POLICY PAPER SERIES

IZA Policy Paper No. 106

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August 2015

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Policy Paper No. 106
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IZA Policy Paper No. 106
August 2015

ABSTRACT

Labour Mobility and Labour Market Adjustment in the EU*

This paper assesses macroeconomic determinants of labour mobility and its role in the adjustment to asymmetric shocks. First, the paper develops stylised facts of mobility at the national and sub-national levels in the EU. Then, it explores the macroeconomic determinants of bilateral migration flows. Econometric evidence suggests that labour mobility increases significantly when a country joins the EU. While euro area membership seems not to be associated with an overall rise in the magnitude of mobility flows, workers do appear more ready to move from countries where unemployment is high to those where it is lower. Thirdly, the paper looks at mobility as a channel of economic adjustment by means of a VAR analysis in the vein of Blanchard and Katz (1992). Results indicate that mobility absorbs about a quarter of an asymmetric shock within 1 year. Movements in response to shocks have almost doubled since the introduction of the euro. Real wages have also become more responsive to asymmetric shocks during the same period.

JEL Classification: J61, J64

Keywords: labour mobility, geographic mobility, migration, gravity, adjustment, asymmetric shocks, optimal currency areas, European Union

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* Earlier versions of this paper were published as Economic Paper 539 in the European Economy series of the European Commission, and Chapter II.1 of the Report 'Labour Market and Wage Developments in Europe 2015' of DG EMPL, European Commission, while an abridged, nontechnical version appeared in the Quarterly Report on the Euro Area of the European Commission (2015, 1st quarter). Opinions expressed in this paper are those of the authors and may not reflect the views of the European Commission. The authors would like to thank Laurent Aujean, Robert Anderton, Anne Bucher, Lewis Dijkstra, Georg Fischer, Valerie Jarvis, Robert Strauss and Sebastian Weber for helpful comments as well as Prakash Loungani and Davide Furceri for useful discussions.

1. Introduction

Labour mobility received attention in the early debate on the Economic and Monetary Union (EMU). It was stressed that the reduced room for absorbing asymmetric shocks (economic shocks that affect some countries only) via macroeconomic policy tools in a monetary union required a sufficient degree of labour mobility as an alternative adjustment channel. Empirical analysis revealed that, as compared with other monetary unions, notably the US, EU countries participating in EMU did not exhibit a comparable degree of mobility, and mobility played a minor role in the process of adjustment (Blanchard and Katz, 1992; Decressin and Fatás, 1995). Several years have passed since the outburst of the financial crisis, and there is growing attention to the potential contribution of labour mobility to counteract the divergence in growth and unemployment among EU countries and particularly within the euro area.

The financial crisis and the ensuing current account and debt crises in the euro area acted as persistent macroeconomic shocks with asymmetric effects, radically changing the landscape of the euro area. The convergence in income per capita observed during the first decade of EMU was to a large extent reversed. Countries in the euro-area periphery witnessed capital flights, a protracted contraction in domestic demand amid deleveraging, and a marked deterioration in public finances. The rebalancing process involving an adjustment in relative costs and prices between net debtor and net creditor members of the euro area is necessary for a durable reduction of external macroeconomic imbalances and the narrowing of unemployment divergences. Such a process, however, can be long-lasting and marked by considerable distress in the countries enduring competitive internal devaluation and high and protracted unemployment.

Against this background, labour mobility would help easing adjustment: it would permit a more moderate reaction of activity rates and part of the divergence in unemployment rates would be absorbed by mobility rather than real wages.

The paper starts out by assessing main stylised facts and trends. Cross-country mobility flows in the EU appear to remain considerably lower as compared with those recorded in other highly integrated areas, most notably the United States, and well below mobility within countries. Moreover, the majority of the population of migrants in most EU Member States is from outside the EU rather than from other EU countries. Nevertheless, cross-EU mobility is on an upward trend, and not only due to the enlargement of the EU to Eastern European countries with high outward migration rates.

The analysis then focuses on the macroeconomic determinants of mobility flows by means of '*gravity equations*', linking gross mobility flows some observable characteristics of origin and destination countries, their distance, and variables capturing the costs of mobility. Previous analyses mostly focused on long-term economic determinants of migration flows (e.g., Lewer and Van den Berg, 2008; Mayda, 2010; Ortega and Peri, 2013). Compared to existing analyses, this study makes a step forward in assessing the extent to which mobility flows have been influenced by the EU integration process and its interaction with labour market developments. Additionally, the estimation of gravity equations provides a benchmark to assess whether actual mobility trends reflect underlying fundamentals. Econometric evidence

suggests that EU membership raises mobility significantly. While membership of the euro area does not affect the size of mobility flows by itself, it increases the response of mobility to changes in the unemployment rate. This suggests that, within the euro area, labour mobility contributes to the adjustment to asymmetric shocks to a greater extent.

Finally, the analysis focuses on identifying the dynamic response of labour mobility to labour demand shocks that affect some countries only (asymmetric shocks). To that purpose, a Vector Auto Regressive (VAR) model in the spirit of Blanchard and Katz (1992) is estimated for a panel of EU countries. The aim is to assess simultaneously the co-movement of unemployment, inactivity rates and labour mobility in response to shocks to labour demand. As compared with recent analyses (e.g., Dao et al., 2014; Beyer and Smets, 2014), the focus is on mobility across countries rather than across regions. This is for two reasons. First, it keeps the analysis close to the type of adjustment that matters in response to country-specific shocks. Second, it permits to explore the behaviour of real wages in response to asymmetric shocks, as this is a key variable to allow the adjustment of relative unemployment rates. Results indicate that labour mobility absorbs about 25% of asymmetric shocks after one year and about 50% at peak, i.e., after about 5 years. It is also shown that the response of mobility, as well as that of real wages, has increased after monetary unification. At peak, the response of mobility for the post-unification period is about twice as large as that for the pre-EMU period.

Some caveats are in order in interpreting these results. First, the paper focuses on labour mobility within the EU. However, due to data availability, it is in some cases hard to disentangle whether mobility takes place fully within the EU or also with third countries. In particular, while the ‘gravity equations’ in the second part of the paper distinguish between flows within the EU and with third countries, the VAR analysis in the last part of the paper cannot. Such a distinction, although relevant from the perspective of the smooth working of the monetary union, is seldom pursued in similar analyses, partly because of the lack of sufficient data, partly because what is relevant from the viewpoint of the adjustment for the single country is the response of labour mobility to shocks, irrespective whether mobility flows take place with another member of the monetary union.

In this paper, the terms “mobility” and “migration” will be used interchangeably, although in the EU policy context, mobility refers to movements within the EU and migration to movements between EU and non-EU countries.

The paper is organised as follows. Section 2 reviews the case for labour mobility as an adjustment channel. Section 3 presents a number of stylised facts. Section 4 analyses the determinants of mobility flows by means of gravity equations. Section 5 assesses the dynamic response of labour mobility to country-specific shocks. Section 6 concludes.

2. Labour mobility as an adjustment channel

Since the onset of the monetary union, labour mobility within the EU attracted attention in the academic and policy debate. In the early debate on EMU it was stressed that the relatively low degree of labour mobility among EU countries would be a weakness of the forthcoming monetary union. The loss of exchange rate flexibility and an independent monetary policy would require alternative channels of adjustment in the presence of asymmetric shocks. Countries hit by persistent negative shocks would face high unemployment for protracted periods. Avoiding the economic and social costs linked to persistently diverging unemployment rates would require a sufficient degree of flexibility in real wages or a sufficiently mobile labour force. These were seen among the conditions for the EMU countries to be part of an "optimal currency area".

The low degree of labour mobility across EU countries as compared with US States can be linked to language and cultural differences, largely heterogeneous policy contexts, notably concerning the labour market, fiscal and social welfare policies. Some reasons underlying reduced labour mobility within Europe were considered to be linked to persisting legal and administrative barriers to the Single Market ensuing notably from limited portability of welfare rights, recognition of qualifications, access to regulated professions. Despite being a relevant adjustment channel, there are limits to what labour mobility can achieve in terms of shock absorption and there are costs that need not be neglected.

The strongest case in favour of adjustment through labour mobility is provided by situations in which persistent asymmetric labour demand shocks lead to persistent unemployment differences due to the rigidity of real wages. In such a context labour mobility is likely to result in lower overall unemployment and relatively limited impact on the rest of the population in both the source and the destination country. On the other hand it is well-known that, under fully flexible wages, migration is likely to bring aggregate gains, but with redistribution in favour of source country workers and against destination country workers, which see their earnings reduced in light of an increased supply of labour (e.g., Borjas, 1999). Moreover, migration may not be justified in case of short-lived, temporary shocks, as national automatic stabilisers could be sufficient to deal with temporary unemployment.

It should also be added that the effects of labour mobility go beyond those considered in standard, simplified, static models of international economics. In particular, from the viewpoint of the source country, the migration of skilled labour and the consequent phenomenon of *brain drain* may lower TFP and income growth rates (Commander et al., 2004). Moreover, in presence of large differences in tax and welfare policies across countries, migration could entail additional redistribution effects via the public budget, and the implications of government debt for future generations could be exacerbated by large-scale outward migration.

Finally, there is ample evidence showing that individual perceptions and attitudes towards migration tend to be more negative than justified on the basis of economic outcomes only, which constitutes an additional limit to what labour mobility can achieve by itself as a channel of adjustment to asymmetric shocks (e.g., Mayda, 2006).

3. Labour mobility in the EU: Stylised facts

3.1. Trends in cross-country mobility after EMU and enlargement

Mobility across the EU has been increasing over the past two decades, as measured by the share of EU population born in a different EU country (Graph 1). The increase is particularly evident when looking at data for the post-enlargement EU. Mobility rates are higher across the enlarged EU, and have been on an upward trend since the mid-2000s. This is mostly the result of large and growing flows from countries of new accession, notably Eastern European countries. However, growing mobility is not only from East to West. Mobility among countries that were Members of the EU before the 2004 enlargement also exhibits a positive, albeit moderate, trend over the past two decades.[1] Conversely, over the same period, mobility within the US appears to be on a downward trend, although from a higher level.

Despite this rising trend, mobility across EU Member States remains lower as compared to other world regions, most notably the US (OECD, 2012). In 2013, less than 5% of working-age EU citizens lived in a different EU country than where they were born (Graph 1). In the US, as a comparison, about 30% of the working age population lives in a state different from their state of birth.[2]

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Graph 1 about here
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Intra-EU mobility is relatively low also when compared to migration from outside the EU.[3] The share of intra-EU migrants in the working-age population is about half of the share of migrants born outside the EU (Graph 2).[4] Within-EU labour mobility appears somewhat higher if cross-border workers are taken into account: there are about 1.1 million EU citizens who work in another EU country (0.3% of the working age population) but do not reside there. In addition, there are about 1.2 million posted workers (0.4%), who were working for their home companies in another Member State for a limited period of time.

There are considerable differences in the size and composition of the foreign born population across EU Member States, with some regularities that are worth noting (Graph 2). First, the share of foreign-born population is in general lower in New Member States. In 2013, this share exceeded 12% in 12 of the 15 “old” Member States, while it remained below 12% in 12 the 13 New Member States. Second, in most countries the share of population born outside the EU exceeds the share of population born in other EU countries.

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[1] Recent surveys of EU mobility trends include European Commission (2014a, pp. 282-286; 2014b) and Barslund and Busse (2014).

[2] Own calculations based on 2010 data of the U.S. Census Bureau (2011). Comparable recent figures and historical data for the U.S. have been published by Molloy et al. (2011).

[3] Surveys indicate that the actual number of mobile Europeans is only a tiny fraction of those who would consider working abroad (e.g. in European Commission, 2013).

[4] In the US, the population share of working age people born outside the US is 16%, or about half the share of people who moved from one state to another (own calculations based on Pew Research Center (2012) tabulation of the 2010 U.S. Census).

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Graph 2 about here

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Recent developments in the share of foreign-born population also show great differences across countries (Graph 3).[5] In general, the weight of intra-EU mobility is higher in recent migration flows than in the stock of migrants which suggests a recent increase in the relative weight of intra-EU migration (compare Graphs 2 and 3).

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Graph 3 about here

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Inward migration flows were generally stronger in "old" Member States both before and after the crisis, but some changes took place with the crisis. The countries where the stock of migrants grew most before the crisis included countries on the euro area periphery like Ireland and Spain. In light of the crisis, in these same countries inflows adjusted downward to a large extent, while the stock of foreign-born population fell substantially in the Baltic countries.

Net migration flows in absolute terms (i.e. number of people rather than expressed as a share of population) are shown in Graph 4. Not surprisingly, the biggest flows in absolute terms are observed most populous Member States. The graph also confirms that net migration flows varied greatly through time in a number of Member States. In a number of EU countries such as the UK, Italy, Spain, net inward flows grew since the nineties, peaked at mid-2000s and fell after the crisis. Net migration flows turned from positive to negative after the financial crisis in countries severely hit by current account and debt crises, such as Spain, Greece, Ireland and Portugal. In a number of Eastern EU countries, notably Romania and the Baltics, net migration flows were generally negative since mid-1990s.

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Graph 4 about here

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Data on gross bilateral migration flows allow a more disaggregated look at the patterns of European mobility.[6] Graph 5 shows the largest absolute bilateral mobility flows observed in the data. A number of observations are in order. First, Most of the large absolute bilateral flows involve large countries. Germany is the most frequent destination country, but it also features as the origin country in three bilateral relationships.

Second, about half of the largest absolute gross bilateral flows, and notably the five largest ones, concerned pair of countries including a new Member State. The other half of the largest absolute gross bilateral migration flows are among two old Member States. These include flows from the "South" to the "North" (from Italy and Greece to Germany), from the "North" to the "South" (from the UK and Germany to Spain), within the "South" (from Italy to Spain)

[5] Data, based on the EU Labour Force Survey, that allows a differentiation between EU and non-EU migrants, go back to 2005 (see Annex A on the data sources).

[6] Gross bilateral migration flows are taken from OECD's International Migration Dataset (see Annex A on the data sources). The results shown in the following graphs may depend on data availability, as data availability is uneven across bilateral relationships.

and six bilateral relationships within the “North” (from France to Belgium, Germany and the UK, from Germany to Austria and the UK, and from Austria to Germany).

Finally, the aggregate time pattern of migration flows to different countries is reflected also in bilateral relationships: in particular, large bilateral flows to Spain peaked in the pre-crisis period, while large bilateral flows to Germany increased in the post-crisis period.

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Graph 5 about here
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Graph 6 provides a detailed time profile of absolute and relative annual net migration by destination country. The graph confirms that countries that were greatly affected by current account reversals and debt crises (e.g. Spain, Cyprus, Ireland) saw a rapid reduction in net migration. It is also visible that this did not happen in a parallel fashion in all affected countries: the decrease occurred more rapidly in Ireland than in Spain, and it occurred in Cyprus only after 2011, reflecting broader economic developments. Net migration was negative before the crisis In Latvia and Lithuania; it fell further and considerably in the first years of the crisis and rebounded in the latest years.

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Graph 6 about here
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Graph 7 and Graph 8 show the largest gross bilateral migration flows relative to the population of the destination and origin countries, respectively. Some of the largest absolute flows appear among the largest relative flows as well, but a number of additional insights can be gained. First, some bilateral migration flows are large in relative terms in both directions. Relative to the smaller country’s population, flows in both directions between Austria and Germany, Ireland and the UK, appear among the largest. Second, a number of bilateral flows that are large relative to the population of the destination country are between neighbouring countries (e.g., from France and the Netherlands to Belgium, from Croatia to Slovenia, Romania to Hungary, Slovakia to the Czech Republic, Hungary to Austria). Finally, most of the bilateral flows that are large relative to the population of the origin country are from new Member States to large old Member States.

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Graph 7 about here
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Graph 8 about here
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Migrants differ from the rest of the population for a number of characteristics. Graph 9 shows the age composition of the total population and that of the population of individuals migrating to EU countries in 2012. The graph shows that the majority of migrants are between 20 and 40 years, an age bracket typical of individuals in tertiary education and prime working age.

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Graph 9 about here
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Finally, Graph 10 compares the employment rate of the population born in EU countries to that of migrants born in other EU Member States and outside the EU. On average, the employment rate of migrants from other EU countries is about 2 percentage points higher than that of the population born in a given country, while the employment rate of migrants from outside the EU is about 8 percentage points lower. This evidence is largely driven by the fact that relatively few migrants are not in working age, and that migrants coming from outside the EU have in general a lower education background and have to face higher legal and administrative obstacles.

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Graph 10 about here
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3.2. Sub-national mobility

Economic shocks in a monetary union can have a differential effect not only on different Member States but also on different regions of the same Member State. Thus, sub-national mobility continues to play a role in the adjustment to asymmetric shocks after monetary unification.

Graph 11 summarises information on annual sub-national and cross-country mobility rates for countries where data are available. About 1% of the population was mobile between NUTS2 regions of the same country, while about 0.5% of the population has migrated from another country (about the half of which from another EU Member State). Thus, in 2013 about five times as many people moved to another region in the same EU Member State than moved between two EU Member States. This ratio is comparable to that by Gáková and Dijkstra (2008) for 2005 and 2006 (their result was somewhat higher, in the order of 6 to 1). This is an indication that between-country mobility may have increased in the EU relative to subnational mobility.

Graph 11 also shows that there are considerable differences across countries concerning the relative importance of sub-national (regional) and international mobility. Countries with high regional mobility rates include large member States (France, Germany and the UK). At the same time, countries in which the regional mobility rate exceeded 1% in 2013 included smaller countries like Belgium and Denmark, while larger countries like Poland and Spain recorded a regional mobility rate below one-quarter of a percent.

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Graph 11 about here
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These figures are well below those for the U.S., where the annual inter-state mobility rate ranges between 1.5% and 3% depending on the methodology used for the calculations

(Molloy et al., 2011).[7] Contrary to the U.S. long-term trend (Molloy et al. 2011; 2014), migration between EU Member States has recently increased (see next Section).

Regional and cross-country migration interact with each-other because international migration flows may affect regions of the same country differently.

Graph 12 shows for each country the overall net migration rates and the same statistic for the region with the highest and lowest net migration rate. A comparison between the different lines helps identifying whether migration developments are characterised by country specific patterns common to all regions or by disparate migration rates across regions of the same country. The data suggest that among large Member States, large regional differences appear for Spain and France, while in Germany, Italy and the UK regional deviations from country-level trends appear to be somewhat smaller. Among smaller Member States, it is notable that large swings of the overall net migration rate in Ireland were reflected in almost parallel developments of both Irish regions. In contrast, relatively large and sustained regional disparities are observed in the Czech Republic, Hungary and Portugal. A high degree of dispersion of mobility rates across regions is also found in Greece and in the Netherlands respectively during the crisis period and in the early 2000s.

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Graph 12 about here
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Graph 13 focuses on a different measure of disparity across regions: it shows, besides the average country-level net migration rate for the post-crisis period, the standard deviation of regional net migration rates. The graph confirms that the regional disparity of regional net migration rates is greatest in the post-crisis period in Spain, France, the Czech Republic, Greece, Hungary and Portugal.

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Graph 13 about here
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4. Explaining mobility flows

This section investigates determinants of bilateral migration flows. Besides estimating the main drivers of migration flows globally, the section intends to answer the following questions. Does membership in the European Union and the euro area increase migration flows between countries? How do cyclical economic conditions affect bilateral migration?

4.1. The approach

A ‘gravity equation’ of migration flows is an appropriate method to analyse the determinants of bilateral migration flows. The term ‘gravity equation’ or ‘gravity model’ refers to a type of empirical regularity in economic interactions between countries. As a prominent application

[7] Molloy et al. (2011) argue that NUTS2 regions (the population ranging between 0.8 and 3 million) are of comparable size to many U.S. states. On this basis, mobility in the EU is about 80% of mobility in the US (taking lower-end estimates for the U.S.) lower estimates.

of the gravity model, it has been long noted that a country's trade with other countries is positively related with the trading partners' economic size but negatively related with the distance between both.[8]

Recent improvements in the quantity and quality of available data on bilateral migration have spurred a new literature on the determinants of migration making use of the gravity model.[9] The literature has found consistent evidence for a number of intuitive relationships: bilateral migration is positively related with the population of countries and negatively with the distance between them; furthermore, common language and past migration between pairs of countries increase migration flows.[10]

Recent studies have chosen a more structural approach, motivating the estimated gravity equations with a theoretical model of migration choice.[11] Only a few studies, however, have investigated the effect of business-cycle fluctuations on migration flows. Beine et al. (2013) show that the business cycle has a statistically significant effect on migration flows. They also find that mutual euro area membership increases migration flows, although their specification does not control for mutual EU membership.[12]

This paper complements previous analyses in that it places more emphasis of how the EMU and the crisis affected the magnitude and direction of migration flows, with a view to investigate whether mobility has gained importance in recent years as adjustment channel.

4.2. Specifying the gravity equation for migration

Bilateral gross migration flows are estimated in a gravity model. The dependent variable is gross migration flow from a given origin country to a given destination country. Explanatory variables include standard gravity controls, such as the product of populations of and distance between the origin and destination country; the expected gain from migration (proxied with per-capita GDP and unemployment rate in the destination country relative to that in the origin country); historical factors influencing the bilateral migration flows (common language, colonial history, as well as the magnitude of past migration between both countries, measured as the stock of migrants in 1990). A series of dummy variables is included to capture the interplay between the process of European integration and the economic context. First, dummy variables control for mutual membership in the EU and the euro area. Appropriate interaction terms allow testing whether the importance of relative unemployment rates has increased since the start of the EMU or during the crisis. In particular, the gravity equation for migration estimated in this paper is specified as follows:

[8] The gravity equation has been first used by Tinbergen (1962) to explain trade flows. Anderson (2010) and Head and Mayer (2013) provide surveys of the literature.
[9] E.g., reviews of the literature by Greenwood (2005), Anderson (2010) and Beine et al. (2014).
[10] E.g., Lewer and Van den Berg, 2008; Mayda, 2010; Pedersen et al., 2008. Studies with a focus on North America include Clark et al. (2007) and Karemera et al. (2000).
[11] E.g. Ortega and Peri (2013), which estimate the effects of immigration policies of destination countries on migration flows.
[12] The controls the authors employ only include mutual membership in the Schengen agreement.

$$\ln MIG_{ijt} = \beta_0 + \beta_1 \ln\left(POP_{it} \cdot POP_{jt}\right) + \beta_2 \ln\left(DIST_{ij}\right) + \beta_3 \ln\left(\frac{PCGDP_{jt}}{PCGDP_{it}}\right) + \beta_4 \ln\left(\frac{UR_{jt}}{UR_{it}}\right) + \beta_5 \ln\left(STOCK_{ij0}\right) + \beta_6\left(LANG_{ij}\right) + \beta_8\left(LINK_{ij}\right) + \beta_9\left(EU_{ij}\right) + \beta_{10}\left(EA_{ij}\right) + a_t + a_i + a_j + u_{ijt}$$

The dependent variable (defined in logarithm as all variables except for the dummies) is gross migration flow (MIG) from origin country i to destination country j in year t. Explanatory variables include standard 'gravity' controls like the product of both countries' populations (POP) and geographical distance ($DIST$). Some variables are included to control for factors that influence the expected individual gain from migration: the ratio of per-capita incomes ($PCGDP$) and unemployment rates (UR) of both countries. The relative unemployment rate is included in first lag to avoid potential endogeneity. Further variables control for the cost of migration, such as dummies for common language ($LANG$), and past colonial links ($LINK$) between both countries, as well as the stock of immigrants ($STOCK$) in destination country j from origin country i prior to the period of study. The effect of mutual membership of country pairs in the EU and the euro area (EA) is controlled for by suitably generated dummy variables. Time dummies (a_t) control for global trends and cycles.

Many unobserved factors may influence the propensity of a country's inhabitants to choose emigration and the relative attractiveness of destination countries. These factors are sometimes called 'multilateral resistance terms' in the literature. Origin and destination country dummies (a_i and a_j) are included to control for such time-invariant factors. Origin and destination country dummies also allow control for the possible problem of differing statistical methodologies used by different countries in the sample.

The log-log specification allows the estimated parameters to be interpreted as elasticities. While weaknesses and alternatives to the logarithmic specification have been discussed in the literature (see, e.g., Head and Mayer, 2013; Beine et al., 2013), it remains a standard way to estimate the gravity equation.

4.3. Data

Gross bilateral migration flows are taken from the OECD International Migration Database.[13] The database includes information of annual gross migration flows from about 200 origin countries to 38 destination countries. Data for the years 1992-2011 are used. Data are scarce for earlier years and incomplete for 2012.

Control variables were collected from the World Bank World Development Indicators. 'Dyadic' control variables describing the geographic distance between country pairs as well as information about common language and colonial history were collected from the publicly available database of CEPII as documented by Mayer and Zignago (2011). Past bilateral migration stock, used as a control variable, is from the World Bank. For a description of these data, see Ozden et al. (2011).

[13] OECD (2013, pp. 311-315). See also Annex A on data sources.

4.4. Estimation results

In the following, two sets of results are presented. The first is from regressions run over the full sample; after the introduction of control variables, it includes 163 origin countries and 38 destination countries. The specifications run on the full sample are able to simultaneously analyse the determinants of migration among EU countries, among countries not belonging to the EU and between pairs of countries of which only one is a member of the EU. They therefore allow exploring the effect of accession to the EU on migration flows to and from other EU Member States. The second set of results is from regressions run on a sample restricted to EU15 countries, which allows focussing on the determinants of migration among pre-enlargement EU Member States.

Table 1 shows results obtained from the specifications run on the full sample. The table goes from a 'bare-bones' specification in column (1), through one including origin and destination country effects in column (2), to the full specification including interaction terms in column (3). The following observations can be made.

The product of both countries' populations and their relative level of GDP per capita have a strongly significant effect on migration flows. The estimation suggests that if either the origin or the destination country's population increases by 1%, gross bilateral migration increases by about half a percent. In a similar vein, if per-capita GDP in the destination country increases by 1% relative to the origin country, the gross bilateral migration flow increases by about 0.06%. When the equation is estimated with country effects, relative per-capita GDP and population lose explanatory power. This means that country dummy variables reflect country size and relative level of development on global migration flows.

Other traditional control variables (distance, common language, past colonial relationship, initial bilateral migrant stock) have a strongly significant effect on bilateral migration in the expected direction. These effects are robust to the inclusion of country effects.

The relative unemployment rate is estimated to affect migration significantly. If the unemployment rate of the destination country increases by 1% relative to the origin country, the bilateral migration flow to this country is estimated to decrease by about 0.14% in the specifications with country effects.

Mutual EU membership is estimated to increase bilateral migration flows by about 25%, everything else being equal, in the specification with country effects.

Finally, mutual euro area membership does not appear to affect migration by itself, but the estimated interaction terms indicate that it does influence migration flows (column 3). Mutual euro area membership intensifies migration toward countries with a relatively low unemployment rate, as suggested by the negative and significant estimated coefficient of the interaction term between the EMU dummy and the relative unemployment rate. This effect appears to have strengthened further in the crisis. This suggests that migration flows have contributed to the adjustment to asymmetric shocks more in the euro area countries than between other countries.

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Table 1 about here

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Table 2 presents gravity equations of gross migration flows among the "old" Member States (EU15). Rather than using interaction terms, this exercise analyses the development of migration patterns by estimating the same relationship on three different sub-periods: the full period 1992-2011; the period following monetary unification (1999-2011); the post-crisis years (2008-2011). All specifications include origin and destination country effects as well as year effects.[14] The following observations can be made.

Over the full sample period, population and relative per-capita GDP affect migration flows significantly among EU15 countries even in the presence of country effects. This indicates that there is a premium to "big-to-big" and "relatively-poor-to-rich" country migration among the "old" Member States.

The effect of other control variables (distance, past migration and common language) is strongly significant, goes in the expected direction, and is robust to the period chosen.

The relative unemployment rate is a significant determinant of migration flows among the EU15. Over the full sample period, the magnitude of the estimated coefficient is similar to that estimated on the global sample.

In the post-EMU period, the effect of the relative unemployment rate is higher than over the full sample period. This indicates that post-EMU, the role of migration as a cyclical adjustment channel between Old Member States has increased.

Post-crisis, the effect of the relative unemployment rate is similarly elevated as over the post-EMU period but the coefficient is not estimated precisely enough to reach statistical significance (potentially because of the relatively low number of observations). The effect of relative per-capita GDP is estimated to be higher than over the longer sample periods, which may be related to the fact that the crisis affected the euro area 'periphery' more than the 'core'. Finally, the "big-to-big" country premium is estimated to have disappeared after 2008, while the effect of other control variables is similar to the magnitudes estimated over the whole sample period.

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Table 2 about here

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4.5. The time profile of migration among old EU member states

Synthetic information on the time profile of mobility among EU15 countries is summarised by the year effects estimated in the specification on the restricted sample. Year effects pick up changes in the mobility that are observed across the board and are not explained by other factors controlled for (e.g., convergence in GDP per capita; changing disparities in unemployment rates; changing country composition of the sample).

[14] In the estimations for this restricted sample, variables controlling for past colonial relations and mutual euro area membership have been dropped for lack of variability.

Graph 14 presents the estimated year effects starting with 1995. The magnitude of the estimated year effects can be interpreted as a general increase or decrease of gross bilateral migration flows as compared to the baseline of 1992. A value of 0.15 in 2006 means, for example, that migration flows in that year were approximately 15% higher in general than in 1992 (after controlling for all factors included in the equation).

The mobility among EU15 countries increased rapidly starting from 2003, and peaked in 2008 about 25% above the levels of the early 1990s (Graph 14). After a drop in 2009 and 2010, mobility picked up in 2011. Despite these decreases, mobility in the EU15 remained overall at historically high levels throughout the crisis years.

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Graph 14 about here

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4.6. Country-specific time profiles

The previous subsection has established that (i) migration flows are affected by the unemployment differential between countries; (ii) that this effect is stronger in the euro area; and (iii) may have increased in the euro area during the crisis.

This subsection presents a visual analysis of the unexplained component of inward and outward migration flows of EU countries. The unexplained component of inward or outward migration is the weighted average (respectively by country of destination or origin) of the residuals from the regressions explaining mobility flows. It represents the part of migration flow which is not explained by structural and cyclical control variables. It provides information about time-variant factors affecting the propensity to migrate beyond those captured by the above variables.

Conversely, the unexplained component of migration flows does not provide information on common trends in migration as these trends are already captured by the year dummies included in the estimated gravity equations. Also, the unexplained component of migration flows cannot be used to compare the absolute magnitude of migration flows across countries. Overall differences across countries are captured by the origin and destination country dummies and thus are part of the explained component.

The unexplained component of migration flows is calculated by countries of destination and origin. It is calculated as weighted average of the residuals from the regression on the whole sample (column (3) of Table 1).[15] Since the gravity equation is specified in log-log terms, the unexplained component can be interpreted as follows: a value of 1 can be interpreted as implying that the actual migration flow was about double the prediction, while a value of (–1) can be interpreted as implying that the actual migration flow was about half the prediction.

[15] The weighting is done in proportion to the average magnitude of bilateral migration flows and to the number of observations in a given bilateral relation. The weighting ensures that the aggregate unexpected component of migration flows is not sensitive to large prediction errors in small bilateral migration flows. It is a consequence of the weighting that the unexplained component of migration flows by origin or destination country does not need to add up to zero over the sample period.

Graph 15 shows the unexplained component of mobility flows by destination country. Movements in the unexplained component of mobility inflows are largest in the Czech Republic, Lithuania, Portugal and Spain. In Spain, the unexplained component moves together with the cycle, suggesting that migration to this country was more pro-cyclical than in other countries. In the other three countries, the unexplained component appears to be largely pro-cyclical as well, but there appear to be idiosyncratic factors. Migration flows to the Czech Republic and Portugal were generally lower than predicted at the beginning of the sample period. Migration flows to Lithuania were higher than predicted in the first years observed in the early 2000s.

Also, there is some increase in 2010-2011 in the unexplained component of migration inflows into countries of the euro area core, i.e., Austria, France, Germany, Luxembourg and the Netherlands, while this is less clear in Belgium and Finland.

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Graph 15 about here

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Graph 16 shows the unexplained component of mobility flows by country of origin. There are more countries with marked movements in the unexplained component of outward mobility than inward mobility. There are a number of distinct patterns across countries:

A marked U-shaped pattern is observed for Greece and Spain and, to a lesser extent, Estonia, Latvia and Slovenia. This suggests that flows of outmigration are more pro-cyclical in these countries than in others. (For Spain, this could be confirmed also for immigration flows, but not for the other countries, potentially for lack of a sufficient number of observations).

In contrast, a hump-shaped development of unexplained outward mobility can be observed in some euro area countries (Belgium, Finland, the Netherlands) and non-euro area countries (Sweden, the UK, and to a lesser extent, Denmark).

There are different patterns observed across New Member States though the sample period: while the unexplained component of outward flows has been increasing for Bulgaria and Romania, it is decreasing for the Czech Republic and Croatia.

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Graph 16 about here

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5. Cross-country labour mobility and adjustment: a general framework

The previous sections have focused on the main trends of labour mobility across EU countries, and on their determinants. This section aims instead to analyse the role of labour mobility as an adjustment mechanism to asymmetric labour demand shocks.

5.1. Plan of the analysis

In a first step, a number of stylised facts concerning labour market dynamics are presented, with a view to assess regularities in the co-movement of employment, the activity rate, the unemployment rate, and labour mobility. It is also assessed whether the dynamics of these variables in each country are closely linked to the dynamics observed for the whole EU. This in turn allows assessing whether labour demand shocks are mostly common or country specific.

Subsequently, the methodology of Blanchard and Katz (1992) is applied to investigate how labour mobility in a typical EU country responds to shocks. Compared with recent analyses (e.g., Dao et al, 2014, Beyer and Smets, 2014), the focus is on mobility across countries rather than regions. Such a focus permits a better identification of the role of labour mobility in response to national asymmetric shocks. Compared with previous studies taking a cross-country perspective, (e.g., l'Angevin, 2007a,b), the availability of longer time series make it possible to examine if the contribution of labour mobility to labour market adjustment for the typical country has changed over time, most notably after the 2008-2009 crisis. Moreover, the role of real wages could not be assessed in previous studies because of the lack of data on wages at regional level. Focusing on cross-country mobility allows exploring the response of real wages to labour demand shocks.

Annual data are used to estimate a VAR (Vector Auto Regression) model using the whole panel of available countries over the period 1970-2013.[16] The panel structure expands the sample size (and results in a gain in statistical degree of freedom) which allows the assessment of whether, on average, the response of labour mobility to shocks has changed over time, possibly as a result of evolving integration across EU Member States. Finally, the labour market adjustment mechanism is evaluated for selected individual Member States. Since the sample size becomes more limited when individual countries are analysed, this exercise is conducted on quarterly data.

5.2. Analytical approach and literature review

In a monetary union, asymmetric shocks are expected to initially cause differences in unemployment and activity rates, which are absorbed over time via the adjustment of real wages, and via geographical mobility. In a country hit by a positive labour demand shock, workers are initially drawn from the unemployment pool and more inactive workers start entering the labour force. Overtime, real wages grow and, if the shock persists, the labour force starts growing also thanks to the inflow of workers from other geographical locations. Similar dynamics play out in the opposite direction in case of a negative shock.

[16] VAR is an econometric model used to capture the linear interdependencies among a set of macroeconomic variables.

With limited data on labour mobility, the standard approach in the literature is to follow the methodology by Blanchard and Katz (1992). Blanchard and Katz (1992) depart from the observation that variations in relative employment levels across US states persist over time, while relative unemployment and activity rates are stationary variables (i.e. shocks to these variables fade away after some time). The main idea is that if asymmetric shocks have permanent effect on employment but not on unemployment and activity rates, the change in employment levels must be absorbed by changes in the working age population. Assuming that labour demand shocks do not influence demographic trends, the response of relative population must reflect the response of labour mobility.

Note that the contribution of mobility is calculated as a residual: it is estimated as the change in employment that is not explained by changes in the activity rate and the unemployment rate. This implies that, as opposed to gravity equations which focus on bilateral mobility flows, this approach includes migration to and from third countries in its definition of adjustment through mobility.

Blanchard and Katz (1992) find that, in a typical US state, a 1% transitory negative labour demand shock raises the unemployment rate by 0.32 percentage points above the national average in the first year and lowers the activity rate by 0.17 percentage points. The effects on the unemployment and activity rates disappear after five to seven years; those on relative employment gradually build up, peaking at *minus* 2% after four years. This pattern implies a substantial role of inter-state mobility in the first years following the shock.

Subsequent analysis applied the same framework to other geographical areas. Table 3 summarises empirical findings of these studies. In each line of the table it is reported how much of the initial labour demand shock is absorbed after 1 year by changes of the unemployment rate, the activity rate and labour mobility, as estimated by the various studies.

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Table 3 about here

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Decressin and Fatás (1995) apply this framework to investigate regional labour mobility in the EU and compare the results to those obtained for the US states. Their sample covers the period 1975-1987 and comprises regions for France, Germany, Italy, the UK and Spain; Belgium, Denmark, Ireland, Greece, the Netherlands and Portugal are taken as single regions. They find that the labour market adjustment in the EU is characterised by a muted response of labour mobility as compared with the US, while the response of activity rates appear stronger. In Europe, it takes about four years for the effect on the activity rate and unemployment rate to disappear. In the US, net inter-state mobility accounts within the first year for 52% of the change in the relative employment and after three years for 70%. In Europe it is only after the third year that mobility accounts for a proportion similar to that reached in the US after only one year.

Bentolila and Jimeno (1998) analyse the response of the typical Spanish region to a labour demand shock and find that for the period 1976-1994 unemployment bears a significant

fraction of the adjustment, accounting for about one third of the change in employment after three years.

Dao et al. (2014) reassess the adjustment of the US states extending the Blanchard and Katz sample to 20 additional years. Compared to Blanchard and Katz, they find that the role of participation and unemployment has increased, while the contribution of inter-state mobility has decreased. Applying the methodology to European regions, they find that the short-term response of labour mobility has increased overtime.

Beyer and Smets (2014) reconsider the comparison between the US and European labour market adjustments made by Decressin and Fatás. In particular, they assess separately the adjustment to region specific shocks, to common shocks with asymmetric effects and to national shocks. They find that a significant difference between the EU and the US can be found only in the response of mobility to common shocks with asymmetric effects. In contrast, the mobility response to region specific shocks plays a relatively minor role both for the EU and the US, and appears to fall over time. Finally, inter-country mobility in response to country-specific shocks is less important than the inter-regional mobility in response to region-specific shocks.

Most studies on the EU focus on regional labour market adjustment. Only few have looked at the role of labour mobility for national labour market dynamics. In a study on the euro area covering the period 1970-2005, L'Angevin (2007b) finds that inter-state mobility plays a minor role in euro area countries and that, compared to the US, it takes more time for unemployment and participation to return to a long-run equilibrium after the shock.[17] Yet, restricting the sample to the period 1990-2005, the euro area labour market responds similarly to that of the US, with a larger contribution of labour mobility in the medium-term.

5.3 Data and empirical implementation

Data

The estimation of the average response to asymmetric labour demand shocks is conducted in an annual panel database that includes the 15 members of the EU before enlargement. Data are taken from the Annual Macro-economic database of DG ECFIN (AMECO). Employment and compensation per employee are from National Accounts, unemployment and the activity rate from the Labour Force Survey, compensation per employee is deflated with the GDP deflator.

The analysis of the pooled data makes use of a panel VAR framework that imposes the same dynamics on all countries. This restriction is removed when estimating the role of labour mobility in the adjustment of selected individual countries. Since the sample size becomes limited when single countries are analysed, the single-country analysis is based on quarterly data. Countries with the longest available data are analysed (Germany, Spain, France, Ireland, Italy and the UK) over the sample period 1998Q1-2013Q4.

[17] The effect of an asymmetric shock fades away after 7-8 years in the US and only after 15-20 years in the euro area. However, after 1990 the persistence of national unemployment rates has diminished in the euro area.

Labour market adjustment: some stylised facts

Before exploring the contribution of labour mobility to labour market adjustment, it is useful to review some stylised facts on the dynamics of employment, unemployment and labour market participation across EU countries.

Graph 17 depicts, for all countries in the sample, the growth rate of the level of employment, the activity rate and the employment rate (defined in this methodology as 1 *minus* the unemployment rate), relative to the EU average, since early 1970s. Defining the variables as deviations from EU average allows a focus on asymmetric shocks. Changes in labour mobility are derived as a residual from changes in employment that cannot be attributed to changes in unemployment or the activity rate. In Graph 17, changes in mobility can be gauged by subtracting both activity and employment rate changes from employment growth along the vertical axis.[18] The visual inspection of the data reveals diversity across countries, but few stylised facts stand out.

Relative employment growth and relative changes in the activity and unemployment rates tend to oscillate around constant averages. This is consistent with the assumption of the Blanchard and Katz model (see next subsection).

For some countries (e.g. Austria, Germany and Ireland until the crisis), national developments diverge only temporarily from the EU average, which is suggestive of the importance of common shocks.

The recessions that followed the two oil shocks of the early 70s had only a temporary effect on employment growth in several countries. This contrasts markedly with the persistent effects of the financial recession that hit Sweden and Finland in the early 1990s or with the effects of the 2008 financial crisis in Greece, Portugal and Spain. For these countries, shocks to employment growth had more persistent effects on unemployment, consistent with the evidence presented by Calvo et al. (2012) that labour market adjustment is sluggish particularly in recessions induced by disruptions of the credit channel.[19]

Fluctuations in employment growth relative to the EU average are matched by changes in either the activity or the unemployment rate or both. For example, fluctuations in employment growth were accompanied by changes in relative unemployment in Germany, Ireland, Italy, and Finland, while in the Netherlands, France and Sweden, relative employment growth moves together with the relative activity rate.

The difference between employment growth and the sum of the growth of activity and employment rates matches the changes in working-age population which mirrors labour mobility flows. A tendency towards greater inward mobility is visible in Spain, Ireland, Luxemburg, and the Netherlands; outward mobility is observed in Finland, Portugal, and

[18] Since the activity rate and the unemployment rate expressed as $a = L/P$ and $u = 1 - E/L$ respectively, where a and u are the activity rate and the unemployment rate, E is employment, L the labour force, and P is the working age population, then, denoting growth rates by a dot, it is easily shown that $\dot{E} - \dot{a} - 1 \dot{-} u = \dot{E} - (\dot{L} - \dot{P}) - (\dot{E} - \dot{L}) = \dot{P}$.

[19] Calvo et al. (2012) showed that recoveries that follow deep recessions are jobless or wage-less depending on the pattern of inflation during the recession episodes.

Sweden. A sustained inflow of workers characterised the increase in the Spanish and Irish employment before the 2008 crisis. The crisis reversed only partly this trend, with the negative labour demand shock leading to huge job destruction and a limited decline in the growth of the working age population. This pattern contrasts with that of Finland following the recession of the early 1990s, when a strong increase in unemployment was accompanied by a persistent and sizeable decline in the activity rate.

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Graph 17 about here

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The extent to which labour market disturbances are common across the EU or asymmetric can be inferred from Table 4. Following standard practice in the literature, country-level variations in the variables are regressed on developments for the EU15 aggregate. The β coefficients indicate how much of the change in the EU aggregate is transferred on national variables within the same year, while the R^2 measures the strength of the relationship between national and aggregate variables. A few facts are worth mentioning.

On average, 40% of the fluctuations in national employment growth are explained by EU15 developments, which is consistent with findings by L'Angevin (2007a,b) over the 1973-2005 period. This suggests that common shocks in the EU are more relevant at the country than at the regional level, but less relevant than in the case of US states.[20]

Employment growth is highly correlated with EU-level developments for the majority of countries; asymmetric shocks seem to prevail in Austria, Denmark, Greece and Luxembourg.

Country-level unemployment rates are in general generally more strongly correlated with the EU aggregate than in the case of employment growth. The same is true for activity rates, with the notable exceptions of Denmark, Finland and Sweden.

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Table 4 about here

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Analytical framework

Following Blanchard and Katz (1992), a vector auto regression (VAR) with two lags has been estimated for the following variables: the change in the logarithm of national employment, the logarithm of the activity rate and the logarithm of the employment rate (defined as 1 minus the unemployment rate).

All variables are relative to the respective EU means. The following subsection describes the VAR methodology in detail. VARs are standard tools for examining the dynamic interrelationships between variables. With a VAR each variable is regressed on its lags and the lagged values of the other variables. Each estimated equation can be used to simulate the response over time of the given dependent variable to shocks in other variables.

[20] The 0.4 regression coefficient is lower than the one found for the US (0.6) by Blanchard and Katz (1992), but higher than what found by Decressin and Fatás (1995) for regional data (0.2)..

The identification of the shocks is based on the assumption that unexplained changes in employment growth correspond to country-specific labour demand shocks. These shocks are assumed to influence within the year relative unemployment and activity rates, with a delayed feedback on employment growth.[21]

In a different specification, real wages are also included in the analysis, to gain insight on the role of relative wages in rebalancing Member States' labour markets. In the identification of the shocks, real wages are assumed to respond contemporaneously to labour demand shocks and to affect contemporaneously the labour supply through changes in the employment or in the activity rate.[22]

5.4. Specifying the VAR framework

Blanchard and Katz (1992) provide the standard framework to assess labour market dynamics. Each country can be thought of producing a given bundle of products; production factors are mobile across states. The labour demand relation in country i and year t can be expressed as:

$$w_{i,t} = -dn_{i,t} + z_{i,t},$$

where $w_{i,t}$ represents the wage rate, $n_{i,t}$ employment and $z_{i,t}$ labour demand. Coefficient d is positive reflecting a negatively sloping demand for a country's products. All variables are expressed as relative to the (weighted) average of the countries in the sample and are in logarithms. The relative labour demand depends on relative wages and country specific characteristics x_d that affects firms' locational decisions and do not change over time (i.e. are a source of permanent differences in employment levels):

$$z_{i,t+1} - z_{i,t} = -aw_{i,t} + x_{di} + \varepsilon^{d}_{i,t+1},$$

where $\varepsilon^{d}_{i,t}$ is a country specific labour demand shock. Changes in the labour supply are driven by the relative wage differential, local labour market conditions (the unemployment rate u) and other country specific characteristics x_s that affect workers' locational preferences:

$$n^{s}_{i,t+1} - n^{s}_{i,t} = bw_{i,t} - gu_{i,t} + x_{si} + \varepsilon^{s}_{i,t+1},$$

were $\varepsilon^{s}_{i,t}$ is a country specific labour supply shock. The relationship between wages and unemployment is

$$w_{i,t} = -cu_{i,t}.$$

The model is closed with the unemployment defined as the difference between labour supply and labour demand:

$$u_{i,t} = n^{s}_{i,t} - n_{i,t}.$$

[21] Shocks are identified with Choleski decomposition of the variance-covariance matrix of reduced form residuals with the order: employment growth, employment rate, activity rate.

[22] The identification strategy orders the variables in a way that real wages come after employment growth but before the other variables. The log of relative real wages are included in the VAR as first differences (i.e. they are assumed to be non-stationary). Panel unit roots tests confirm their non-stationarity.

In the long run, relative employment growth and relative unemployment are determined by the following equations:

$$\Delta n_i = \frac{cax_{si} + (cb + g)x_{di}}{ca + d(cb + g)}$$

$$u_i = -\frac{w_i}{c} = \frac{dx_{si} - x_{di}}{ca + d(cb + g)}$$

Employment growth is determined by country specific factors x_{di} and x_{si}. In countries more attractive to companies, the inflow of firms leads to higher wages and lower unemployment, which stimulates the arrival of workers that allow for employment growth to be permanently higher. In countries more attractive to individuals, the inflow of workers pushes wages down and unemployment up. Labour and firm mobility ensures that the effect of labour demand shocks on relative wages, unemployment and participation rates are transitory.

A VAR is estimated to investigate the response of employment, unemployment and participation rate to an asymmetric labour demand shock, i.e., all variables are expressed as deviations from the respective national means. For any variable, the following decomposition holds: $y_{it} - y_t = (y_{it} - \beta y_t) + (\beta - 1)y_t$. The first component represents the asymmetric shock while the second common shocks with asymmetric effects. Therefore, the focus of the analysis is on country specific shocks and common shocks with asymmetric effects.

The fact that asymmetric shocks have permanent effect on employment levels but not on unemployment and participation rates has two consequences. First, the change in employment levels must occur through labour mobility. Second, the VAR should be estimated with the relative employment in first differences and the employment rate (defined as 1– unemployment rate) and the activity rate in levels.

The following VAR with two lags has been estimated:

$$v_{it} = A + A_1(L)v_{it-1} + f_i + \varepsilon_t,$$

where v_{it} is the vector $(\Delta n_{it}, le_{it}, lp_{it})$; Δn_{it} is the first difference of the logarithm of employment in country i minus the logarithm of aggregate employment in the EU; le_{it} is the logarithm of the employment rate (1 – unemployment rate) in country i minus the logarithm of the employment rate (1 – unemployment rate) in the EU; lp_{it} is the logarithm of the participation rate in country i minus the logarithm of the participation rate in the EU.

A key identifying hypothesis of Blanchard and Katz (1992) framework is that innovations to the employment growth equation are exogenous labour demand shocks. This is a reasonable hypothesis when the correlation between unemployment rates and employment growth is negative, while this correlation is positive if growth derives mostly from labour supply. A panel regression of unemployment rate on employment growth gives a significant slope of (–0.56), implying that the hypothesis that innovations to employment growth mostly represent demand shocks is valid also for the EU sample.

The hypothesis that innovations to the employment growth represent labour demand shocks is implemented through orthogonalised (i.e. uncorrelated) shocks. Since the variance covariance matrix of the estimated errors ε_t is unlikely to be diagonal (i.e., errors in the equation are likely to be correlated), the residuals of the equations have to be decomposed in such a way that they become orthogonal. The Choleski decomposition represents the standard way to do this. In practice, it consists in ordering the variables in the VAR so that shocks to the variables that comes earlier affect the following variables contemporaneously, while those that came after affect the previous variables only with a lag. Thus, it this assumed that labour demand shocks affect the unemployment rate and the participation rate contemporaneously. Supply side shocks effects are assumed to operate through uncorrelated shocks to the employment rate or the participation rate.

Another identifying assumption is that country-specific characteristics create constant differences across countries that can be modelled as fixed effects f_i. Since the fixed effects are correlated with the regressors through the lagged dependent variables, fixed effects are eliminated expressing variables as deviation from their country specific means.

The availability of data on wages at the national level allows to explore how much of a labour demand shock is absorbed by changes in relative real wages. The inclusion of wages allows for a better identification of the labour demand shock, where their response should be positive, from labour supply shock, where their response should be negative.

5.5. Adjustment to asymmetric labour demand shocks

Evidence from panel VAR analysis

Graph 18 shows the responses of employment, unemployment and the activity rate to a one-standard-deviation positive labour demand shock for the whole sample (top panel) and for the pre-crisis period (bottom panel).[23] Results are shown separately in the parsimonious VAR specification with no real wages (left panels) and for the specification including a wage equation (right panels). The results suggest the following.

As expected, labour demand shocks result mostly in a variation of unemployment and activity rates on impact. These effects dissipate very slowly over time. In contrast, the effect on mobility and real wages is smaller on impact and builds up gradually.

Over the period 1970-2013, the average size of the labour demand shocks identified is about 1.1%. The effect on employment is persistent and reaches a maximum after about 4 years, before falling to a value permanently higher than the initial level. Within one year, the unemployment rate falls and the activity rate rises respectively by about 0.5 and 0.3 percentage points above the EU average. The effect of the shock on the unemployment and activity rate is very persistent and lasts beyond 5 years.

[23] The response to a negative shock is symmetric. For presentational purposes, confidence intervals are not shown. The responses of the employment rate and the activity rate are significant at the 5% for about 10 years while the response of the employment is always significant.

Labour mobility increases by 0.3% the first year and peaks after about 10 years. Thus, in the first year, the unemployment and the activity rates and labour mobility absorb respectively 4%, 32% and 25% of the initial labour demand shock. The proportion of the initial demand shock absorbed by changes in the population rises over time.

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Graph 18 about here

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All in all, in analogy with previous studies, results indicate that, over the medium term, the large majority of asymmetric demand shocks are absorbed via an adjustment in relative activity rates and mobility, the former being more responsive in the first years after the shock, while the latter becoming predominant after some years.

Over the pre-crisis sample (1970-2007), the average shock is estimated to be about equally sized but more persistent. In response to the shock, within the first year the unemployment rate declines by 0.3 percentage points and the activity rate increases by 0.4 percentage points. Within the first year the unemployment rate and the activity rate absorb about 34% and 38% of the labour demand shock. (24) Compared to the whole sample, the response of unemployment is weaker and more persistent; in contrast, the response of the activity rate larger and more persistent. A key difference across the two periods is found in the response of labour mobility, which appears less responsive to the shock in the pre-crisis period. In the whole sample, the response is about 5% after 5 years, while it is below 4% in the pre-crisis sample.

In the long-term, the increase of the labour supply through higher activity rate and greater labour mobility accounts for respectively 40% and 60% of the overall increase in employment. The figures for the pre-crisis period are 40% and 50%. It also emerges that, while for the whole sample in less than 8 years mobility becomes the prominent form of adjustment, for the pre-crisis period it takes more than 11 years for mobility to overtake activity rates as the most relevant adjustment channel.

The evidence suggests that since the start of the 2008 crisis, mobility has played a more important role in the adjustment of labour markets than in the past; in contrast, the adjustment of unemployment and activity rates was comparatively short-lived. This is consistent with the observation that activity rates were resilient in the EU during since 2008, while the so-called discouraged-worker effect appears to have been weaker than in previous downturns.[25]

These findings remain largely unchanged when real wages are included in the analysis. For the whole sample, relative real wages gradually increase in response to the positive labour demand shock and stabilise after about 10 years, broadly in parallel with the stabilisation of unemployment. In response to a 1% shock, relative wages change by about 0.5% after 10 years. Including wages in the model does not appear to matter greatly for the adjustment of

[24] The response of the unemployment rate up to 4 years after the shock stays within the standard errors computed over the whole period; after the fourth year, the dynamics of the unemployment rate does not differ over the two samples. In contrast, the response of the activity rate is always within the standard errors computed for the whole period.

[25] These findings are consistent with those by Jauer et al. (2014).

the relative unemployment rate, consistent with the findings of Blanchard and Katz (1992) for the US states and Bayoumi et al (2006) for Canadian Provinces.[26]

When restricting the sample to the pre-crisis period, the response of real wages appears considerably more muted. Thus, since 2008 relative wages have become more reactive to country specific cyclical conditions.

The responses to an asymmetric labour demand shock have also been computed for a different sample split: a pre-EMU and EMU period. Graph 19 shows that the labour market adjustment has changed during the EMU period in a number of respects.

First, despite the fact that the estimated average labour demand shock is about equally sized over the two periods (1.1% in the first period and 0.98% in the second), the response of unemployment is quicker and less persistent in the EMU period.[27] Second, the activity rate exhibits a more muted and short-lived reaction to the shock. Third, labour mobility appears to respond more quickly during the EMU period, absorbing a bigger fraction of the shock than the activity rate at any lag.[28] A possible explanation for this finding could be linked to the fact that activity rates in EU countries have been driven to larger extent by structural factors, including linked to reforms and policies facilitating labour market participation by females and the elderly, and less by cyclical factors. Moreover, the more rapid response of the working age population may reflect more the effect of enlargement than a migration of national citizens. Finally, real wages in the EMU period seem to be more reactive to country specific labour demand shocks. Before the EMU, the response of real wages to the shock is initially muted and becomes statistically significant after 5 years. In the post-EMU period, wages are significantly different from the pre-shock level after the second year.[29]

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Graph 19 about here

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Table 5 provides a measurement of the contribution of an asymmetric labour demand shock to the cyclical fluctuations of each variable. For example, 37% of the fluctuations in the activity rate are attributed at the 5 year horizon to a labour demand shock. The decomposition of unemployment is not reported because, trivially, labour demand shocks explain at all horizons the largest proportion of unemployment fluctuations.

Before EMU, labour demand shocks account for a sizeable proportion of the variance of the activity rate, while these shocks are less relevant for wages or labour mobility. After monetary unification, there is a considerable change in the relative importance of labour demand

[26] These findings are robust to a specification where wages are an exogenous variable. The results are also robust to a different identification scheme where wages respond contemporaneously to labour demand and labour supply shocks but affect the unemployment and the activity rates only with a lag. Finally, the results do not change significantly for a specification where relative wages are stationary.

[27] This may reflect the persistency of the labour demand shock itself which is lower in the post-EMU period.

[28] This is consistent with the results obtained by L'Angevin (2007a,b) comparing the 1990-2005 period with that over the 1970-2005 period. Results are robust to the exclusion from the sample of Denmark, Sweden and the UK.

[29] This finding is influenced substantially by change of relative wages over 2012-2013; in fact, the dynamic adjustment of real wages is closer when the response is computed for the 1999-2011 period is closer to that of the pre- than to that of the post-EMU period.

shocks. Within one year, they still remain more important for the activity rate than for labour mobility or real wage growth; however, over the medium- to the long-run, labour demand shocks become relatively more important for the variance of labour mobility. These results underscore the increased role of wages and mobility as adjustment mechanism to asymmetric labour demand shocks.

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Table 5 about here

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Evidence for selected country-specific VAR analysis

The response to an asymmetric labour demand shock has been simulated for selected member states. Quarterly data are used; employment growth is computed quarter on quarter. For each country a VAR with 4 lags has been estimated over the period 1998Q2-2013Q4.

Graph 20 suggests that results are qualitatively similar to those obtained for the representative EU member states with panel VAR analysis. A number of interesting findings stand out concerning differences in labour market responses across countries. Labour demand shocks appear more persistent in continental European countries than in the UK or Ireland. The response of labour mobility is faster and more short-lived in countries such as Ireland and the United Kingdom where mobility flows are quite high. Conversely, it is more persistent in continental countries (e.g. France and Italy). Finally, labour mobility accounts for a large share of shocks in Spain and Ireland, which is consistent with the evidence of the post-EMU period obtained on annual data.

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Graph 20 about here

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6. Conclusions

Cross-country mobility flows in the EU are still much lower than those recorded in other highly integrated economic areas, notably the United States, and well below mobility within countries. The population of migrants from within the EU is also generally much lower than the population of migrants from outside the EU. Nevertheless, an upward trend in mobility is visible in the EU, not only as a result of the enlargement.

The analysis of the determinants of bilateral migration flows by means of gravity equations shows that migration flows are affected by the unemployment rate differential between the origin and destination country, besides traditional variables like the distance between countries, existence of a common language, colonial history and the extent of past migration. EU membership is found to increase mutual migration flows positively (by about 25%). Euro area membership does not seem to increase mobility *per se*, but it is estimated to make mobility more sensitive to unemployment differentials. Evidence from gravity equations also reveals that labour mobility flows among the fifteen countries that were EU members before 2004 have increased since the mid-2000s on top of what is explained on the basis of the evolution of fundamentals. All in all, the evidence suggests that increased mobility flows

within the EU are not only due to the enlargement or growing heterogeneity of EU countries, but also linked to a gradual deepening of the extent of labour market integration.

The analysis of the dynamic response of mobility flows to asymmetric shocks in the vein of Blanchard and Katz (1992) confirms the findings of the literature that in Europe unemployment and labour market participation absorb the largest fraction of asymmetric labour demand shocks in the short- to medium-term. Over the period 1970-2013, about one quarter of asymmetric labour demand shocks are absorbed by labour mobility within 1 year, while about 50% of the shock is absorbed after 5 years, an estimate which is in line with that obtained in previous studies (see Table 3). In line with L'Angevin (2007a,b) and Dao et al (2014), the paper shows that the importance of mobility as an adjustment mechanism has increased in the EU. The response of real wages to demand shocks also appear to have strengthened. Beyer and Smets (2014) found that the role of labour mobility as adjustment mechanism for the EU regions has fallen over the period 1994-2011; their analysis is however not in contradiction with those of this paper, which focuses on mobility across countries and not regions. The difference suggests that mobility adjustment within the EU is triggered more by country than by region specific shocks.

Overall, the findings of this paper suggest that, although the magnitude of mobility flows in the EU remains below what could be expected in a fully integrated monetary union, the responsiveness of labour mobility to asymmetric demand shocks has increased over time.

Further analysis is needed to investigate the reasons underlying such increased responsiveness of mobility flows, notably the relative roles of enlargement (see, e.g., Jauer et al., 2014) and the loss of the exchange rate and an independent monetary policy as shock absorbers. The analysis also suggests that, in the coming years, the persistence of the large unemployment differentials observed after the crisis could entail cross-country labour mobility flows of a considerable magnitude, which could require in some cases supportive policy frameworks to ensure the effective integration of mobile workers.

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Annex A: Data sources on migration

A number of data sources on migration statistics are available for EU countries, with different sources providing insights on different aspects of migration. Below a description is provided of the main features of the statistical sources used in the present analysis.

Eurostat population statistics

Eurostat data on net migration plus statistical adjustment give a snapshot of migration balances. Net migration flows are constructed as the difference between the total population change and the estimated 'natural population change' (i.e., the change due to natality and mortality). Such flows, expressed as shares of population are named crude rate of net migration. The advantage of these net migration flows is that they are available for most countries in long time series. The statistic is available also at regional (including NUTS2) level. The main shortcoming is that these flows are affected by inaccuracies in the estimation of population change, as underlying administrative registers are not always up-to-date. Statistical adjustments, including census-related population revisions, lead to outliers and breaks in the series in some instances. Since this indicator is calculated on a residual basis, it does not allow the identification of actual inflows and outflows, or their composition.

Comprehensive statistics on population by citizenship and country of birth are made available by Eurostat since 2008. The data sources are administrative records or national surveys. The advantage of these statistics is that they capture migration directly, rather than on a residual basis. Such statistics also allow for a breakdown by sex, age. However, shortcomings may be related to imperfect comparability of administrative data and lack of compliance of migrants to register or deregister as residents.

Eurostat Labour Force Survey

The Eurostat Labour Force Survey (LFS) is a standardised survey primarily aiming at assessing employment and unemployment in the EU. Harmonised data, allowing assessment of EU27 mobility, are available in general starting 2005. As the survey asks questions about recent changes of residence, the data provides an estimate of recent sub-national and international migration movements. It also allows researchers to analyse the age profile and labour market status of migrants. Its shortcomings are those of surveys in general: migrants, among other vulnerable groups, may be underrepresented in the sample partly due to a higher non-response rate. As a result, mobility flows implied by LFS are usually lower than those implied by Eurostat population statistics. Also, not all statistical breakdowns are available for all countries. A somewhat more detailed discussion of European data sources and, in particular, of the EU LFS is provided by European Commission (2012, p. 282-283).

OECD International Migration Database

The OECD International Migration Database cover migration flows into most OECD Member countries as well as the Baltic States, Bulgaria and Romania from more than 200 origin countries. The period covered is 1990-2011, and coverage is higher for more recent time periods. The data are based on submissions by national correspondents and reflect existing national statistics, so that methodologies and definitions are not always harmonised (OECD, 2013, Statistical annex, pp. 311-315).

Annex B: Estimation of the gravity equation: sample composition

This Annex documents the sample composition of the gravity equations by year and destination country and it provides the list of origin countries included in the sample.

Table 6 shows that the number of observations progressively increases by year.

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Table 6 about here

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Table 7 shows the sample composition by 38 destination countries in the OECD International Migration Database. The table shows that the number of observations is very heterogeneous across countries. This has multiple reasons. First, few observations are available for some countries that were included in the database relatively recently (the Baltic countries, Greece, Slovenia). Second, few observations are available for some destination countries that report only few bilateral relationships per year (this is the case most notably for Ireland).

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Table 7 about here

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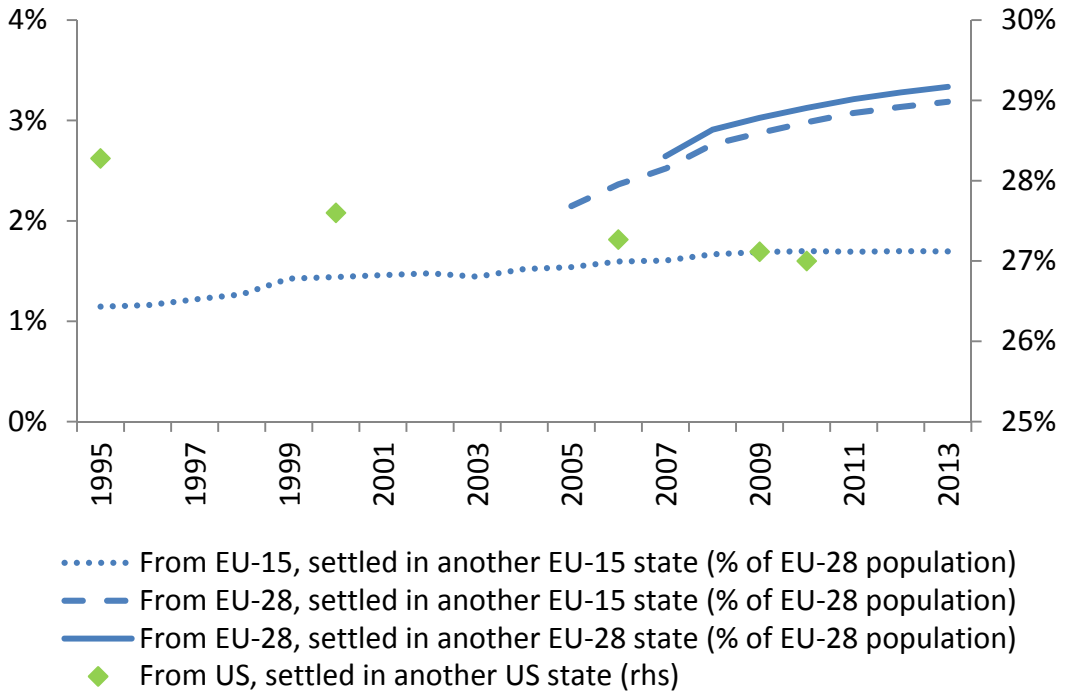
Finally, the sample includes the following 163 origin countries: Afghanistan, Albania, Algeria, Antigua and Barbuda, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bermuda, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Cambodia, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Côte d'Ivoire, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Fiji, Finland, France, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea Rep., Kuwait, Kyrgyz Republic, Lao People's Dem. Rep., Latvia, Lebanon, Lesotho, Liberia, Lithuania, Luxembourg, Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Norway, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Puerto Rico, Qatar, Romania, Russia, Rwanda, Samoa, San Marino, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Slovak Republic, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syrian Arab Republic, São Tomé and Principe, Tajikistan, Tanzania, Thailand, Timor-Leste, Tonga, Trinidad and Tobago, Tunisia, Turkey, Tuvalu, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

Graphs

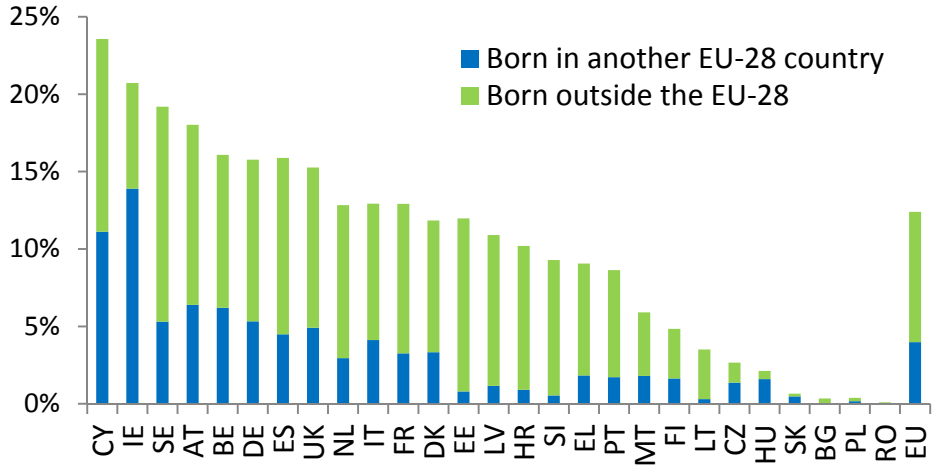
Graph 1: Share of EU working-age population born in other EU countries, and share of US population born in a different US state



Note: Data for the EU series excludes Germany, since no time series is available about the breakdown of foreigners living in Germany by country of origin.

Source: Eurostat population statistics and Eurostat special extraction from the Eurostat LFS; US Census Bureau, Census and American Community Survey.

Graph 2: Share of working-age population born in other countries, 2013

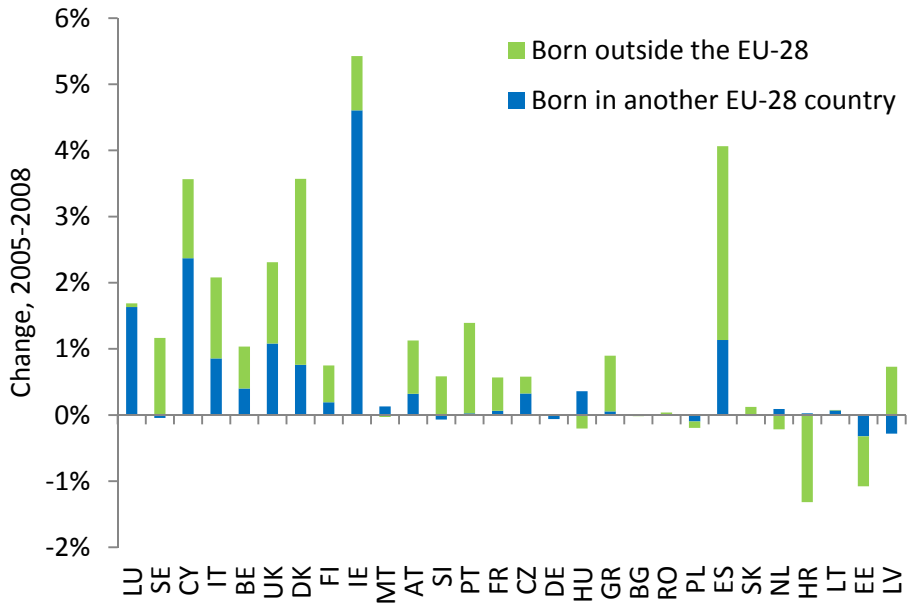


Note: Luxembourg omitted as out of scale. In Luxembourg, 38% of the population was born in another EU-28 country, and 9% outside the EU-28.

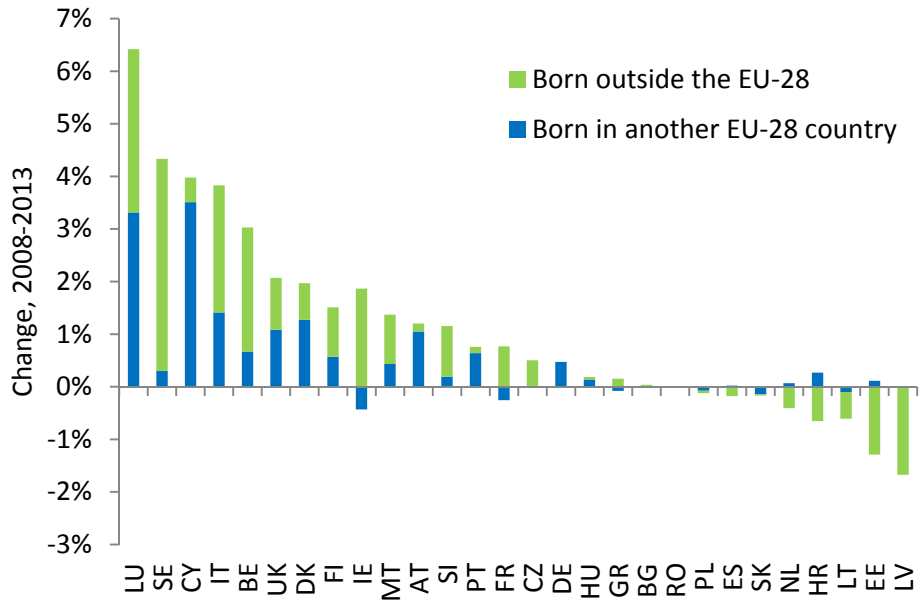
Source: Eurostat for Germany and EU-28, for others calculations based on a Eurostat special extraction from the European LFS.

Graph 3: Change in the share of working-age population born abroad, before and during the crisis: Contribution of migrants from the EU and from third countries

Panel A: 2005-2008



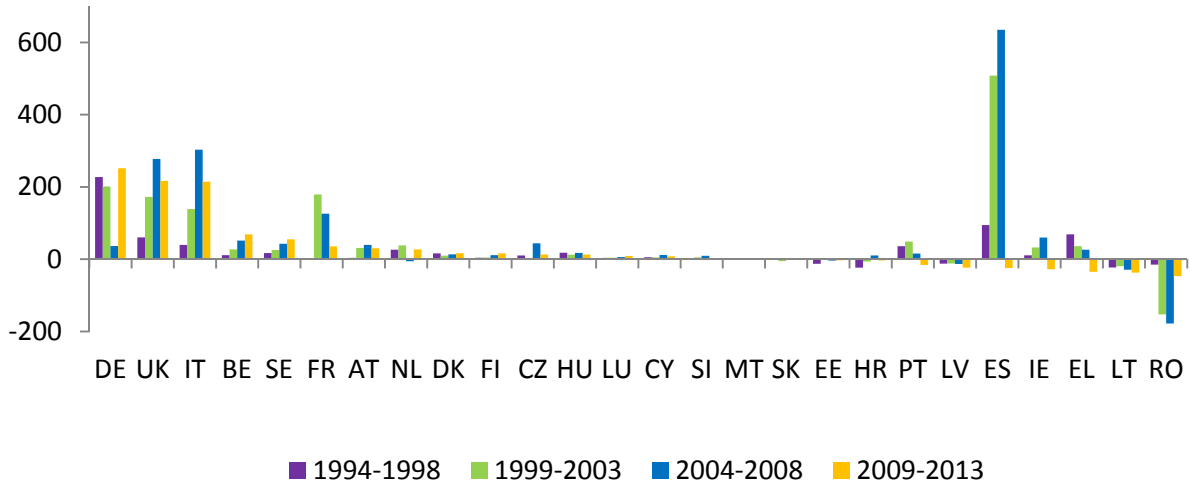
Panel B: 2008-2013



Note: For Bulgaria, Germany and Ireland, 2006 instead of 2005. For Germany, the value is for all foreigners, no breakdown available. Countries are ranked according to change 2008-2013.

Source: Own calculations, based on a Eurostat special extraction from LFS.

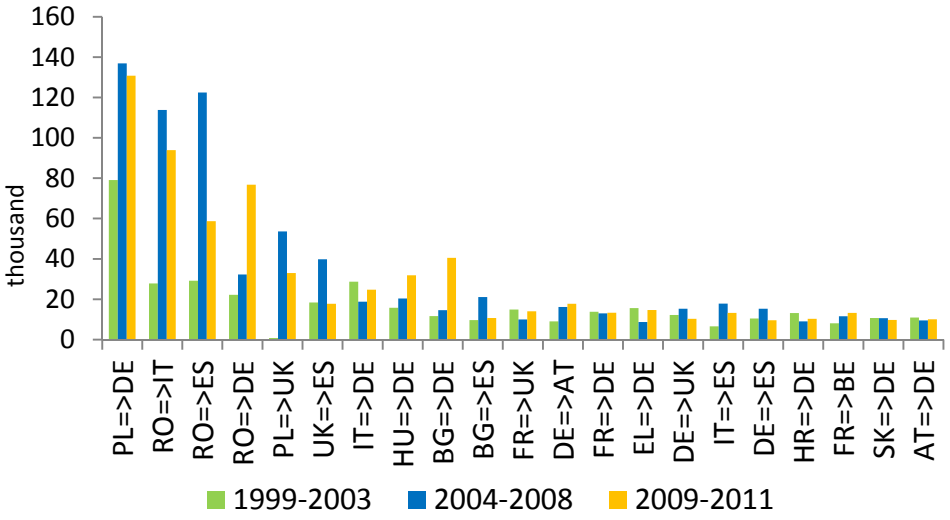
Graph 4: Average annual net migration flows over five-year periods (thousand)



Note: Bulgaria and Poland have been omitted as the size of reported flows was consistently below what is suggested by other sources. Countries are ordered according to net migration in the latest period 2009-2013.

Source: Own calculations based on Eurostat population statistics.

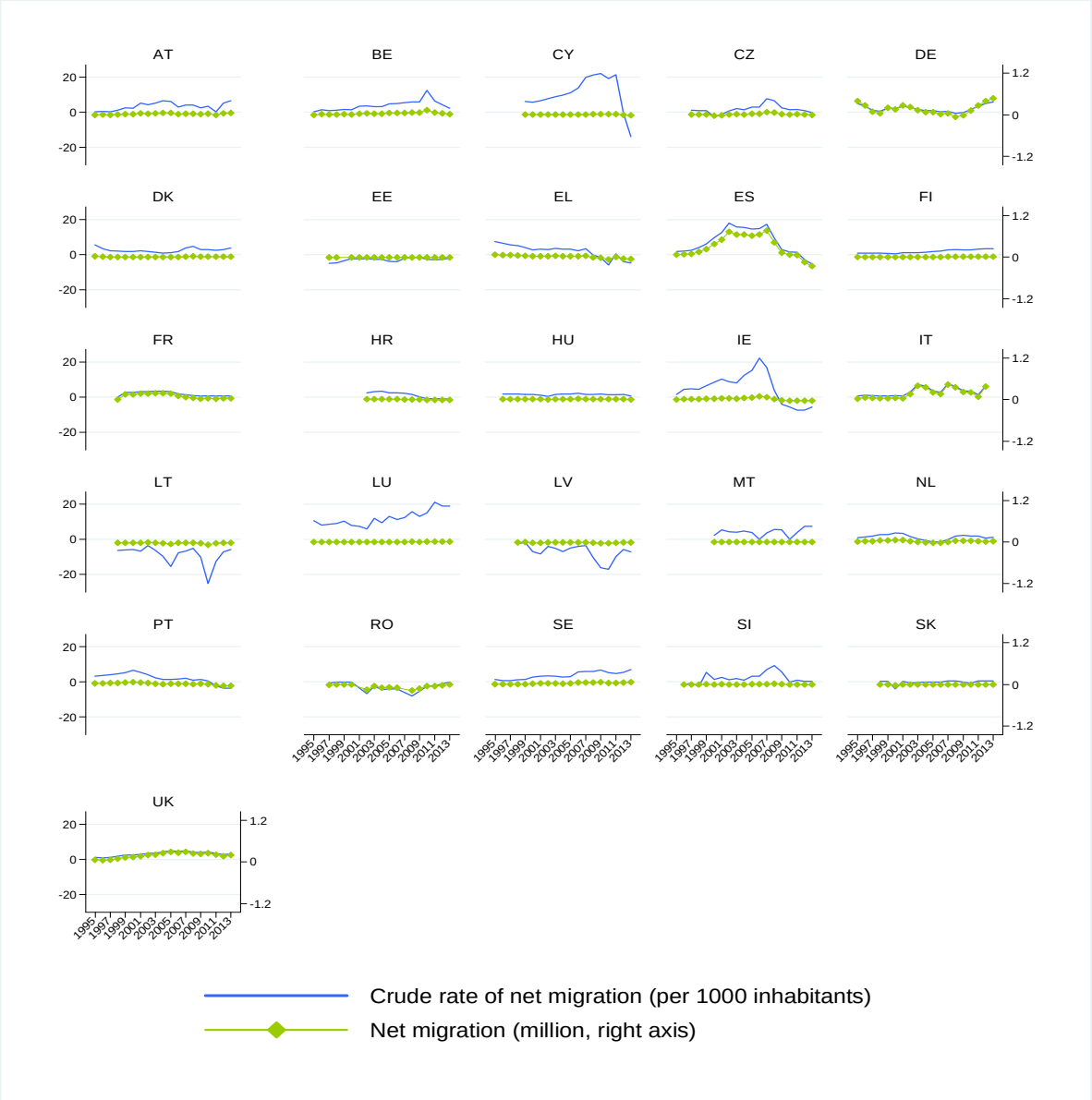
Graph 5: Average gross bilateral flows exceeding 10,000 over the period 1999-2011, within EU-28



Note: The results may be affected by data availability and differing data collection methodologies applied by different countries. Bilateral relations are ordered according to the overall period average.

Source: Own calculations, OECD International Migration Database.

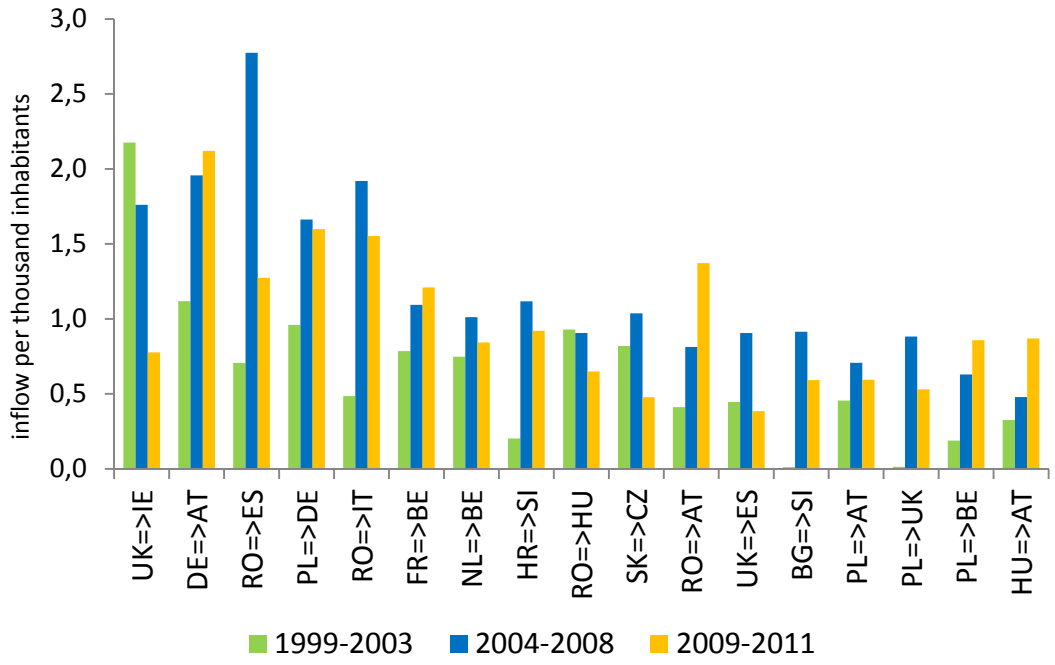
Graph 6: Relative and absolute net migration, 1995-2013.



Note: Statistics on net migration include statistical adjustment by national statistical offices. The results may be affected by differing data collection methodologies applied by different countries. Bulgaria and Poland have been omitted as the size of reported flows was consistently below what is suggested by other data sources. Outliers in the data for Estonia, Italy and Romania have been removed.

Source: Eurostat population statistics.

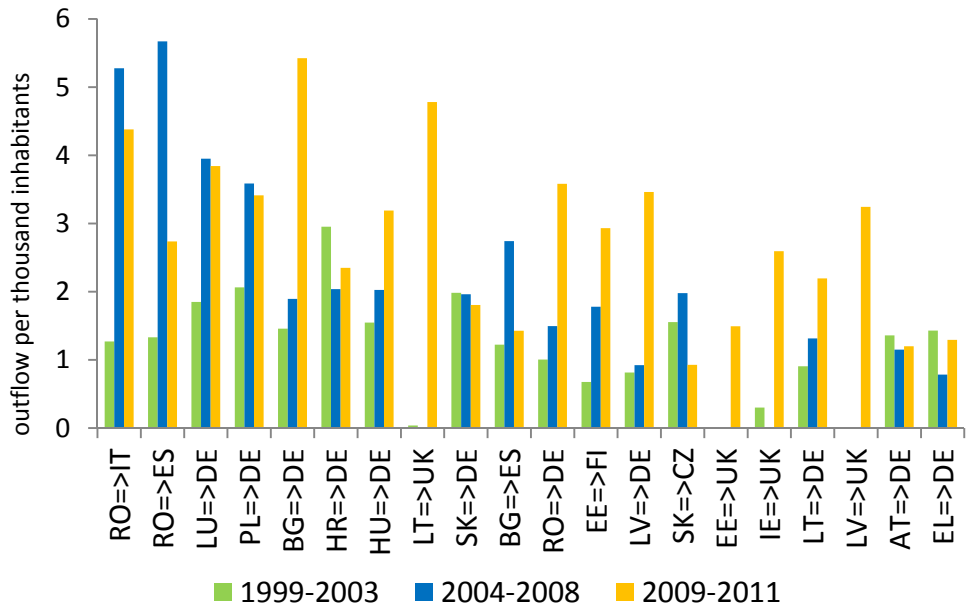
Graph 7: Average gross bilateral flows exceeding 0.5 per 1000 of destination country population over the period 1999-2011, within EU-28



Note: The results may be affected by data availability and differing data collection methodologies applied by different countries. Migration flows to Luxembourg have been omitted for better visibility. The highest flows per 1000 inhabitants into Luxembourg over the period were from PT (7.5), FR (5.2), BE (2.4), DE (1.8), IT (1.3), UK (0.9), PL (0.5).

Source: Own calculations, OECD International Migration Database.

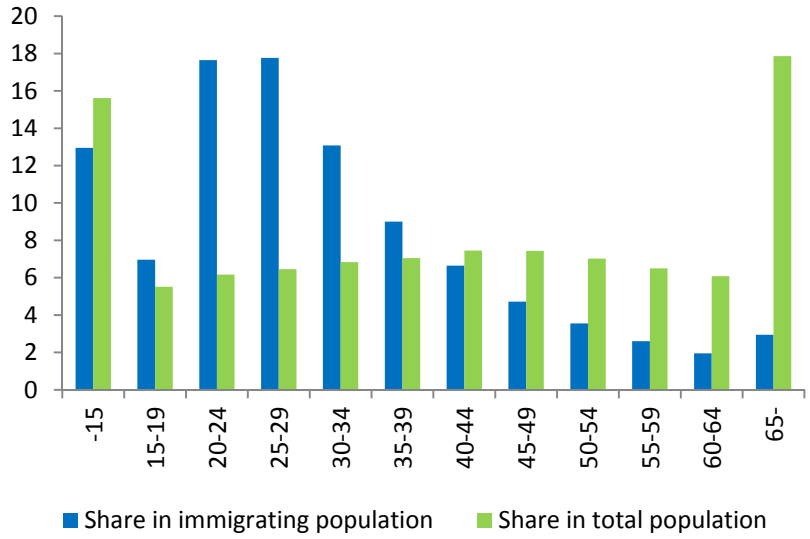
Graph 8: Average gross bilateral flows exceeding 1 per 1000 of origin country population over the period 1999-2011, within EU-28



Note: The results may be affected by data availability and differing data collection methodologies applied by different countries. Data on migration inflows to the UK are missing for various years depending on the source country. There is only 1 year available on migration from EE, 3 years (LV), 5 years (LT) and 6 years (IE).

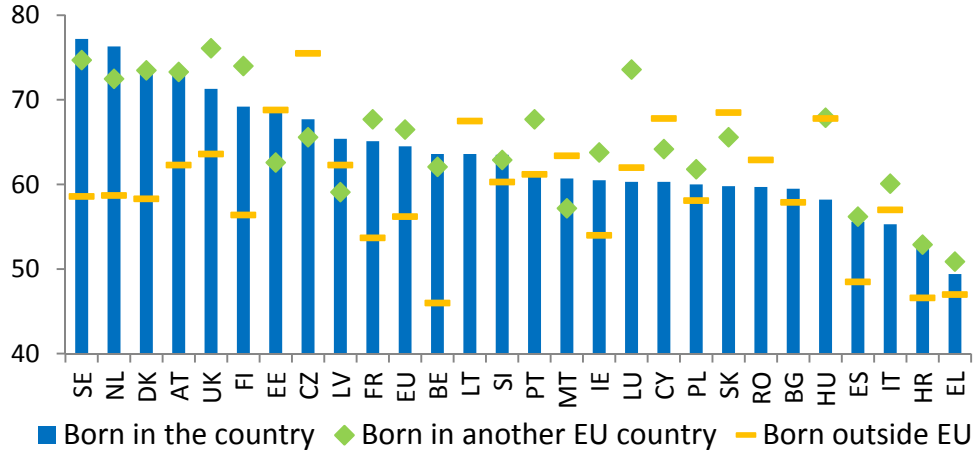
Source: Own calculations, OECD International Migration Database.

Graph 9: Share of different age groups among the total population and among the flow of migrants in 2012



Source: Own calculations, Eurostat population statistics.

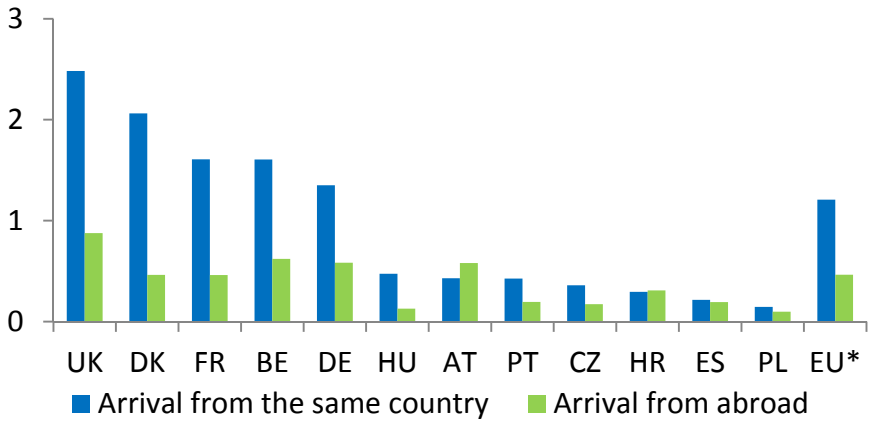
Graph 10: Employment rate by country of birth, 2013



Note: Germany is omitted because the employment rate for EU and non-EU migrants is not available for this country. For Bulgaria, Lithuania and Romania the of the employment rate of people born in another EU country is not available.

Source: Eurostat LFS.

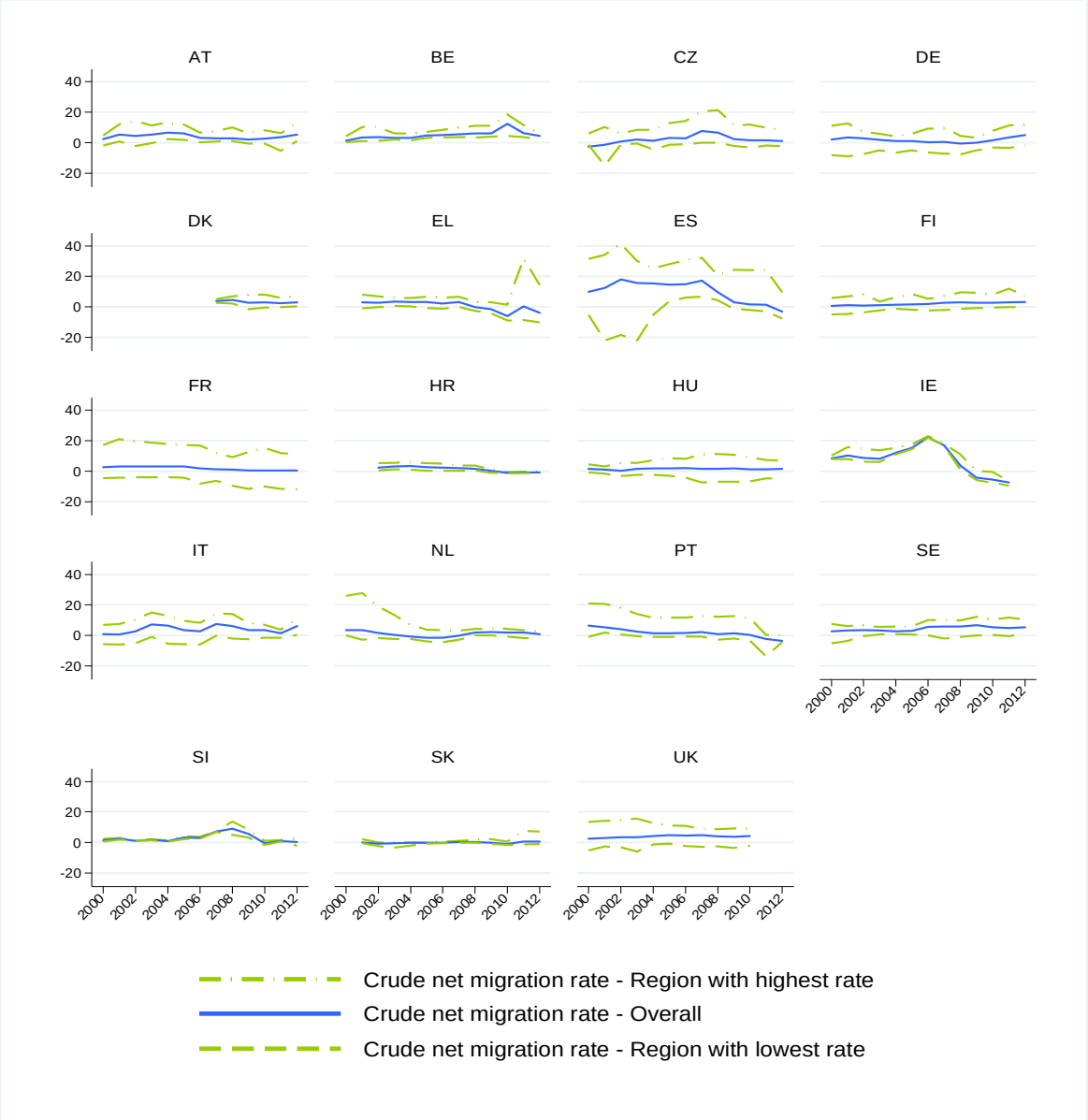
Graph 11: Annual rates of sub-national and international inward mobility, 2013, % of total population



Note: 'Arrival from the same country' refers to working-age individuals who were residents of another NUTS2 region of the same country 1 year before the interview. The EU average is a weighted average that covers the available countries, representing 70% of EU's working age population. Data not available for Bulgaria and Ireland. Countries for which the data are unreliable for internal mobility (Italy, Romania, Slovenia, Slovakia), for external mobility (Greece, Finland, the Netherlands, Sweden) have been excluded.

Source: Eurostat special extraction from the European LFS.

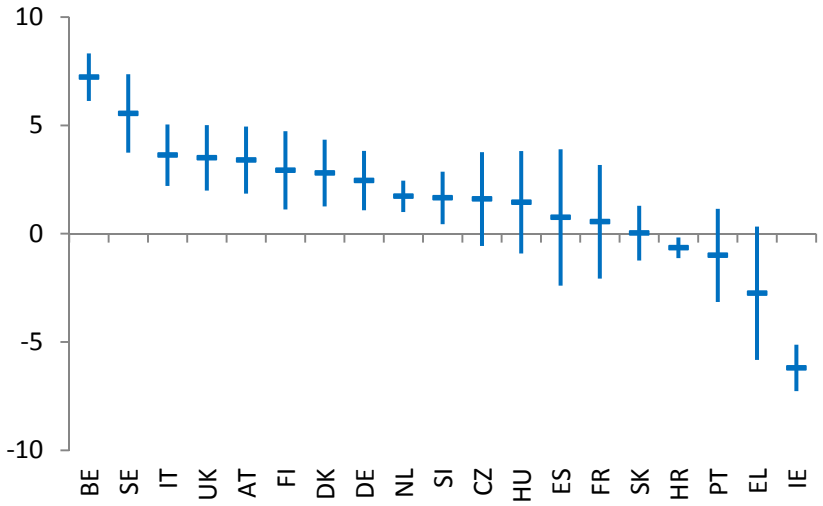
Graph 12: Crude rate of net migration at the country level, and region with the highest and lowest value



Note: Only countries with more than one NUTS2 level region are shown. Bulgaria, Poland and Romania have been omitted because of data concerns**.**

Source: Own calculations, Eurostat population statistics.

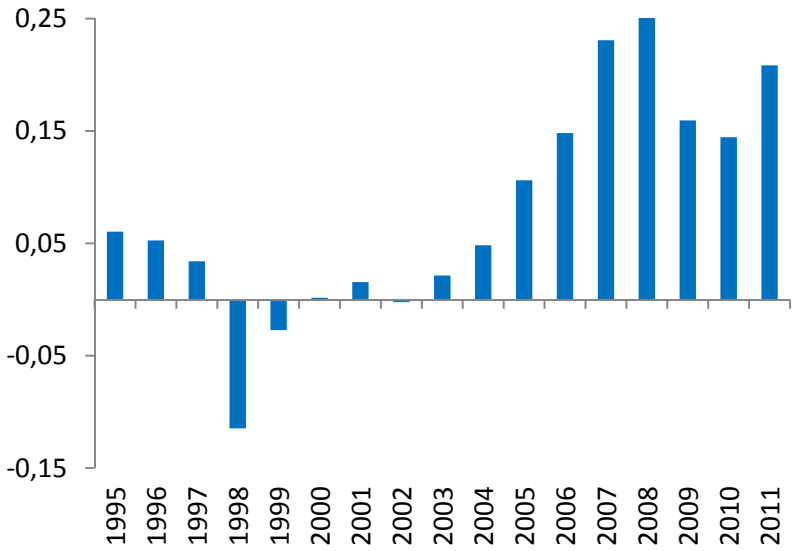
Graph 13: Crude rate of net migration, country-level and one standard deviation range, average, 2009-2012



Note: Crude rate of net migration and statistical adjustment. The standard deviation is calculated as the average of annual standard deviations**.**

Source: Own calculations, Eurostat population statistics.

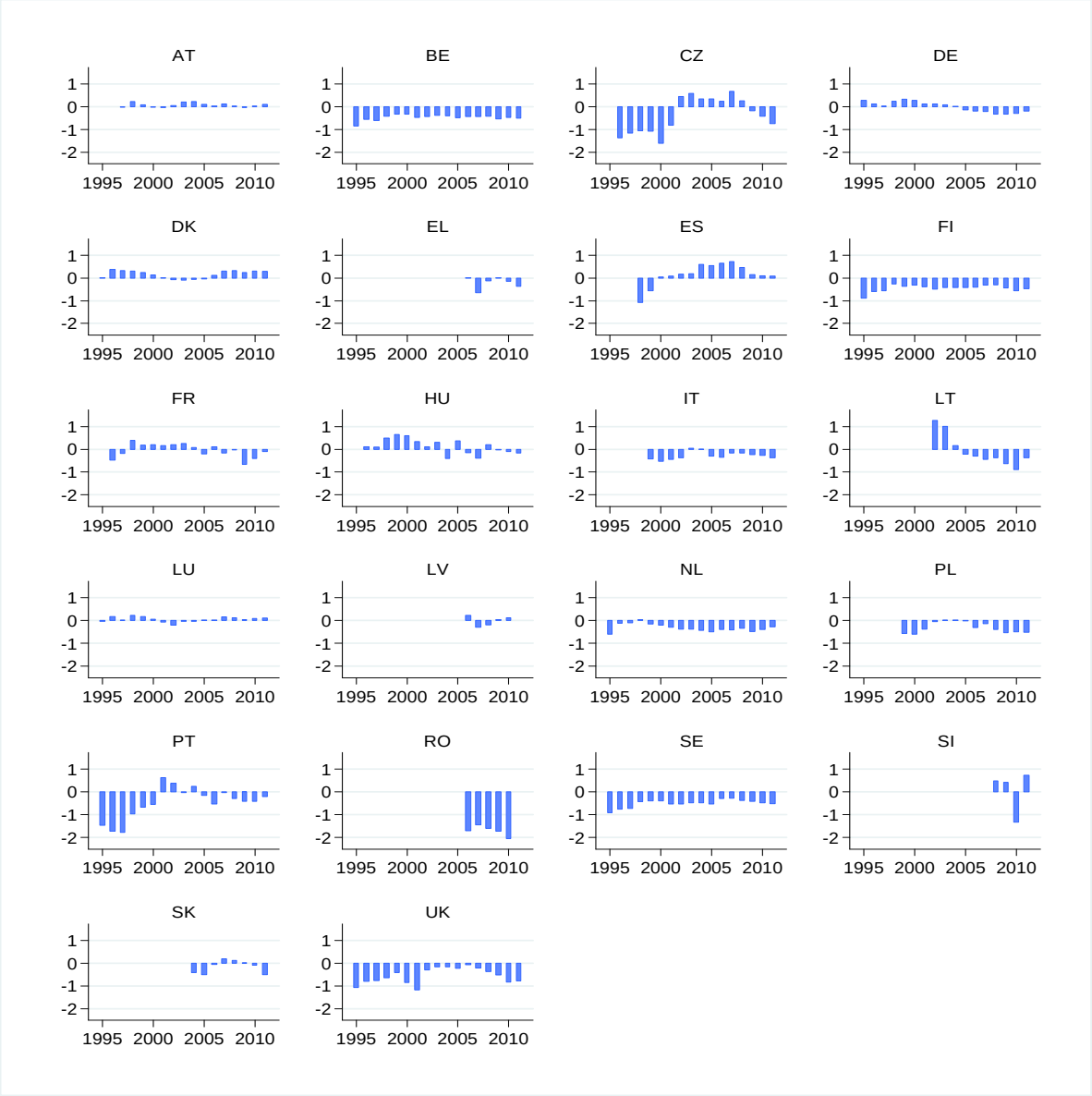
Graph 14: Time profile of intra-EU15 mobility: Estimated year effects



Note: The graph shows the year effects estimated from regression (1) of Table 2. The level zero is set by mobility flows in 1992.

Source: Own calculations, based on data from the OECD International Migration Database.

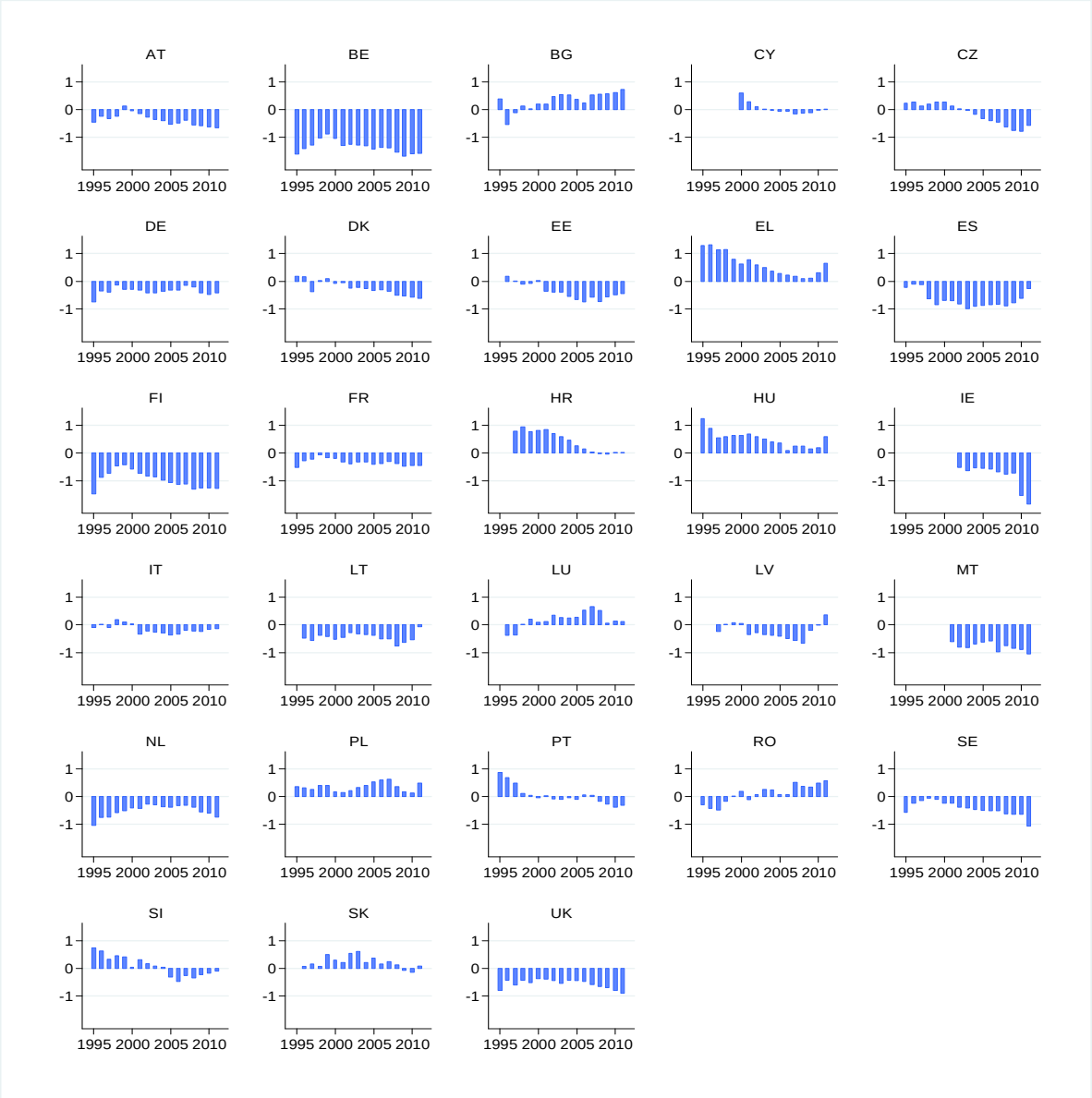
Graph 15: Unexplained mobility flows: weighted average by destination country (EU-28 countries in the sample)



Note: The graph depicts the weighted average of estimated residuals by destination country, as obtained from regression (3) of Table 1. Weights are time-invariant; they take into account the average migration flow and the number of observations for a given pair of origin and destination countries. The graph includes EU member states for which there is information in the database. Estonia and Ireland have been excluded for a low number of observations. For a documentation of the sample, see Annex B.

Source: Own calculations, based on data from the OECD International Migration Database.

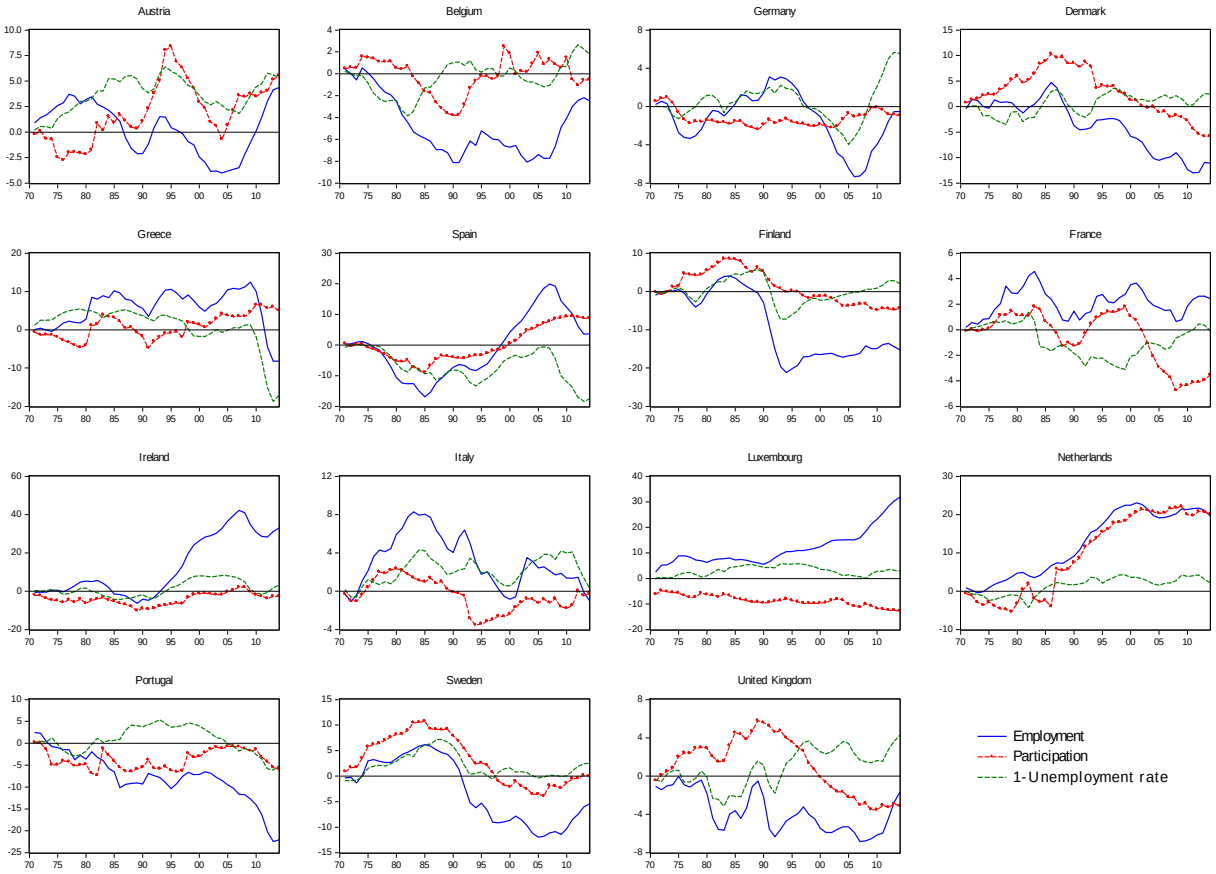
Graph 16: Unexplained mobility flows: weighted average by origin country (EU-28)



Note: The graph depicts the weighted average of estimated residuals by origin country, as obtained from regression (3) of Table 1. Weights are time-invariant; they take into account the average migration flow and the number of observations for a given pair of origin and destination countries. For a documentation of the sample, see the Annex B.

Source: Own calculations, based on data from the OECD International Migration Database.

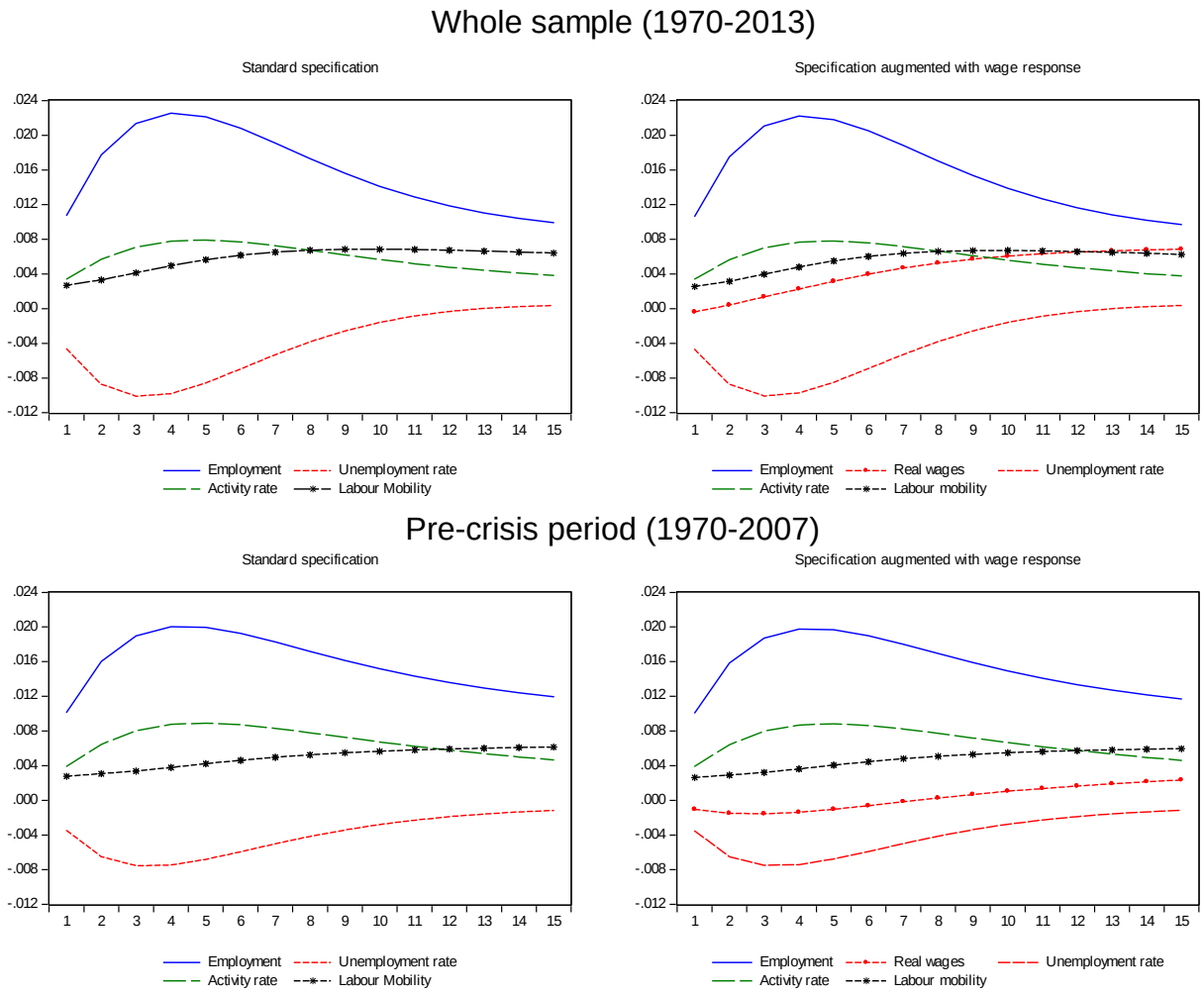
Graph 17: Labour market dynamics in selected European countries relative to the EU average (cumulative growth since 1970)



Note: The chart shows growth rates of national variables relative to EU15 growth rates. To focus on business cycle developments, each relative variable is expressed as a deviation from its mean over the whole period.

Source: European Commission, DG ECFIN AMECO database.

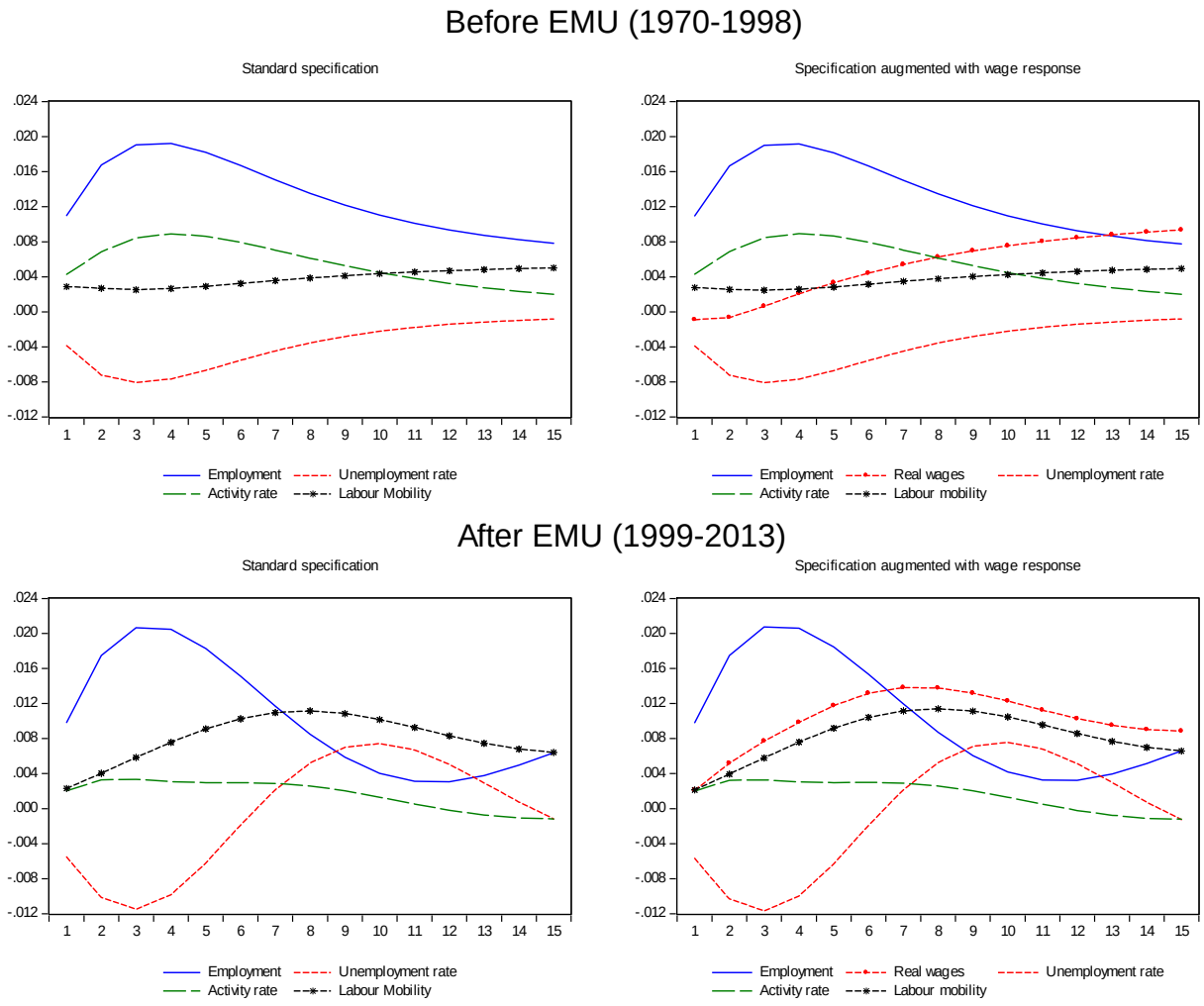
Graph 18: Responses to a country specific positive labour demand shock



Note: The horizontal axis represents years after the shock. The vertical axis represents log points. Mobility is defined as the change in employment not explained by changes in the employment rate (defined as 1 minus unemployment rate) or the activity rate.

Source: Own calculations.

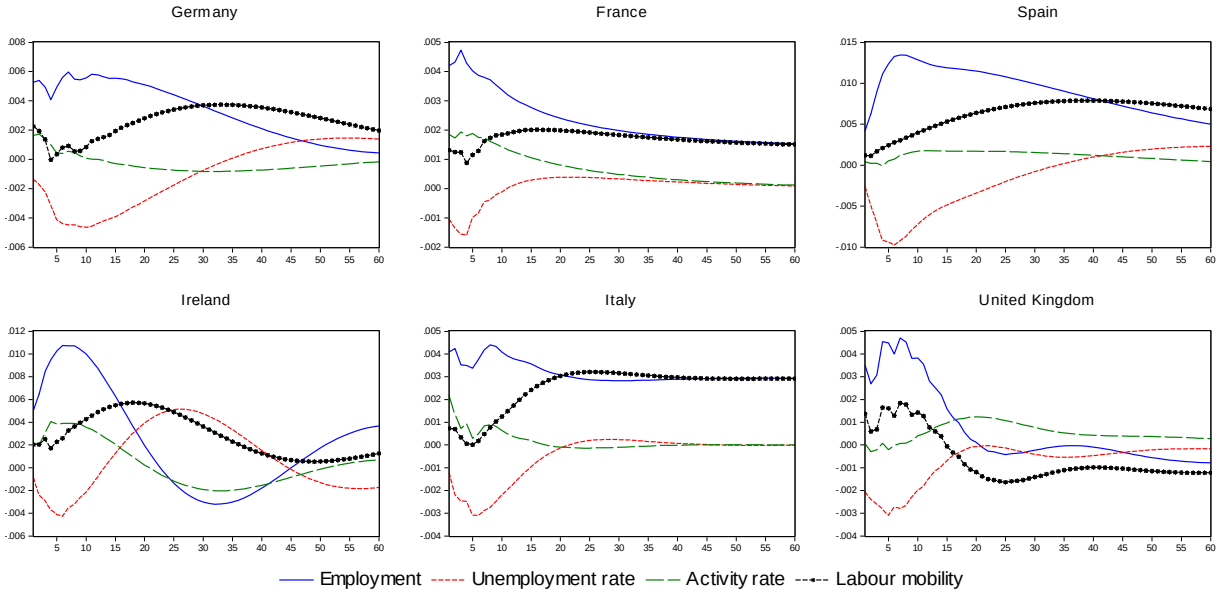
Graph 19: Responses to a country specific positive labour demand shock



Note: The horizontal axis represents years after the shock. The vertical axis represents log points. Mobility is defined as the change in employment not explained by changes in the employment rate (defined as 1 minus unemployment rate) or the activity rate.

Source: Own calculations.

Graph 20: Responses to a country specific positive labour demand shock for selected EU member states



Note: The Impulse response functions are based on estimates of VARs with 4 lags for each country over the period 1998Q2-2013Q4. The horizontal axis represents quarters after the shock. The vertical axis represents log points. Mobility is defined as the change in employment not explained by changes in the employment rate (defined as 1 minus unemployment rate) or the activity rate.

Source: Own calculations.

Tables

Table 1: Determinants of gross bilateral migration flows: Gravity equations on the full sample

Dependent variable: Log gross migration flow	(1) No country effects	(2) Country effects	(3) Full specifi-cation
Log product of populations	0.491***	0.274*	0.244
	(0.005)	(0.164)	(0.163)
Log weighted distance	-0.514***	-0.669***	-0.668***
	(0.010)	(0.014)	(0.014)
Log relative GDP per capita in the destination country	0.061***	-0.002	-0.003
	(0.006)	(0.068)	(0.069)
Log relative unemployment rate in the destination country (lag)	-0.099***	-0.137***	-0.138***
	(0.011)	(0.022)	(0.022)
Log bilateral migrant stock in the destination country, 1990	0.358***	0.301***	0.302***
	(0.004)	(0.005)	(0.005)
Common language	0.779***	1.028***	1.027***
	(0.024)	(0.026)	(0.026)
Past colonial relationship	0.556***	0.615***	0.613***
	(0.041)	(0.041)	(0.041)
Both countries are EU members in given year	0.179***	0.248***	0.249***
	(0.035)	(0.034)	(0.034)
Both countries are EA members in given year	0.160***	0.020	-0.024
	(0.041)	(0.039)	(0.040)
Interaction term: Relative Unemp. * Post-2008 crisis			0.040*
			(0.024)
Interaction term: EMU * Post-2008 crisis			0.081
			(0.061)
Interaction term: EMU * Relative Unemp.			-0.179***
			(0.039)
Double interaction: EMU * Rel. Unemp. * Crisis			-0.115
			(0.080)
Constant	-15.950***	-9.472**	-8.673*
	(0.173)	(4.492)	(4.480)
Source country effects	no	yes	yes
Destination country effects	no	yes	yes
Year effects	yes	yes	yes
Observations	27,924	27,924	27,924
R-squared	0.721	0.823	0.823

Note: OLS estimations. Sample period: 1992-2011. After the introduction of control variables, the sample includes 163 origin countries and 38 destination countries. For a more detailed documentation of the time and country coverage, see Annex B. Asterisks indicate estimated coefficients that are statistically significant at the 1% (***), 5% (**), or 10% (*) level.

Source: Own calculations, based on data from the OECD International Migration Database.

Table 2: Determinants of gross bilateral migration flows: Gravity equations of intra-EU15 mobility

Dependent variable: Log gross migration flow	(1) Full sample (1992-2011)	(2) EMU period (1999-2011)	(3) Crisis period (2008-2011)
Log product of populations	1.350***	1.504***	-0.268
	(0.475)	(0.552)	(2.922)
Log weighted distance	-0.258***	-0.308***	-0.331***
	(0.042)	(0.045)	(0.068)
Log relative GDP per capita in the destination country	1.704***	1.308***	2.050**
	(0.260)	(0.387)	(1.035)
Log relative unemployment rate in the destination country (lag)	-0.143***	-0.209***	-0.197
	(0.040)	(0.048)	(0.124)
Log bilateral migrant stock in the destination country, 1990	0.407***	0.386***	0.350***
	(0.017)	(0.019)	(0.030)
Common language	0.511***	0.507***	0.604***
	(0.054)	(0.063)	(0.102)
Constant	-42.047***	-49.792***	8.303
	(13.927)	(16.874)	(103.897)
Source country effects	yes	yes	yes
Destination country effects	yes	yes	yes
Year effects	yes	yes	yes
Observations	2,217	1,751	550
R-squared	0.913	0.922	0.935

Note: OLS estimations. Asterisks indicate estimated coefficients that are statistically significant at the 1% (***), 5% (**), or 10% (*) level

Source: Own calculations, based on data from the OECD International Migration Database.

Table 3: Decomposition of the response of labour market variables after 1 year to an asymmetric labour demand shock

	Unemployment	Participation	Mobility
Euro area (12 Member States 1973-2005) (1)	33	44	23
EU (51 regions 1975-87) (2)	21	74	4
EU (47 regions 1977-2011) (3)	30	40	31
EU (NUTS1 regions 1998-2009) (4)	16	60	24
United States (51 States 1978-1990) (5)	32	17	51
United States (51 States 1958-90) (2)	18	29	52
United States (51 States 1976-95) (6)	24	43	33
United States (51 States 1976-2005) (1)	22	34	44
United States (51 States 1977-2011) (3)	14	43	43
United States (51 States 1977-2009) (4)	22	24	54
Spain (1976-94) (7)	36	23	41
Italy (1969-95) (6)	23	56	22
Germany (1970-93) (6)	28	61	11
United Kingdom (1969-94) (6)	11	85	4
Canada (1976-96) (6)	46	43	11

Source: (1) L'Angevin (2007a,b); (2) Decressin and Fatás; (3) Beyer and Smets (2014); (4) Dao et al. (2014); (5) Blanchard and Katz (1992); (6) Obstfeld and Peri (1998); (7) Jimeno and Bentolila (1998).

Table 4: Common labour market disturbances: 1970-2013

	Employment growth			Unemployment rate			Participation rate		
	β- coefficient	t-statistic	R2 adj	β- coefficient	t-statistic	R2 adj	β- coefficient	t-statistic	R2 adj
Austria	0.49	4.9	0.34	0.41	11.0	0.73	1.29	13.9	0.82
Belgium	0.76	7.3	0.55	0.81	10.4	0.71	0.98	19.5	0.90
Germany	0.74	5.5	0.41	0.68	6.6	0.50	1.10	33.9	0.96
Denmark	0.59	3.3	0.19	0.61	6.7	0.50	0.26	2.3	0.09
Greece	0.57	1.6	0.04	1.62	6.1	0.46	1.34	19.5	0.90
Spain	2.43	9.5	0.68	2.43	16.9	0.87	1.95	26.2	0.94
Finland	1.40	4.9	0.35	0.98	5.7	0.41	0.20	2.1	0.07
France	0.86	9.4	0.67	1.24	21.3	0.91	0.60	14.2	0.82
Ireland	1.89	5.1	0.37	0.93	4.3	0.28	1.35	15.9	0.85
Italy	0.80	5.1	0.37	0.68	11.1	0.74	0.73	16.0	0.89
Luxembourg	0.37	2.5	0.11	0.50	7.1	0.53	0.53	10.5	0.72
Netherlands	0.85	5.7	0.43	0.46	4.8	0.34	3.06	19.4	0.90
Portugal	1.20	5.5	0.41	0.80	4.9	0.34	1.27	19.2	0.86
Sweden	1.00	5.1	0.37	0.75	5.9	0.43	0.17	1.4	0.02
United Kingdom	0.96	5.5	0.41	0.77	7.5	0.56	0.50	7.4	0.55
Average	0.99		0.38	0.91		0.55	1.02		0.69
OLS estimate	0.99	16.8	0.30	0.91	16.2	0.28	1.01	11.8	0.17
Average D&F (1995)			0.20			0.89			0.27

Note: The coefficients are from regressions of each variable on the relative EU-15 aggregate; they represent the response of a country-specific variable to the EU aggregate. Estimation over the sample period 1970-2013. D&F stands for Decressin and Fatàs (1995).

Source: Own calculations, based on AMECO database of DG ECFIN.

Table 5: Variance decomposition: percentage of the variance of each variable explained by a country specific labour demand shock

	Before EMU			After EMU		
Years after the shock	Growth of relative real wages	Activity rate	Labour mobility	Growth of relative real wages	Activity rate	Labour mobility
1	0.3	12.6	6.0	1.1	8.4	7.6
3	0.5	27.7	6.0	5.2	15.2	18.9
5	0.9	36.9	6.0	5.7	18.3	21.1
10	1.2	44.0	6.1	5.8	19.8	21.6
15	1.3	45.2	6.2	5.8	19.8	21.6

Note: FEVDs are computed estimating a VAR on relative employment growth, relative growth of real wages, relative change in the working age population and relative activity rate with 4 lags over the period 1970-2014.

Source: Own calculations.

Table 6: Sample composition of gravity equation by year

Year	No of obs.
1992	183
1993	210
1994	217
1995	250
1996	521
1997	723
1998	1094
1999	1248
2000	1449
2001	1743
2002	1765
2003	1723
2004	1802
2005	1937
2006	2019
2007	2060
2008	2193
2009	2330
2010	2269
2011	2188
Total	**27924**

Table 7: Sample composition of gravity equations by destination country

Destination country	No of obs.
Australia	1449
Austria	1214
Belgium	678
Canada	1626
Chile	817
Czech Republic	288
Denmark	1391
Estonia	7
Finland	1266
France	1146
Germany	1596
Greece	36
Hungary	831
Iceland	791
Ireland	19
Israel	423
Italy	385
Japan	633
Korea, Rep.	904
Latvia	53
Lithuania	67
Luxembourg	1248
Mexico	330
Netherlands	758
New Zealand	1078
Norway	1525
Poland	800
Portugal	268
Romania	58
Russia	131
Slovak Republic	530
Slovenia	162
Spain	1329
Sweden	1264
Switzerland	563
Turkey	127
United Kingdom	506
United States	1627
Total	**27924**