and the row corresponds to the country group in the row heading. The responses to the variables of Group 4 are inverted to aid comparison.

An important thing to note is the size of net migration shock in each group. The shock size in Group 1 is relatively smaller than any of the others, while in Group 4 it is the largest. Overall, the impulse responses indicate that, in macroeconomic terms, net immigration proves to be expansionary, and net emigration contractionary. The effects on investment are particularly differing in magnitude between the different groups of countries. The increase in Group 1 and large decrease in Group 4 shows that investment is relatively sensitive to changes in migration flows. The large fall in private investment for Group 4 countries suggests that the economy is particularly vulnerable to financially active individuals leaving these countries.

### Model 2: The Fiscal Budget

The second model considers the effects of migration on the fiscal budget, and vice versa. The variables included are similar to the ones in d'Albis et al. (2019). The vector of endogenous variables therefore in Model 2 is set as follows:

$$y_t = [\mathrm{NM_t}, \mathrm{GovPur_t}, \mathrm{NetTaxRev_t}, \mathrm{FisBal_t}, \mathrm{GDP_t}]'$$

The fiscal balance is calculated thus, with hats denoting impulse responses of variables (d'Albis et al., 2019): $100*(NT/GDP(\widehat{NetTax}_t - \widehat{GDP_t}) - GP/GDP(\widehat{GovPur}_t - \widehat{GDP_t}))$. The impulse response functions corresponding to migration shocks are shown in Fig. 2 :

The results show that net immigration is expansionary to the fiscal budget, by increasing (net) tax revenues and reducing government transfers.[8] The effects on government transfers are prolonged for Group 1, whilst the effects for Groups 2–4 only decrease for three years. For the Western European nations, in Groups 1 and 2, the improvement in the fiscal balance is larger and longer-lasting. For Group 3, the effects are only short-lasting, and in addition, for Group 4, they can be very large. The effects for Group 4 would be concerning from a policy perspective, as they could indicate brain drain, or at least that

[8]Further studies with *Tax Revenue* rather than *Net Tax Revenue* show increases as well.

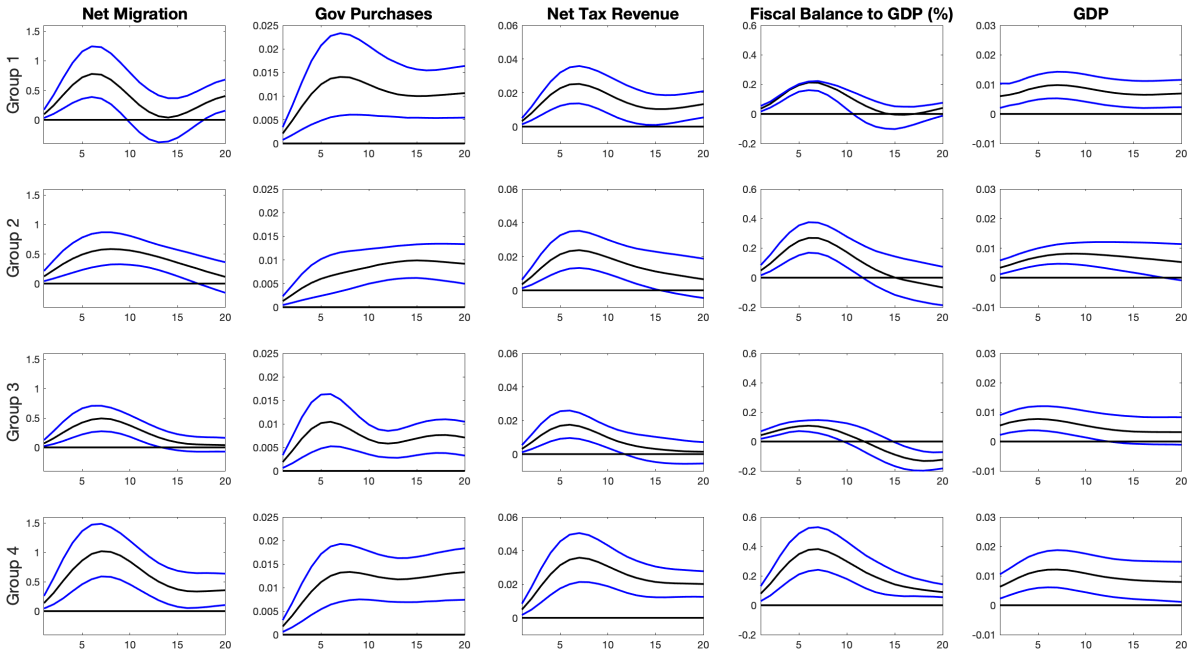


Figure 2: Impulse Responses for a Net Migration Shock in Model 2

The responses to a one standard deviation net immigration shock for Groups 1-3 and a net emigration shock for Group 4. The vertical axis identifies the responses expressed as percentage deviations from trend. For $\text{FisBal}_t$, the changes are expressed in percentage points. The horizontal axis identifies the quarter after the shock, up to five years (20 quarters). The column identifies the response of a variable which is in the column heading, and the row corresponds to the country group in the row heading. The responses to the variables of Group 4 are inverted to aid comparison.

the higher earners and thus larger contributors to government finances are emigrating. Group 1 gains the most in terms of net tax revenue (tax revenue minus transfers), as well as a relatively small increase in government purchases. These results are consistent with existing literature (d'Albis et al., 2019; Furlanetto and Robstad, 2019). The increase in tax revenues occurs both through direct and indirect means – directly from the receipts of consumption and labour taxes due to new migrants being more likely employed, and indirectly through the stimulation and expansionary effects on the economy.[9]

[9]As shown in Figure 1, there is an increase in private consumption – as tax rates remain largely unchanged (or even increase during expansionary periods) – higher levels of consumption generate more income for governments. There is an equivalent argument for labour market revenues (see Figure 3).

### Model 3: The Labour Market

Expansionary or improving labour markets are some of the largest migration pull factors within Europe. As such, in the third model, we incorporate the unemployment and employment rate as the key labour market-related drivers of migration.[10] The vector of endogenous variables in Model 3 is therefore as follows:

$$y_t = [\mathrm{NM_t}, \mathrm{Unemp_t}, \mathrm{Emp_t}, \mathrm{WageSal_t}, \mathrm{GDP_t}]'$$

The impulse response functions are shown in Figure 3. This analysis is potentially one of the most important from a policy (and political) perspective, since one key argument of anti-immigration parties is that immigrants take the jobs of natives and decrease or suppress wages, at least in some segments of the labour market.

The results for this model show that increases in net immigration (respectively, net emigration) reduce (increase) unemployment and increase (decrease) employment. The changes for unemployment significantly differ from zero for all countries, with between 0.2% decrease on impact, rising to up to 0.8% after three years (Group 2). The increase in employment helps demonstrate that the effects of migration do not cause an exit of people from the labour market, but rather lead to an increase of overall labour supply. For Group 3, the impacts are much quicker to return to average (un)employment levels, whilst the wages and salaries show more long lasting effects. On the whole, the improvements in the labour market for net immigration countries, are mirrored by the labour market deterioration for the countries with net emigration. The effects visibly differ from zero, even allowing for errors, and are persistent.

The reduction in unemployment is consistent with the findings of Furlanetto and Robstad (2019), who looked at the example of Norway. One reason is that immigrants are likely to enter the labour market as employed – would-be immigrants will likely search for a job in their current location then move to the receiving country once they

[10]The unemployment rate is calculated the percentage of unemployed persons of all economically active persons. Employment rate is the employment as a percentage of all working-age people.

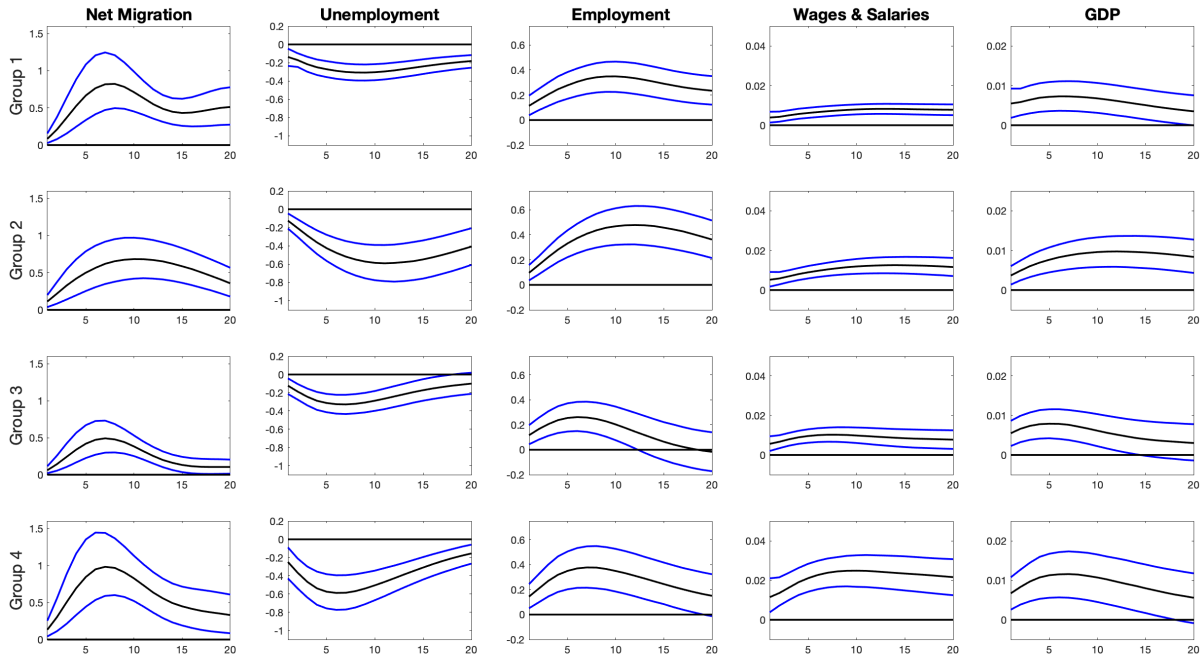


Figure 3: Impulse Responses for a Net Migration Shock in Model 3

The responses to a one standard deviation net immigration shock for groups 1-3 and a net emigration shock for group 4. The vertical axis identifies the responses in percentage deviations from trend. For $\text{Unemp}_t$ and $\text{Emp}_t$, the changes are expressed in percentage points. The horizontal axis identifies the quarter after the shock, up to five years (20 quarters). The column identifies the response of a variable which is in the column heading, and the row corresponds to the country group in the row heading. The responses to the variables of Group 4 are inverted to aid comparison.

have found employment. In addition, the peaks in the responses to immigration shocks are after generally after two years (8 quarters), which allows the business cycle effects, or feedback from expansion to GDP, to play a role in expanding the economy. The results are in line with the theoretical and empirical models presented in Barker (2021*a*).

At the same time, the effects on unemployment and wages, in particular, are also of interest due to the Borjas (2006) and Card (2005) debate about the complementary (or, conversely, substitute) nature of migrant and native labour. Whilst this debate comes from a microeconomic standpoint, rather than a macroeconomic one, it is nonetheless relevant, despite the focus on the United States, where the role of migrants can be different to that in Europe, especially in two key aspects. Firstly, the migration policies differ: the European common labour market makes achieving legal migration status much easier than visa-based routes. Secondly, the skill level of migrants provides another key

distinction factor, even more notable on a macroeconomic scale than on a microeconomic one. If a new migrant earns an above-average wage, this increases the average wage slightly, and to a similar extent increases the level of complementarity between natives and migrants.

As this is such a country-dependent topic, highly- or low-skilled migrants may be either substitute or complementary, depending on the exact circumstances. The challenge of incorporating this issue into a formal analysis remains beyond the scope of this report, although arguably issue this constitutes yet another source of uncertainty, this time in the theoretical description of migration patterns, their drivers and impacts.

### Model 4: Drivers of Net Migration

There is a large literature dedicated to examining the macro-level pull and push factors and drivers of migration, including Massey et al. (1993) or Grogger and Hanson (2011). Still, most of the pull factors of immigration operate at a microeconomic level, even those with the labour market focus. Workers are more likely to migrate to countries that have better employment opportunities, and higher labour income, which enables them to experience higher consumption levels. We investigate this in the fourth model, with focus on the wage premium variable. The wage premium is particularly effective for Group 1 and Group 4 countries, as it explains the large wage gaps observed for these countries. The vector of endogenous variables in Model 4 is set as follows:

$$y_t = [\mathrm{NM_t}, \mathrm{Cons_t}, \mathrm{WagePre_t}, \mathrm{Emp_t}, \mathrm{GDP_t}]'$$

For the final model, including the drivers of net migration, the impulse response functions are presented in Figure 4. Here, the effect of a migration shock on wage premium is only significant for Group 1. No other country group seems to be noticeably closing the wage premium gap, and there may be a slight increase of the gap for Group 4. From a broader perspective, continued migration into Group 1, increasing the wage premium, may be

counterproductive for economic convergence between different country groups.

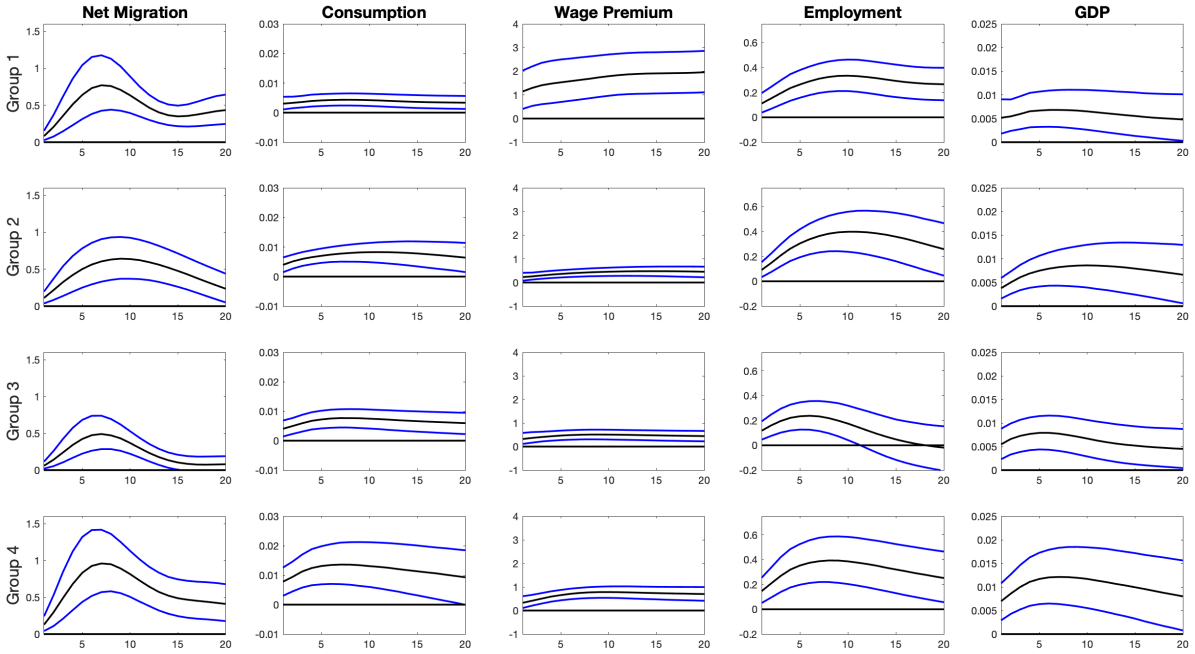


Figure 4: Impulse Responses for a Net Migration Shock in Model 4

The responses to a one standard deviation net immigration shock for Groups 1-3 and a net emigration shock for Group 4. The vertical axis identifies the responses in percentage deviations from trend. The horizontal axis identifies the quarter after the shock, up to five years (20 quarters). The column identifies the response of a variable which is in the column heading, and the row corresponds to the country group in the row heading. The responses to the variables of Group 4 are inverted to aid comparison.

# 5 Discussion

In evaluating the role of migration on the macroeconomy, important data limitations need to be mentioned. A significant portion of migration can be attributed to economic (labour) migration. Since a migrant needs to apply for a job to gain employment, this must be in response to a posted vacancy. There are data available for vacancies, however, the required detail does not cover the required sample period or enough countries. The number of vacancies would be an interesting indicator for the effect of the financial crisis and pandemic in particular: while fiscal policies employed by governments limited the impacts of the crisis on unemployment levels, vacancies were significantly impacted.

On the whole, Bayesian VAR methods presented here enabled assessing, even if partially, both the aleatory, as well as epistemic features of the migration uncertainty.The panel VAR is approximated by the parameters of the model (and their uncertainty), which can be identified from the data and – where available – prior knowledge, for example elicited from experts.

A factor for further investigation would be how increases to net migration affect productivity – however this is only available for half of the countries in our sample. Furlanetto and Robstad (2019) see that there is an increase in Total Factor Productivity (TFP), which agrees with the findings of Peri (2012) as to the positive link between immigration and TFP. An increase to TFP improves the productivity across factor inputs as such would increase the productivity of workers, and hence forth wages.

The topic on the labour market effects, in particular wages, of natives continued to Dustmann et al. (2013) and Card (2012). The point made by these papers is that their research looked at no more than two sectors, which Borjas looked at more. Thus from a macroeconomic level, where in effect only one type of wage is considered, then we are more likely to see an increase.

Net immigration is expansionary for the macroeconomy and improves the fiscal budget balance with net emigration resulting in the opposite. A negative response to unemployment indicates that migrants are quickly absorbed into the labour force and employment, and/or stimulate further employment of natives as found by Albert (2021). The increase in unemployment for the countries with net emigration indicates that it is the employed leaving and business cycle effects causing the contractions. This is a concern for the net senders of migrants and has potential policy implications for those seeking to join the European Union, who face the trade off from the benefits of joining the Common Market for goods, capital, and services, with the (likely) loss of persons due to the economic pull factors in the rest of Europe. Only Turkey had a GDP per capita greater than Bulgaria or Romania in 2019.

**Future Changes** Estonia and Poland, in particular, from Group 4 could move into Group 3 looking at recent trends. Both countries have seen immigration increase such that net immigration has become positive in the last two years of the sample. Slovenia, aside from its' geographical location in Central Europe, has a profile that is close to the countries in Group 2, though will for the foreseeable future still be associated with CEE countries even if the macroeconomic profile is sufficiently into Group 2.

The United Kingdom will likely drop out of Group 1, and the analysis, due to exiting the European Union in 2020, with a significant reduction in the flow of CEE immigrants who are typically employed in low-skill industries which fail to meet the wage earnings set out in the new immigration policy. The independent variable for size of the common market would be significantly tested. In addition, some explanatory variables such as wage premium and GDP that we calculated in euros for analysis, is no longer available such that the United Kingdom would likely be removed from further analysis.

# 6 Conclusion

The research has introduced new countries into time series analysis of net immigration and net emigration. The effects of an increase to net immigration (emigration) in per capita terms has expansionary (contractionary) effects to the macroeconomy and labour market. The results presented in this paper show the effects of net migration differ across (groups of) countries as acknowledged by Bijak (2010) and Disney et al. (2015). They explain that forecasting migration is difficult due to the number of social, economic, and political factors driving migration decisions that are difficult to model and hence predict (see also e.g. Willekens, 2018). The differing effects between countries in groups 1 and 2 which include the OECD countries that were grouped together in d'Albis et al. (2019), and in group three shows that net immigration cannot be assumed to be same across all net receivers of migrants. The results are equally important for senders of migrants.

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# Appendix

## A Data Sources

Croatia, Cyprus, Iceland and Malta are not included to lack of data availability. The study excludes Netherlands due to an inability to categorise the country and non-macroeconomic rules and legal policies that cannot be explained with macro-level data. Due to the lack of countries providing the deflator for the General government fixed capital formation (PIGAA), we substitute it for the Gross total fixed capital formation deflator to ensure consistency across the country selection.[11]

**Independent Variables** For the variable which shows the increase in the common labour market, the country is only included in its first full period of inclusion. For example, the 2004 expansion came into force on 1st May 2004 which is part way through the second quarter. The increase in labour market is shown in the third quarter. Due to search and matching frictions in the labour market, the effects are more likely to be seen in the third quarter. The treatment is continued when restrictions on accession countries were lifted.

[11] Of the country sample, only Belgium, Denmark, Finland, France, Germany, Iceland, Norway, Sweden, and the UK provided PIGAA.

Table 2: Data Variables and Descriptions

| **Variable** | **Description** | **Source** | **Transformation** |
|---|---|---|---|
| *Migration* | | | |
| NM | Net Migration | Eurostat, IMEM, Nat. Stat. | Per 1000 WA Residents |
| Emig | Emigration | Eurostat, IMEM, Nat. Stat. | Per 1000 WA Residents |
| Immig | Immigration | Eurostat, IMEM, Nat. Stat. | Per 1000 WA Residents |
| *National Accounts - Expenditure* | | | |
| GDP | Gross Domestic Product | OECD - CARSA, DNBSA | Real, Per WA, Logged |
| Cons | Private Consumption | OECD - CARSA, DNBSA | Real, Per WA, Logged |
| X | Private Investment | OECD - CARSA, DNBSA | Real, Per WA, Logged |
| *National Accounts - (General) Government* | | | |
| GovCons | Gov Final Consumption | OECD - CARSA, DNBSA | Real, Per WA, Logged |
| GovInv | Gov Fixed Capital Formation | OECD - CARSA | Real, Per WA, Logged |
| SocSecP | Social security benefits paid GG | OECD - CARSA | Real, Per WA, Logged |
| SocSecR | Social security benefits received GG | OECD - CARSA | Real, Per WA, Logged |
| TaxProdImp | Taxes on production and imports | OECD - CARSA | Real, Per WA, Logged |
| TaxOther | Other current receipts | OECD - CARSA | Real, Per WA, Logged |
| TaxDir | Total direct taxes | OECD - CARSA | Real, Per WA, Logged |
| PropIncP | Property income paid | OECD - CARSA | Real, Per WA, Logged |
| PropIncR | Property income received | OECD - CARSA | Real, Per WA, Logged |
| OutOther | Other current outlays | OECD - CARSA | Real, Per WA, Logged |
| GovPur | Government Purchases | GovCons+GovInv | |
| TaxRev | Tax Revenues | TaxProdImp + TaxDir + SocSecR + PropIncR + TaxOther | |
| Transf | Transfers | SocSecP + PropIncP + OutOther | |
| PubSpen | Public Spending | GovPur + Transf | |
| *Labour Market* | | | |
| Unemp | Unemployment 15-64 % | Eurostat | |
| Emp | Employment 15-64 | Eurostat - 1000 presons | Per WA, as % |
| WageSal | Wages and Salaries | Eurostat | Real, Per WA, Logged |
| WagePre | Wage Premium to EU 15 | Eurostat | WageSal to WageSal-EU15, as % |

Variables, description, sources, and transformation for data included in the estimation. Data apart from migration and those in percentages are logged (log-transformed) during the estimation. **Abbreviations used:** WA = working-age population. Nat. Stat. = National statistic offices. CARSA = National currency, current prices, annual levels, seasonally adjusted. DNBSA = Deflator, national base year, seasonally adjusted. Variables are deflated by using the GDP deflator unless a corresponding one is available. *Wage premium to EU-15* is a ratio of wage and salary data taken from the national accounts via Eurostat, transformed into real terms, per working-age population, relative to that of the EU-15 countries.