I Z A Institute
of Labor Economics
Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 11328

Migration as an Adjustment Mechanism in the Crisis? A Comparison of Europe and the United States 2006–2016

Julia Jauer
Thomas Liebig
John P. Martin
Patrick A. Puhani

FEBRUARY 2018

I Z A Institute
of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 11328

Migration as an Adjustment Mechanism in the Crisis? A Comparison of Europe and the United States 2006–2016

Julia Jauer
German Federal Ministry of Labour and Social Affairs (BMAS)

Thomas Liebig
OECD

John P. Martin
Geary Institute, University College Dublin and IZA

Patrick A. Puhani
Leibniz Universität Hannover and IZA

FEBRUARY 2018

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Migration as an Adjustment Mechanism in the Crisis? A Comparison of Europe and the United States 2006–2016[1]

We estimate whether migration can be an equilibrating force in the labour market by comparing pre- and post-crisis migration movements at the regional level in both Europe and the United States, and their association with asymmetric labour market shocks. Based on fixed-effects regressions using regional panel data, we find that Europe's migratory response to unemployment shocks was almost identical to that recorded in the United States after the crisis. Our estimates suggest that, if all measured population changes in Europe were due to migration for employment purposes – i.e. an upper-bound estimate – up to about a quarter of the asymmetric labour market shock would be absorbed by migration within a year. However, in Europe and especially in the Eurozone, the reaction to a very large extent stems from migration of recent EU accession country citizens as well as of third-country nationals.

JEL Classification: F15, F22, J61

Keywords: free mobility, migration, economic crisis, labour market adjustment, Eurozone, Europe, United States

Corresponding author:
Patrick A. Puhani
Leibniz Universität Hannover
Institut für Arbeitsökonomik
Königsworther Platz 1
30167 Hannover
E-mail: puhani@aoek.uni-hannover.de.

[1] We are very grateful to the referees and the editor for their helpful comments on an earlier draft which have greatly improved it. We also thank Franziska Braschke for helpful research assistance. The views expressed are our own and cannot be held to represent those of the institutions with which we are associated.

1. Introduction

With the large and growing unemployment disparities in Europe in the wake of the global economic crisis (also termed the 'Great Recession'), the question of whether or not free labour mobility can be an equilibrating force on the labour market is a highly topical one. In the EU-27, the average unemployment rate rose between 2008 and 2013 from 7.5% to 10.9%, before falling back to 8.7% in 2016. However, not all countries were equally affected. Whereas the unemployment rate rose in Greece and Spain by 16 and 8 percentage points, respectively, between 2008 and 2016, it actually declined in Germany, by more than 3 percentage points. In the United States, the labour market impact of the crisis across states has also been far from even, although the variation has been less marked than in Europe.

This paper looks at the response of migration to differing labour market conditions, by analysing pre- and post-crisis migration movements in both Europe and the United States and how they have been linked to asymmetric economic shocks. Unlike most previous literature on this topic, we focus explicitly on the distinction between the pre- and post-crisis periods, and use region-fixed-effects regressions in a comparative study using two types of regional classifications for both free-mobility citizens' migration and total migration for both Europe and the United States. We also update our previous work (Jauer et al., 2014) by using data up to 2016, when unemployment rates had already decreased for 3 and 6 consecutive years from their crisis peaks in Europe and the United States, respectively. Consistent with Arpaia et al. (2016), Beyer and Smets (2015) and our previous results, we find that the migratory response to unemployment shocks increased with the crisis in Europe such as to almost catch up with the response observed for the United States. Still, a large share of population growth differences between regions in the Eurozone has been accounted for by inflows of citizens from outside of the Eurozone. Many of these migrants have been citizens from new EU member states (Arpaia et al., 2016; Kahanec and Pytliková, 2016; Kahanec and Guzi, 2016; Kahanec and Zimmermann, 2016).

As Kahanec and Zimmermann (2016) point out, the first decade of the 21st century was characterized by a 'double experiment of both EU enlargement … as well as the Great Recession' in Europe. Although regional mobility used to be low in the central European countries before EU accession (Bornhorst and Commander, 2006; Fidrmuc, 2004; Huber, 2007), east-west migration in the free mobility area in Europe

accelerated with the EU enlargements in 2004 and 2007 (Kahanec, Pytliková, and Zimmermann, 2016).[2] According to the OECD standardised migration statistics, the share of free movement inflows in total permanent inflows to those EU countries for which the OECD publishes standardised statistics rose from 43% on average over the period 2007-2010 to 52% on average over the period 2011-2015 (OECD, 2017). OECD data also show that migration of the free-mobility type is the component in international migration flows that has reacted most strongly to the crisis.

This paper is structured as follows. Section 2 reviews the existing empirical literature on the role of migration as a labour market adjustment mechanism. Section 3 presents the data used for the analysis as well as some descriptive information on recent trends in regional labour market disparities in Europe and the United States. Section 4 outlines the empirical approach used in the paper. Section 5 analyses the links between labour market disparities and migration responses, distinguishing between the pre-and post-crisis periods. Section 6 concludes.

2. The literature on migration as an adjustment mechanism to asymmetric shocks

With the introduction of the euro as the common currency, a higher degree of factor mobility, especially labour mobility, is required as an adjustment mechanism in the face of economic shocks if the Eurozone is to function effectively as an optimal currency area (Mundell, 1961). It is thus an important empirical question whether labour mobility acted as an adjustment mechanism in Europe, especially after experiencing a large negative shock during the crisis. It is particularly interesting to compare the responsiveness of labour mobility to labour market shocks in Europe with the one observed for the United States.

Nevertheless, mobility is not a sufficient condition for regional convergence after asymmetric shocks. Indeed, the New Economic Geography literature stresses spillover effects of human capital investments leading to agglomeration economies such that migration from less to better performing regions might exacerbate rather than counter regional divergence (Epifani and Gancia, 2005, and Francis, 2009). Moretti (2004) provides evidence for agglomeration economies with an influx of college graduates increasing wages even for that same group of workers in a city. Moretti (2013) provides a vivid account of the 'Great Divergence' in the United States. Empirical evidence for migration increasing rather than decreasing unemployment gaps is provided in Basile et al. (2012) for Italy, as well as in studies surveyed by Pastore

[2] The countries which joined in 2004 were Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia. Bulgaria and Romania joined in 2007.

(2012), although Niebuhr et al. (2012) reach the opposite conclusion for Germany. Zaiceva and Zimmermann (2016) show that there is significant return migration of migrants from recent EU accession countries (up to almost 20% depending on the source country).[3] Still, the New Economic Geography literature reminds us that, even if migration reacts to asymmetric shocks, this will not necessarily lead to regional convergence. Consistent with this hypothesis are the responses to an IZA labour market expert opinion survey where 59 percent of participants expected long-lasting effects of the asymmetric shocks experienced in Europe during the crisis (Krause, Rinne, and Zimmermann, 2017).

More than 20 years ago, Decressin and Fatás (1995) used a methodology developed by Blanchard and Katz (1992) to show that employment shocks led to a smaller migratory reaction in Europe than in the United States during the period 1968 to 1987. For the period 1981 to 1994, Bentivogli and Pagano (1999) obtain similar results. Von Weizsäcker (2008) agrees that *internal* mobility within the euro area is relatively low compared with mobility within the United States, but he argues that *external* immigration, i.e., from new EU member states and non-EU countries, can be a powerful substitute and thereby help assure the labour market adjustment process within the euro area, a judgement that is consistent with Puhani's (2001) findings for Italy.

All of the above studies refer to the pre-crisis period. Inspired by older papers such as Blanchard and Katz (1992) and Decressin and Fatás (1995), more recent literature has looked at the response of migration to economic conditions or shocks (Cadena and Kovak, 2013, and Kaplan and Schulhofer-Wohl, 2017, for the United States, Elsner and Zimmermann, 2016, for Germany, Kahanec, 2013, and Arpaia et al., 2016, for Europe). Regarding more recent trends, Molloy et al. (2011) review migration patterns within the United States over the past thirty years and find evidence for a secular decline in internal migration. Kaplan and Schulhofer-Wohl (2017) argue that this decline can largely be explained by easier learning about distant places before making a migration decision and by more homogeneity in returns to skills across regions. Molloy et al. (2011) also compare the experience of interregional migration in the United States with European data on within-country, inter-NUTS-2 mobility, where the latter data show an upward trend in the second half of the 2000s, although still below that observed in the United States.[4]

A few recent studies have looked specifically at the impact of the crisis on mobility in Europe. For the period 1970-2013, Arpaia et al. (2016) find that mobility reacts to (un)employment shocks and 'absorbs

[3] Beine and Coulombe (2018) estimate different effects of temporary versus permanent immigrants on the labour market in Canada.

[4] Note, however, that the data for Europe reported by Molloy et al (2011) only cover the pre-crisis period up to 2007.

about 25 % of asymmetric shocks after 1 year and about 50 % at peak, after about 5 years' (p.2) in the European Union, analysing data at the country level. Elsner and Zimmermann (2016), on the basis of a descriptive overview of migration flows to Germany and economic conditions, conclude that while there has been an increase in immigration from countries hardest hit by the crisis, the flows in question are too small to have a large impact on reducing unemployment in origin countries. A similar conclusion has been reached by Bräuninger and Majowski (2011) who modeled the links between migration to Germany and wage and unemployment differentials with Greece, Ireland, Portugal and Spain – the four EU countries hardest hit by the Eurozone debt crisis. Bertoli et al. (2013) analysed the effect of the economic crisis on net migration of EU-27/EFTA nationals to Germany. They argue that, although differences in the economic conditions between the origin countries and Germany played a role in the observed increase in net migration to Germany between 2006 and 2012, changes in the relative attractiveness of alternative destinations were more important. Beine et al. (2018) analyse the reaction of gross bilateral migration flows between 30 OECD countries from 1980 and 2010 to differences in business cycles and employment rates between origin and destination countries. They find that labour mobility in Europe has increased over the period considered and has become more reactive to asymmetric shocks.

Nevertheless, comparative studies for the United States and Europe, such as Dao et al. (2014) or Beyer and Smets (2015), are still rare. These studies look further into the past, which allows them to say more on dynamic adjustment. Using the methodology developed by Blanchard and Katz (1992), Dao et al. (2014) compare inter-state migration in the United States and mobility between 173 European regions in 21 countries and the response to regional labour demand shocks from 1998 to 2009. They find that the migration response to such shocks has increased in Europe over that period while it declined in the United States. They also find that the migration response has on average been larger in the countries which joined the EU in 2004 than in the EU-15 countries. Beyer and Smets (2015) use data from 1976 until 2013 and find that adjustment to shocks takes longer in Europe than in the United States, but that adjustment speeds have converged over time. However, unlike our study, these authors do not provide separate estimates for the periods before and after the crisis.

We add to this literature by explicitly focusing on recent events and by providing separate estimates for the pre- and post-crisis periods. In addition, we analyse both *internal* migration movements, that is of nationals of the free-mobility zone, and *all* migration flows. Estimates are provided both at NUTS-1 or state and at the NUTS-2 or SuperPUMA levels for Europe and the United States, respectively. We estimate the relationship between migration (proxied by population changes) and lagged regional unemployment and non-employment rate differentials. For reasons of data availability, we restrict ourselves to *net* migration, as we are not able to observe gross inflows and outflows separately (Coen-Pirani, 2010). Following Treyz et

al. (1993), we only consider a one-year lag and do not take into account the expectations of potential migrants' *future* labour earnings (Gallin, 2004; Kennan and Walker, 2011).

3. Data and regional disparities

The datasets used in this paper cover the EU-27/EFTA, the Eurozone, and the United States at two different levels of regional aggregation for the years 2005/06 (henceforth 2006) to 2015/16 (henceforth 2016). This period was chosen to cover both the crisis and the initial recovery period and the years preceding it; in addition, data at the more disaggregated regional level are only available consistently for both areas since 2005. The European free-mobility zone is defined as the EU-27 plus the countries of the European Free Trade Association (EFTA) for the entire period. Note that in terms of labour mobility, the EFTA countries form part of the same labour market as the EU-27. We include all of these countries in the free-mobility zone for the entire period in spite of the fact that not all the countries in question formed part of the free-mobility zone throughout that period – in particular, Bulgaria and Romania joined the EU only in 2007 – and that a number of transitional measures applied.[5] Indeed, migration flow data from a number of countries suggest that there was already significant migration from the new member countries prior to their accession to the European Union; a similar argument can be made for Switzerland regarding the gradual introduction of free mobility with the EU-15 (see OECD, 2012, for a discussion). In addition, immediately upon accession, all EU-27/EFTA countries had to introduce facilitations for nationals from the new EU member countries. For the purposes of this paper, the Eurozone is defined as the 17 member countries of the Euro currency union as of 2011, and comprises thus a subset of the EU-27/EFTA countries.

The period 2006-2016, to which we limit our analysis, followed the introduction of the euro as a common currency in 1999 and the EU enlargements in 2004 and 2007 with the adhesion of twelve new member countries to the EU and the gradual integration of Switzerland into the free-mobility zone. It has also been marked by the global economic crisis which started in 2008, and which had profound effects on both the labour markets of the EU-27/EFTA and the United States. The labour force survey data used for the analyses have been aggregated on a regional level for the entire EU-27/EFTA zone (including a subset for

[5] Croatia is excluded, because it only joined the EU in 2013.

the Eurozone) and the United States. The sample has been restricted to the working-age population (i.e., persons aged 15/16-64)[6].

Data for the EU-27/EFTA and the Eurozone are taken from the European Labour Force Survey (LFS). The regional classification used for the EU-27/EFTA and Eurozone countries is the Nomenclature of Statistical Territorial Units (NUTS). The survey data used for the estimations are aggregated on both the basic regional (NUTS-2) and major regional (NUTS-1) levels. The number of observed NUTS-2 regions in the EU-27/EFTA and Eurozone estimations is 263 and 168, respectively, with an average of about 1.3 million working-age inhabitants per region for each of the two areas under consideration. For the estimations on the NUTS-1 level, 98 regions for the EU-27/EFTA and 61 for the Eurozone are included, each with an average of about 3.5 million working-age inhabitants. Because we received the European Labour Force Survey as a data extract in the form of cell data, we took data on unemployment and non-employment as well as GDP per capita (used as a proxy for regional income per capita in the regressions) from the Eurostat Regional Database. In order to obtain a time-consistent regional coding, some NUTS2 regions for some countries had to be combined, such as for Switzerland, for which data are only included at the national level.

Data for the United States have been derived from the American Community Survey (ACS). Compared with other large-scale U.S. surveys, such as the Current Population Survey (CPS), the ACS has the advantage that it includes detailed geographic information below the state level on so-called Public Use Microdata Areas (PUMAs) since 2005. Compared with Metropolitan areas, the PUMA regional classification has the advantage that it covers the whole territory (see also Molloy et al. 2011). PUMA regions are the smallest geographic entity available in the ACS and have an average of 100,000 working-age inhabitants. Because the PUMA coding changed in 2012, we wrote an algorithm to create new 'PUMA' regions using information on the overlaps between the pre- and post-2012 PUMA classifications.[7] As a result, we created 836 time-consistent 'PUMA' regions from the original 2,071 and 2,351 pre- and post-2012 PUMA regions, respectively. The original pre-2012 PUMAs were aggregated into larger units, the SuperPUMAs, of which there are 532 with an average of 382,000 inhabitants in working age.[8] Because many of our 836 time-consistent new 'PUMA' regions overlapped with more than one pre-2012 SuperPUMA region, we again defined, based on an algorithm using overlap information, 230 time-consistent new 'SuperPUMA' regions.

---

6 While the minimum age of labour force entry in most European countries is 15, in a few countries and the United States it is 16.

7 Information on overlapping old (pre-2012) and new (2012 and after) PUMA regions is provide on the web page http://mcdc.missouri.edu/data/corrlst/puma2k_puma2010.csv

8 The SuperPUMA codes can be found on the following web page https://usa.ipums.org/usa/volii/2000PUMAsASCII.txt

With an average working-age population of about 0.9 million people, these time-consistent 'SuperPUMA' regions are somewhat smaller than the NUTS-2 regions in Europe with about 1.3 million working-age inhabitants. The equivalent to the NUTS-1 level is the state level in the United States, with an average working-age population of about 4 million, which is very similar in size to Europe's NUTS-1 regions. For the United States, we merge GDP per capita (obtained from the OECD Regional Database) as a proxy for regional income at the state level to both the state and 'SuperPUMA' regional data sets.

The unemployment rates are defined as the number of unemployed divided by the labour force (employed plus unemployed) of working age (15/16-64 years old), using the standard ILO definition for unemployment.[9] The non-employment rates are defined as the share of those not employed among the total working-age population. Population changes are measured by dividing the size of the population with the size of the population in the respective region one year earlier. Both the ACS and the LFS allow distinguishing between nationals and non-nationals in the regional population. For both data sets, weights are applied.

Figure 1 shows how unemployment has evolved in the EU-27, the Eurozone and the United States since 2005. As can be seen, both Europe and the United States experienced a strong increase in unemployment rates with the crisis, i.e. between 2008 and 2010. The unemployment increase was more sudden in the United States than in Europe, where it was more protracted. While unemployment has fallen continuously in the United States since 2010, it continued to grow in Europe until 2013, after which it also started to decline. A further observation is that unemployment had declined quite significantly in Europe in the years just prior to the crisis, whereas the decline was only marginal in the United States.

Figure 1 about here

A measure of the interregional disparity in unemployment rates is given by the coefficient of variation of the unemployment rates, which is about twice as large in Europe than in the United States (Figure 2). There is also much more cyclical variation in this measure in Europe, where a decline is observed until the beginning of the crisis (EU-27/EFTA) and an increase since 2009, which accelerated after 2010 until 2012, whereas no such changes are observed in the United States. One also observes a somewhat stronger increase in the unemployment variation in the Eurozone compared with the whole EU-27/EFTA at both NUTS-1 and NUTS-2 levels. However, after 2012/13, unemployment rates in the Eurozone started to converge whereas they continued to diverge for EU-27/EFTA.

[9] According to the ILO definition, the unemployed comprise all persons who, during the week prior to the survey interview, were without work while both being available for work and seeking work.

Figure 2 about here

4. Empirical approach

In the following, we measure shocks by increases in the regional un-/non-employment rate relative to the respective rate of the economic area of interest.[10] The unemployment rate is the standard indicator for labour market shocks. Many labour economists, however, like to supplement it with the non-employment (or employment) rate in order to get a more accurate picture of the state of the labour market (Cadena and Kovak, 2013). In the following, we will therefore use both indicators to measure the state of the labour market and the economy in general. Similar to a study by Puhani (2001) on labour mobility as a potential adjustment mechanism for economic shocks in Europe, we will investigate the statistical relationship between population changes in a region (both total population changes and changes induced by population changes of nationals within the free-mobility area) and the regional unemployment (non-employment) rate relative to the overall unemployment (non-employment) rate in the free-mobility area. Likewise, we include regional GDP/income per capita relative to the overall GDP/income per capita in the free-mobility area as a proxy for relative wages.[11] As pointed out by Harris and Todaro (1970), migration is determined by the expected wage, which is a positive function of the wage and a negative function of the unemployment (or non-employment) rate.

Our model is based on the concept of the population growth factor generated by net migration in a region being "produced" by its un-/non-employment rate and income per capita relative to the unemployment rate and income per capita in the whole economic area (here the EU-27/EFTA, the Eurozone, or the United States).[12] Hence, we set up the following production-function-like model:

$$\frac{mig_{it}+pop_{it-1}}{pop_{it-1}} = A_{it}\left(\frac{ur_{it-1}^{\alpha_1} y_{it-1}^{\alpha_2}}{ur_{nt-1}^{\alpha_1} y_{nt-1}^{\alpha_2}}\right), \qquad (1)$$

[10] It would be preferable to include a measure of relative real wages but unfortunately such data are not available at the regional level.

[11] By using relative measures, we assume that the decision to migrate or not is affected by the labour market situation in a given region relative to that elsewhere in the free-mobility area.

[12] By relating a flow (migration proxied by population change) to a stock (the lagged unemployment or non-employment rate), we build on the matching function literature, which is based on an analogy to the production function where the flow of new hires is "produced" by the stock of unemployed workers and vacancies (see Petrongolo and Pissarides, 2001 for a survey of this literature).

where *mig* indicates net migration and *pop* the population level. The relative unemployment rate $\left(\frac{ur_i}{ur_n}\right)$ in equation (1) equals the ratio of the unemployment rate in region *i* and the unemployment rate of the whole economic area *n* (EU-27/EFTA, Eurozone or United States). The relative non-employment rate $\left(\frac{nr_i}{nr_n}\right)$ is calculated in the same manner, as is the proxy measure of relative income per capita $\left(\frac{y_i}{y_n}\right)$.

Because our data do not allow us to observe net migration directly, we proxy the migration-induced population growth factor by the *actual* population growth factor as it is observed in the data. Hence,

$$\frac{mig_{it}+pop_{it-1}}{pop_{it-1}} \approx \frac{\Delta pop_{it}+pop_{it-1}}{pop_{it-1}} = \frac{pop_{it}}{pop_{it-1}} \qquad (2)$$

The following regressions are estimated separately for two dependent variables. In a first set of regressions, the total population change in a region is the dependent variable. It is henceforth called the '*population growth factor'* and is defined as $\left(\frac{pop_{it}}{pop_{it-1}}\right)$, where *pop* is the working-age population in region *i.* In a second set of regressions, the dependent variable is approximately the percentage change of the population that is induced by inter-regional movements of nationals of the free-mobility zone, hereafter referred to as the '*free-mobility-induced population growth factor*'. It is defined as $\left(\frac{\Delta fmp_{it}+ pop_{t-1}}{pop_{t-1}}\right)$, where Δ*fmp* characterises the *change* (proxy for *net migration*) in the working-age population accounted for by nationals of countries in the free-mobility area, that is $fmp_{it} - fmp_{it-1}$.

Thus, the simulated free-mobility-zone-migration-induced population change is the hypothetical population growth factor that would have been observed had the population only varied due to the changes in the number of free-mobility-zone migrants in that region. Ideally, we would like to measure migration-induced population change in all our regressions, but instead, the data only allow us to measure the total population change. This means, for example, that we also capture the effect of population ageing in our dependent variable – if more people pass our upper age limit of 64 than our lower age limit of 15/16, this shows up as a negative population change (i.e. a population growth factor smaller than one) – even if no migration is taking place. Although we would much prefer to have data on interregional migration flows directly, this measurement error need not be a problem for our analysis: any measurement error that is constant over our estimation period in any given region (such as steady population ageing) will not bias our estimates, because the region fixed effects will control for these time-constant measurement errors in the population change. To the extent that all regions in the free-mobility zone also experience a common trend in population ageing or any other measurement error, this measurement error will be controlled for by the fixed time (year) effects in our regressions. Even time-varying measurement error that is specific to certain

regions will not bias our coefficient of interest as long as this measurement error is not correlated with either the relative unemployment or non-employment rate.

Combining expressions (1) and (2) and taking logs, we obtain the following estimating equation:

$$\ln\left(\frac{pop_{it}}{pop_{it-1}}\right) = \alpha_0 + \alpha_1 \ln\left(\frac{ur_{it-1}}{ur_{nt-1}}\right) + \ln\left(\frac{y_{it-1}}{y_{nt-1}}\right) + \eta_t + \mu_i + \varepsilon_{it} \quad (3)$$

Note that the unemployment rate and the income variables for the whole economic area ur_{nt-1} and y_{nt-1}, which are included in the denominators of the right-hand side of the estimating equation, do not vary over time and are thus captured by the time fixed effects η_t; the normalization of the regressors by these variables for the whole economic area therefore has no effect on the empirical estimates. A ceteris paribus increase of 1% in the number of unemployed people amounts to a ceteris paribus increase of 1% (not one percentage point) in the relative unemployment rate, because

$$1.01 \times \frac{ur_{it-1}}{ur_{nt-1}} = \frac{1.01 \times \left(\frac{u_{it-1}}{lf_{it-1}}\right)}{\left(\frac{u_{nt-1}}{lf_{nt-1}}\right)} \quad (4)$$

where *lf* stands for 'labour force'. In the first set of regressions, we simulate how many persons migrate in year *t* for each additional person unemployed in year *t-1*.[13] By restricting the measurement of population change to migration of nationals from within the area under consideration in the second set of regressions, we can also isolate the size of the contribution of this particular group to the migratory response to regional unemployment dispersion and compare the intra-free mobility of the EU-27/EFTA area with interregional migration in the United States.

5. Analysis

We estimate regressions at two different regional levels in the free-mobility areas under consideration (EU-27/EFTA, Eurozone and the United States). Both OLS and fixed effects (FE) regressions are estimated. The FE estimates control for time-constant unobserved factors, such as time-constant measurement errors or time-constant differences in amenities (climate, infrastructure) that are unobserved but have an impact on

[13] We also ran separate regressions for the youth population aged 15/16-24 (available upon request). The results indicate, not surprisingly, that this group tends to be more responsive to changes in the relative regional labour market conditions than the overall working-age population.

net migration into a region. Whereas the OLS estimator uses all the variation in the data (within and between regions), the FE estimator only uses the variation in the dependent and impact variables over time in each region, that is the so-called 'within' variation in the data. The advantage of FE over OLS estimates is that time-constant unobserved factors (including measurement error) that influence net migration and are correlated with any impact variable will not lead to biased estimates once fixed region effects are included into the regression. The FE estimates are therefore our preferred estimates. We display coefficients for the full observation period 2005/06-2015/16 (because data on the lagged regressors unemployment and income per capita start already in 2005) and for the subperiods *before*, that is 2006-2009 for Europe and 2006-2008 for the United States and *after* the beginning of the financial crisis, that is 2010-2016 for Europe and 2009-2016 for the United States. When we write '2006', we mean that we regress the population change between 2005 and 2006 on the unemployment rate in 2005.

Table 1 shows the regression results for the full period (2006-2016). The OLS regressions generally indicate a statistically significant negative effect of relative unemployment on population growth, with the exception of the United States at state level, whereas none of the estimates for non-employment are both significant and negative. In contrast, in the FE specification all unemployment and all non-employment coefficients are significant for both Europe and the United States. The relative income per capita variable is significant with a positive coefficient in almost all the OLS regressions for both Europe and the United States but it becomes insignificant and often changes sign in the FE estimates, with the sole exception of the relative non-employment rate in the US state-level regression.

More than that, the coefficients on relative unemployment or non-employment rates are of similar size across regions (EU-27/EFTA, Eurozone, and United States) for any given regional coding (that is smaller or larger regions). The FE estimated coefficient of -0.012 for the Eurozone at NUTS-2 over the full period can be interpreted as follows: if the number of unemployed persons in the previous year increases by 1% *ceteris paribus*, the population growth rate in that region decreases by 0.012%.

In order to interpret the above coefficients correctly, we have to take into account that unemployed people are usually only a small fraction of the population. Therefore, in the Annex Tables we interpret the estimation coefficients at the sample means. For example, the average number of unemployed people in a Eurozone NUTS-2 region in our sample over the whole period is 91,707 people. A 1% increase in this number corresponds to 917 people. Thus, if unemployment in the previous year increased by 917 people, the population would decrease by 0.012%. How large is that number? The average population size for a Eurozone NUTS-2 region in our sample is 1,279,976 people, 0.012% of which are 157 people. Thus, 917 additional unemployed in a region in year *t-1* decreases the population in the region in year *t* by 157

people according to our FE estimates. This means that at a maximum 17% of the unemployment increase may be offset by a population change/out-migration. This is non-negligible and higher than previous estimates, such as those reported by Puhani (2001) which suggest a migration offset of 4% and 8% over the period for Italy and France, respectively.[14] Note, however, that these estimates provide upper bounds for the impact, since not all migration movements will be of unemployed people, and not all of those who move will take up employment elsewhere.

Table 2 disaggregates the results into the pre- and post-crisis periods, for the FE specification which is our preferred one. All estimated coefficients are negative, both for the unemployment and the non-employment measure, and most are statistically significant. The income per capita variable tends to be insignificant and sometimes changes sign depending on which of the two periods is the basis for the estimation. Here, it is interesting to observe that during the period after the start of the financial crisis 2009/10-2016, our point estimates for the two European areas are mostly much larger than for the period 2006-2008/09, whereas the reverse is the case in the United States in three out of four cases. Indeed, the estimates suggest that the pre-crisis labour mobility reaction to asymmetric labour market shocks was stronger in the United States than in Europe, in line with previous results in the literature. However, this pattern has disappeared with the crisis, with estimates sometimes being larger in Europe and sometimes in the United States, depending on the specification. We find, for example at the NUTS-2 level in the EU-27/EFTA, that in the period 2010-2016 at most 19% of the increase in unemployment was adjusted for by a population change, whereas the potential adjustment was only 16% and non-significant in the pre-crisis period (see the simulations in Table A1). For the estimates using relative non-employment as the impact variable, the simulation results are 18% during the crisis and an insignificant 5% in the pre-crisis period (Table A2). For the United States at the SuperPUMA level, the simulated upper bounds are 21% versus 87% post- and pre-crisis for unemployment shocks and 13% versus 27% post- and pre-crisis for non-employment shocks, respectively.

Tables 1 and 2 about here

Up to now, we have looked at the association between labour market disparities and all migration-induced population changes. Of particular interest is the population change that is generated by *nationals* within the free-mobility zone, as nationals of third countries from outside the respective region do not

[14] These estimates refer to the period 1985 to 1996. For Western Germany, Puhani (2001) reported an estimated offset of up to 30%; however, this period covered German reunification which was associated with large-scale movements from East to West Germany.

necessarily enjoy the same mobility rights.[15] Tables 3 and 4 present the OLS and FE results under this alternative specification, for the full period in the former table, and the FE results disaggregated between the pre- and post-crisis periods in the latter. In general, and not surprisingly, restricting the sample to nationals from within the free-mobility zone tends to weaken the association somewhat. This holds more in Europe than in the United States, particularly in the Eurozone, where per-capita migration flows from nationals outside of the free-mobility zone are much higher than in the United States (see OECD, 2017).[16] Despite a weaker association between regional population changes and labour market shocks for nationals, all coefficients in the fixed effects regressions in Table 3 remain negative when restricting population changes in the dependent variable to those induced by nationals only. When looking at mobility caused by citizens before and after the crisis (Table 4), this type of mobility increases for the EU-27/EFTA area, but results are not consistent for the United States, where mobility seems to have decreased at the SuperPUMA level, and they are also not consistent for the Eurozone, where an increase in mobility is observed only at the NUTS-1 but not at the NUTS-2 level. The upper bounds of the simulated adjustments due to migration in Tables A1 and A2 are similar for EU-27/EFTA and the United States in the post-crisis period, but mostly lower or statistically insignificant for the Eurozone.

Taking these different sets of estimates for the Eurozone and the EU-27/EFTA together, especially when comparing Tables 2 and 4, we conclude that labour market adjustment in Europe during the crisis was driven primarily by citizens from outside the Eurozone, such as the recent EU accession countries or non-EU-27/EFTA countries.

Tables 3 and 4 about here

6. Conclusion

This paper aimed at analysing the migration response to asymmetric labour market conditions in the pre- and post-crisis periods in Europe and the United States. We find that prior to the crisis, the migration response to labour market shocks was much stronger in the United States, in line with previous results in the

15 However, it is possible that part of the measured effect arises from naturalisations, i.e. immigrants with a non-EU-27/EFTA nationality taking up citizenship of their respective host countries – and this is a group that is particularly mobile.

16 Cadena and Kovak (2013) still demonstrate that Mexican migrants played a significant role in the absorption of labour market shocks in the United States during the crisis.

literature. This picture appears to have changed with the crisis and the evidence suggests that migration in Europe has reacted more strongly to changes in labour market conditions since the Great Recession whereas the opposite appears to be the case in the United States. Thus, the size of the gap in terms of the labour market adjustment due to migration between Europe and the United States narrowed significantly between the pre- and post-crisis periods irrespective of which regional classification is used.

The increase in labour mobility in Europe is linked to the EU enlargements of 2004 and 2007 which greatly increased the scope of free labour mobility within the EU/EFTA and the Eurozone. By doing so, it added to the adjustment capacity of the labour markets to cope with asymmetric shocks. It is also conceivable that there may be threshold effects at work (e.g., through fixed costs like language differences), implying that intra-European mobility has grown disproportionately only once labour market disparities have reached a certain level. Indeed, these disparities have widened more strongly with the crisis in Europe than in the United States and were, in terms of unemployment at the larger regional level, more than twice as large in Europe as in the United States.

With regard to the important issue of whether migration has functioned effectively in recent years as a labour market adjustment mechanism for the Eurozone in the face of asymmetric shocks, it is too early to pass a definitive judgement based on our results. More time and data would be needed to test this hypothesis. But we can conclude that migration has served to increase labour market adjustment within the Eurozone in recent years. Our findings suggest that within the Eurozone, adjustment due to labour migration occurred only to some extent from citizens within the Eurozone, and to a larger extent from other countries' citizens such as recent EU accession countries or non-EU-27/EFTA countries. Raising the contribution of Eurozone citizens to labour market adjustment within the Eurozone requires a continued move towards freer movement of labour within Europe.

COMPLIANCE WITH ETHICAL STANDARDS:

Funding: This study was not funded by external sources.

Conflict of Interest: The authors declare that they have no conflict of interest.

References

Arpaia A, Kiss A, Palvolgyi B, Turrini A (2016) Labour mobility and labour market adjustment in the EU. IZA Journal of Migration 5:21

Basile R, Girardi A, Mantuano M (2012) Migration and regional unemployment in Italy. The Open Urban Studies Journal 5:1-13

Beine M, Bourgeon P, Bricongne J-C (2018) Aggregate fluctuations and international migration. forthcoming in: Scandinavian Journal of Economics

Beine M, Coulombe S (2018) Immigration and internal mobility in Canada, Journal of Population Economics 31:69–106

Bentivogli Ch, Pagano P (1999) Regional disparities and labour mobility: the Euro-11 versus the USA. Labour 13:737-760

Bertoli S, Brücker H, Fernández-Huertas Moraga, J (2013) The European crisis and migration to Germany, Expectations and the diversion of migration flows. IZA Discussion Paper No. 7170, Bonn

Beyer RCM, Smets F (2015) Labour market adjustments and migration in Europe and the United States: how different? Economic Policy, October 2015:643–682

Blanchard OJ, Katz LF (1992) Regional evolutions. Brookings Papers on Economic Activity 1:1-75

Bornhorst F, Commander S (2006) Regional unemployment and its persistence in transition countries. Economics of Transition 14:269-288

Bräuninger D, Majowski C (2011) Labour mobility in the euro area. Deutsche Bank Research, Reports on European integration EU Monitor 85

Cadena BC, Kovak BK (2013) Immigrants equilibrate local labor markets: Evidence from the great recession. NBER Working Paper No. 19727, Cambridge, MA.

Caroleo FE and Pastore F (2010) Structural change and labour reallocation across regions: A review of the literature. In: Caroleo FE, Pastore F (eds.): The labour market impact of EU enlargement, A new regional geography of Europe? 17-47, Heidelberg: Physica/Springer

Coen-Pirani D (2010) Understanding gross worker flows across U.S. states. Journal of Monetary Economics 57:769-784

Dao M, Furceri D, Loungani P (2014) Regional labour market adjustments in the US and Europe. IMF Working Paper No. WP/14/26

Decressin J, Fatás A (1995) Regional labor market dynamics in Europe. European Economic Review 39: 1627-1655

Elsner B, Zimmermann KF (2016) Migration 10 years after: EU enlargement, closed borders, and migration to Germany. In: Kahanec M, Zimmermann KF (eds.): Labor migration, EU enlargement, and the Great Recession. Springer: Berlin

Epifani P, Gancia GA (2005) Trade, migration and regional unemployment. Regional Science and Urban Economics 35:625-644

Fidrmuc J (2004) Migration and regional adjustment to asymmetric shocks in transition economies. Journal of Comparative Economics 32:230-247

Francis J (2009) Agglomeration, job flows and unemployment. Annals of Regional Science 43:181-198

Gallin JH (2004) Net migration and state labor market dynamics. Journal of Labor Economics 22:1-21

Harris JR, Todaro MP (1970) Migration, unemployment and development: a two-sector analysis. American Economic Review 60:126-142

Huber P (2007) Regional labour market developments in transition: a survey of the empirical literature. European Journal of Comparative Economics 4:263-298

Jauer J, Liebig Th, Martin JP, Puhani PA (2014) Migration as an adjustment mechanism in the crisis? A comparison of Europe and the United States. IZA Discussion Paper No. 7921, Bonn

Jimeno JF, Bentolila S (1998) Regional unemployment persistence (Spain, 1976-1994). Labour Economics 5:25-51

Kahanec M (2013) Labor mobility in an enlarged European Union. In: Constant AF, Zimmermann KF (eds.): International handbook on the economics of migration. Edward Elgar: Cheltenham, UK, and Northampton

Kahanec M, Pytliková, M, Zimmermann KF (2016) The free movement of workers in an enlarged European Union: institutional underpinnings of economic adjustment. In: Kahanec M, Zimmermann KF (eds.): Labor migration, EU enlargement, and the Great Recession. Springer: Berlin

Kahanec M, Zimmermann KF (2016) EU post-enlargement migration and the Great Recession: lessons and policy implications. In: Kahanec M, Zimmermann KF (eds.): Labor migration, EU enlargement, and the Great Recession. Springer: Berlin

Kaplan G, Schulhofer-Wohl S (2017) Understanding the long-run decline in interstate migration. International Economic Review 58:57-94

Kennan J, Walker JR (2011) The effect of expected income on individual migration decisions. Econometrica 79:211-251

Krause A, Rinne U, Zimmermann KF (2017) European labor market integration: what the experts think International Journal of Manpower 38:954-974

Molloy R, Smith CL, Wozniak AK (2011) Internal migration in the United States. Journal of Economic Perspectives 25:173-196

Moretti E (2004) Estimation of the social return to higher education: evidence from longitudinal and repeated cross-sectional data. Journal of Econometrics 121:175-212

Moretti E (2013) The New Geography of Jobs. Mariner Books: Boston

Mundell RA (1961) A theory of optimum currency areas. American Economic Review 51:657-665.

Niebuhr A, Granato N, Haas A, Hamann S (2012) Does labour mobility reduce disparities between regional labour markets in Germany? Regional Studies 46:841-858

OECD (2012) Free movement of workers and labour market adjustment - recent experiences from OECD countries and the European Union. OECD Publishing: Paris

OECD (2017) International migration outlook. OECD Publishing: Paris

Pastore F (2012) *Primum vivere* … industrial change, job destruction and the geographical distribution of unemployment. IZA Journal of European Labor Studies 1:7

Petrongolo B, Pissarides CA (2001) Looking into the black box: a survey of the matching function. Journal of Economic Literature 39:390-431

Puhani PA (2001) Labour mobility, an adjustment mechanism in Euroland? Empirical evidence for Western Germany, France and Italy. German Economic Review 2:127-140

Treyz GI, Rickman DS, Hunt GL, Greenwood MJ (1993) The dynamics of U.S. internal migration. Review of Economics and Statistics 75:209-214

Von Weizsäcker J (2008) Divisions of labour: rethinking Europe's migration policy. Bruegel Blueprint Series, No. 6, Brussels

Zaiceva A, Zimmermann KF (2016) Returning home at times of trouble? Return migration of EU enlargement migrants during the crisis. In: Kahanec M, Zimmermann KF (eds.): Labor migration, EU enlargement, and the Great Recession. Springer: Berlin

Table 1: Unemployment, non-employment, and population change 2006-2016

	OLS EU-27/ EFTA	OLS Eurozone	OLS USA	FE EU-27/ EFTA	FE Eurozone	FE USA
Effect of Lagged Relative Unemployment						
NUTS-1/States						
log relative unemployment rate	-0.004***	-0.005**	-0.001	-0.015***	-0.013***	-0.016***
(s.e.)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.005)
log relative income	0.007***	0.006*	0.013***	-0.003	0.023	0.018
(s.e.)	(0.001)	(0.003)	(0.004)	(0.009)	(0.020)	(0.011)
R2 / R2 within	0.092	0.065	0.511	0.064	0.083	0.582
Number of regions	98	61	51	98	61	51
Number of time periods	11	11	11	11	11	11
Number of observations	1,076	669	561	1,076	669	561
NUTS-2/SuperPUMA						
log relative unemployment rate	-0.002**	-0.003**	-0.005***	-0.012***	-0.012***	-0.015***
(s.e.)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.004)
log relative income	0.007***	0.004*	0.005	-0.007	0.012	0.002
(s.e.)	(0.001)	(0.002)	(0.004)	(0.006)	(0.009)	(0.014)
R2 / R2 within	0.068	0.045	0.187	0.022	0.075	0.207
Number of regions	263	168	230	263	168	230
Number of time periods	11	11	11	11	11	11
Number of observations	2,887	1,842	2,530	2,887	1,842	2,530
Effect of Lagged Relative Non-employment						
NUTS-1/States						
log relative non-employment rate	0.002	0.007*	0.008	-0.056***	-0.048***	-0.041**
(s.e.)	(0.003)	(0.004)	(0.006)	(0.012)	(0.017)	(0.018)
log relative income	0.009***	0.010***	0.014***	-0.004	0.024	0.028***
(s.e.)	(0.001)	(0.003)	(0.003)	(0.010)	(0.021)	(0.010)
R2 / R2 within	0.084	0.059	0.515	0.062	0.080	0.579
Number of regions	98	61	51	98	61	51
Number of time periods	11	11	11	11	11	11
Number of observations	1,078	671	561	1,078	671	561
NUTS-2/SuperPUMA						
log relative non-employment rate	0.000	0.003	-0.001	-0.049***	-0.047***	-0.053***
(s.e.)	(0.002)	(0.003)	(0.003)	(0.007)	(0.009)	(0.012)
log relative income	0.007***	0.007***	0.006	-0.007	0.012	0.003
(s.e.)	(0.001)	(0.002)	(0.004)	(0.006)	(0.010)	(0.013)
R2 / R2 within	0.018	0.004	0.184	0.046	0.070	0.208
Number of regions	263	168	230	263	168	230
Number of time periods	11	11	11	11	11	11
Number of observations	2,891	1,846	2,530	2,891	1,846	2,530

Note: *** p<0.01, ** p<0.05, * p<0.1. All regressions include year fixed effects.
Source: European Labour Force Survey, Eurostat Regional Database, American Community Survey.

Table 2: Unemployment, non-employment, and population change in Europe and the United States before and after the crisis

	FE EU-27/ EFTA 2006-09	FE EU-27/ EFTA 2010-16	FE Eurozone 2006-09	FE Eurozone 2010-16	FE USA 2006-08	FE USA 2009-16
Effect of Lagged Relative Unemployment						
NUTS-1/States						
log relative unemployment rate	-0.011	-0.022***	-0.013***	-0.027***	-0.019	-0.025***
(s.e.)	(0.015)	(0.004)	(0.004)	(0.003)	(0.024)	(0.005)
log relative income	0.020	-0.013	-0.002	-0.022*	0.079	0.015
(s.e.)	(0.029)	(0.013)	(0.012)	(0.012)	(0.077)	(0.010)
R2 / R2 within	0.022	0.091	0.150	0.324	0.618	0.278
Number of regions	98	98	61	61	51	51
Number of time periods	4	7	4	7	3	8
Number of observations	390	686	238	427	153	408
NUTS-2/SuperPUMA						
log relative unemployment rate	-0.009	-0.013***	-0.012***	-0.011***	-0.041**	-0.013***
(s.e.)	(0.006)	(0.003)	(0.003)	(0.003)	(0.016)	(0.003)
log relative income	0.010	-0.003	-0.016	0.027**	0.086	0.004
(s.e.)	(0.014)	(0.011)	(0.012)	(0.012)	(0.105)	(0.014)
R2 / R2 within	0.012	0.020	0.040	0.074	0.213	0.059
Number of regions	263	263	168	168	230	230
Number of time periods	4	7	4	7	3	8
Number of observations	1,050	1,837	665	1,172	690	1,840
Effect of Lagged Relative Non-employment						
NUTS-1/States						
log relative non-employment rate	-0.042	-0.075***	-0.017	-0.106***	-0.065	-0.060***
(s.e.)	(0.061)	(0.017)	(0.098)	(0.014)	(0.078)	(0.016)
log relative income	0.024	-0.011	0.191**	-0.026*	0.090	0.028***
(s.e.)	(0.027)	(0.014)	(0.093)	(0.013)	(0.072)	(0.010)
R2 / R2 within	0.022	0.080	0.055	0.289	0.618	0.247
Number of regions	97	97	62	62	51	51
Number of time periods	4	7	4	7	3	8
Number of observations	392	686	244	427	153	408
NUTS-2/SuperPUMA						
log relative non-employment rate	-0.017	-0.061***	-0.027	-0.047***	-0.087*	-0.044***
(s.e.)	(0.025)	(0.013)	(0.038)	(0.014)	(0.050)	(0.011)
log relative income	0.017	-0.008	0.056	0.023*	0.136	0.004
(s.e.)	(0.013)	(0.011)	(0.035)	(0.014)	(0.102)	(0.014)
R2 / R2 within	0.010	0.023	0.018	0.061	0.207	0.059
Number of regions	263	263	168	168	230	230
Number of time periods	4	4	7	7	3	8
Number of observations	1,052	1,839	672	1,174	690	1,840

Note: *** p<0.01, ** p<0.05, * p<0.1. All regressions include year fixed effects.
Source: European Labour Force Survey, Eurostat Regional Database, American Community Survey.

Table 3: Unemployment, non-employment, and population change generated by nationals of the area under consideration 2006-2016

	OLS EU-27/ EFTA	OLS Eurozone	OLS USA	FE EU-27/ EFTA	FE Eurozone	FE USA
Effect of Lagged Relative Unemployment						
NUTS-1/States						
log relative unemployment rate	-0.003*	-0.002	-0.000	-0.009***	-0.005	-0.014***
(s.e.)	(0.002)	(0.001)	(0.003)	(0.003)	(0.004)	(0.005)
log relative income	0.007***	0.004*	0.012***	-0.004	0.012	0.010
(s.e.)	(0.001)	(0.002)	(0.004)	(0.009)	(0.017)	(0.011)
R2 / R2 within	0.072	0.046	0.451	0.033	0.047	0.504
Number of regions	98	61	51	98	61	51
Number of time periods	11	11	11	11	11	11
Number of observations	1,076	669	561	1,076	669	561
NUTS-2/SuperPUMA						
log relative unemployment rate	-0.001	0.000	-0.003*	-0.007***	-0.002	-0.011***
(s.e.)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.004)
log relative income	0.006***	0.003**	0.005	-0.007	0.006	0.002
(s.e.)	(0.001)	0.000	(0.004)	(0.006)	(0.009)	(0.014)
R2 / R2 within	0.051	0.022	0.148	0.024	0.022	0.162
Number of regions	273	167	230	273	167	230
Number of time periods	11	11	11	11	11	11
Number of observations	2,887	1,842	2,530	2,887	1,842	2,530
Effect of Lagged Relative Non-employment						
NUTS-1/States						
log relative non-employment rate	0.003	0.008**	0.009	-0.035***	-0.021	-0.032*
(s.e.)	(0.003)	(0.003)	(0.006)	(0.011)	(0.015)	(0.019)
log relative income	0.008***	0.007***	0.013***	-0.005	0.009	0.020*
(s.e.)	(0.001)	(0.002)	(0.004)	(0.009)	(0.018)	(0.010)
R2 / R2 within	0.070	0.049	0.456	0.034	0.047	0.500
Number of regions	97	62	51	97	62	51
Number of time periods	11	11	11	11	11	11
Number of observations	1,078	671	561	1,078	671	561
NUTS-2/SuperPUMA						
log relative non-employment rate	0.001	0.004*	-0.000	-0.028***	-0.013*	-0.054***
(s.e.)	(0.002)	(0.002)	(0.003)	(0.007)	(0.008)	(0.012)
log relative income	0.007***	0.005***	0.006	-0.008	0.003	-0.002
(s.e.)	(0.001)	(0.002)	(0.004)	(0.006)	(0.009)	(0.014)
R2 / R2 within	0.051	0.023	0.147	0.024	0.022	0.166
Number of regions	263	168	230	263	168	230
Number of time periods	11	11	11	11	11	11
Number of observations	2,891	1,846	2,530	2,891	1,846	2,530

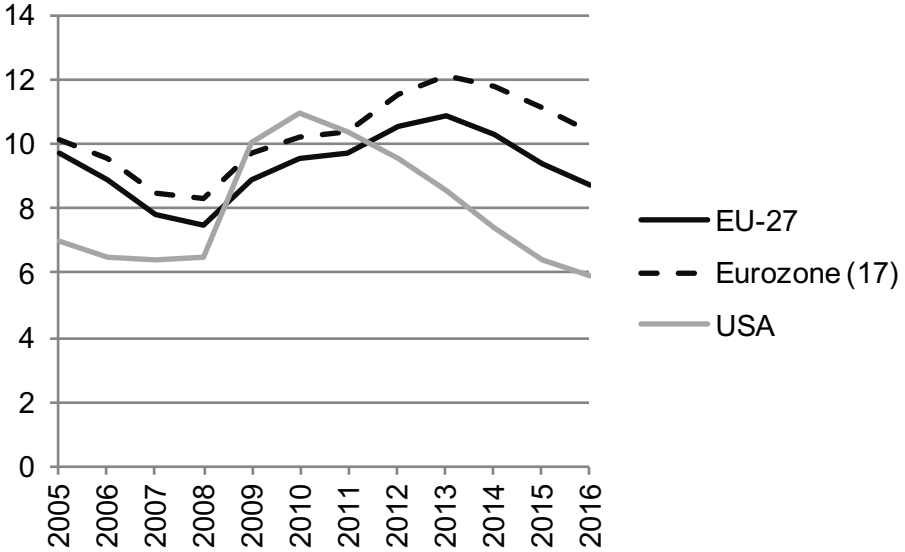
Note: *** p<0.01, ** p<0.05, * p<0.1. All regressions include year fixed effects.
Source: European Labour Force Survey, Eurostat Regional Database, American Community Survey.

Table 4: Unemployment, non-employment, and population change generated by nationals of the area under consideration, before and after the crisis

	FE EU-27/ EFTA 2006-09	FE EU-27/ EFTA 2010-16	FE Eurozone 2006-09	FE Eurozone 2010-16	FE USA 2006-08	FE USA 2009-16
Effect of Lagged Relative Unemployment						
NUTS-1/State						
log relative unemployment rate	-0.009	-0.016***	-0.004	-0.014***	-0.021	-0.024***
(s.e.)	(0.014)	(0.004)	(0.024)	(0.003)	(0.025)	(0.005)
log relative income	0.004	-0.005	0.141*	-0.015	0.098	0.012
(s.e.)	(0.027)	(0.013)	(0.082)	(0.010)	(0.079)	(0.011)
R2 / R2 within	0.015	0.052	0.055	0.119	0.546	0.179
Number of regions	98	98	61	61	51	51
Number of time periods	4	7	4	7	3	8
Number of observations	390	686	242	427	153	408
NUTS-2/SuperPUMA						
log relative unemployment rate	-0.008	-0.008**	-0.010	0.002	-0.041**	-0.007*
(s.e.)	(0.006)	(0.003)	(0.009)	(0.003)	(0.016)	(0.004)
log relative income	0.003	0.006	0.034	0.034***	0.110	0.005
(s.e.)	(0.013)	(0.011)	(0.032)	(0.012)	(0.101)	(0.015)
R2 / R2 within	0.009	0.009	0.023	0.015	0.177	0.024
Number of regions	263	263	168	168	230	30
Number of time periods	4	7	4	7	3	8
Number of observations	1,050	1,837	670	1,172	690	1,840
Effect of Lagged Relative Non-employment						
NUTS-1/State						
log relative non-employment rate	-0.027	-0.057***	-0.019	-0.064***	-0.059	-0.054***
(s.e.)	(0.056)	(0.017)	(0.084)	(0.013)	(0.081)	(0.018)
log relative income	0.009	-0.006	0.141*	-0.025**	0.112	0.025**
(s.e.)	(0.025)	(0.014)	(0.079)	(0.012)	(0.074)	(0.011)
R2 / R2 within	0.014	0.048	0.055	0.121	0.546	0.147
Number of regions	98	98	61	61	51	51
Number of time periods	4	7	4	7	3	8
Number of observations	392	686	244	427	153	408
NUTS-2/SuperPUMA						
log relative non-employment rate	-0.003	-0.046***	-0.013	-0.009	-0.094**	-0.043***
(s.e.)	(0.024)	(0.013)	(0.034)	(0.014)	(0.048)	(0.012)
log relative income	0.011	-0.004	0.041	0.021	0.157	0.001
(s.e.)	(0.012)	(0.011)	(0.031)	(0.013)	(0.098)	(0.015)
R2 / R2 within	0.007	0.014	0.021	0.014	0.172	0.030
Number of regions	263	263	168	168	230	230
Number of time periods	4	7	4	7	3	8
Number of observations	1,052	1,839	672	1,174	690	1,840

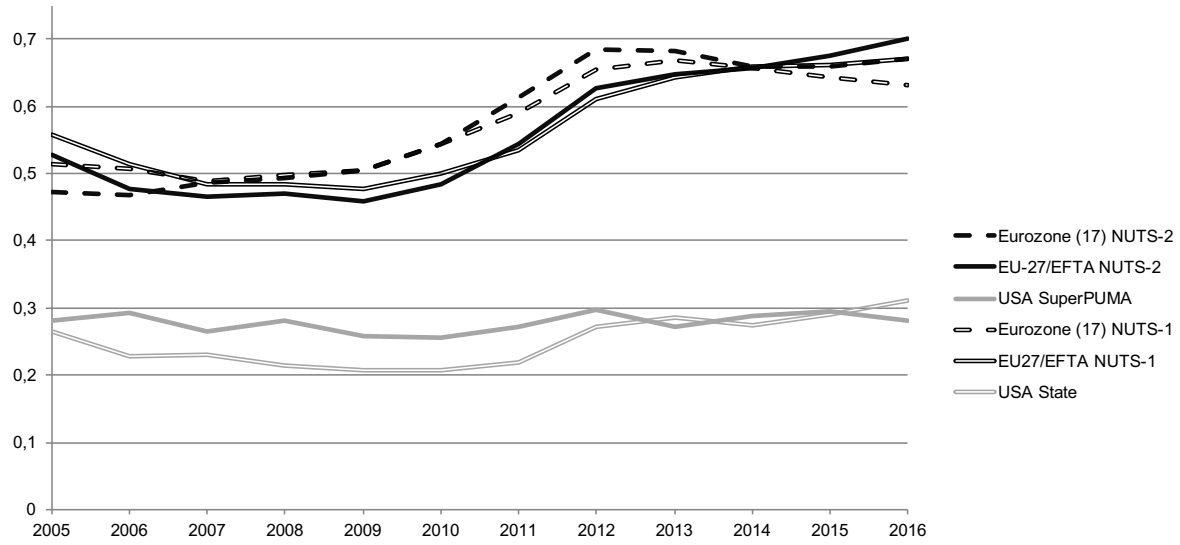
Note: *** p<0.01, ** p<0.05, * p<0.1. All regressions include year fixed effects.
Source: European Labour Force Survey, Eurostat Regional Database, American Community Survey.

Figure 1: Unemployment rates in the EU-27, Eurozone, and the United States, 2005-2016



Source: Eurostat Regional Database, American Community Survey.

Figure 2: Coefficients of variation in regional unemployment in Europe and in the United States



Source: Eurostat Regional Database, American Community Survey.

ANNEX: SIMULATIONS

Table A1: Simulated unemployment adjustment due to migration (based on FE models)

	Coeff.	Average Number of Unemployed	Average Population	1 Percent Change in Unemployment	Migration-Induced Population Change	Unemployment Adjustment due to Migration (%)
Larger Regions						
EU-27/EFTA NUTS-1						
All Migration						
2006-2016	-.015	222,580	3,434,495	2,226	-502	23
2006-2009	(-.011)	190,391	3,461,596	1,904	(-394)	(21)
2010-2016	-.022	240,879	3,419,087	2,409	-759	32
Only EU Citizens' Migration						
2006-2016	-.009	222,580	3,434,495	2,226	-301	14
2006-2009	(-.009)	190,391	3,461,596	1,904	(-322)	(17)
2010-2016	-.016	240,879	3,419,087	2,409	-543	23
Eurozone NUTS-1						
All Migration						
2006-2016	-.013	252,523	3,529,182	2,525	-472	19
2006-2009	-.013	211,190	3,604,143	2,112	-475	22
2010-2016	-.027	277,694	3,514,620	2,777	-954	34
Only Eurozone Citizens' Migration						
2006-2016	(-.005)	252,523	3,529,182	2,525	(-166)	(7)
2006-2009	(-.004)	208,110	3,554,876	2,081	(-149)	(7)
2010-2016	-.014	277,694	3,514,620	2,777	-491	18
USA States						
All Migration						
2006-2016	-.016	237,110	4,078,656	2,371	-654	28
2006-2008	(-.019)	187,223	3,977,084	1,872	(-769)	(41)
2009-2016	-.025	255,818	4,116,745	2,558	-1,015	40
Only US Citizens' Migration						
2006-2011	-.014	237,110	4,078,656	2,371	-574	24
2006-2008	(-.021)	187,223	3,977,084	1,872	(-835)	(45)
2009-2011	-.024	255,818	4,116,745	2,558	-990	39
Smaller Regions						
EU-27/EFTA NUTS-2						
All Migration						
2006-2016	-.012	82,945	1,278,909	829	-158	19
2006-2009	(-.009)	70,777	1,285,736	708	(-113)	(16)
2010-2016	-.013	89,898	1,275,006	899	-172	19
Only EU Citizens' Migration						
2006-2016	-.007	82,945	1,278,909	829	-84	10
2006-2009	(-.008)	70,777	1,285,736	708	(-97)	(14)
2010-2016	-.008	89,898	1,275,006	899	-96	11
Eurozone NUTS-2						
All Migration						
2006-2016	-.012	91,707	1,279,976	917	-157	17
2006-2009	-.012	75,672	1,289,667	757	-159	21
2010-2016	-.011	101,097	1,277,675	1,011	-146	14
Only Eurozone Citizens' Migration						
2006-2016	(-.002)	91,707	1,279,976	917	(-31)	(3)
2006-2009	(-.010)	75,271	1,284,000	753	(-123)	(16)
2010-2016	(.002)	101,097	1,277,675	1,011	(23)	(-2)
USA SuperPUMA						
All Migration						
2006-2016	-.015	52,577	904,398	526	-132	25
2006-2008	-.041	41,515	881,875	415	-362	87
2009-2016	-.013	56,725	912,844	567	-122	21
Only US Citizens' Migration						
2006-2011	-.011	52,577	904,398	526	-95	18
2006-2008	-.041	41,515	881,875	415	-357	86
2009-2016	-.007	56,725	912,844	567	-64	11

Note: Values in brackets are not within significance level of $p<0.1$.

Source: European Labour Force Survey, Eurostat Regional Database, American Community Survey.

Table A2: Simulated non-employment adjustment due to migration (based on FE models)

	Coeff.	Average Number of Non-employed	Average Population	1 Percent Change in Non-employment	Migration-Induced Population Change	Non-employment Adjustment due to Migration (%)
Larger Regions						
EU-27/EFTA NUTS-1						
All Migration						
2006-2016	-.056	1,151,509	3,428,432	11,515	-1,903	17
2006-2009	(-.042)	1,152,827	3,444,785	11,528	(-1,433)	(12)
2010-2016	-.075	1,150,630	3,419,087	11,506	-2,548	22
Only EU Citizens' Migration						
2006-2016	-.035	1,151,509	3,428,432	11,515	-1,189	10
2006-2009	(-.027)	1,152,827	3,444,785	11,528	(-916)	(8)
2010-2016	-.057	1,150,630	3,419,087	11,506	-1,939	17
Eurozone NUTS-1						
All Migration						
2006-2016	-.048	1,213,672	3,519,160	12,137	-1,700	14
2006-2009	(-.017)	1,196,204	3,527,104	11,962	(-594)	(5)
2010-2016	-.106	1,225,317	3,514,620	12,253	-3,715	30
Only Eurozone Citizens' Migration						
2006-2016	(-.021)	1,213,672	3,519,160	12,137	(-727)	(6)
2006-2009	(-.019)	1,196,204	3,527,104	11,962	(-653)	(5)
2010-2016	-.064	1,225,317	3,514,620	12,253	-2,250	18
USA States						
All Migration						
2006-2016	-.041	1,373,319	4,078,656	13,733	-1,677	12
2006-2008	(-.065)	1,271,319	3,977,084	12,713	(-2,575)	(20)
2009-2016	-.060	1,411,568	4,116745	14,116	-2,479	18
Only US Citizens' Migration						
2006-2011	-.032	1,373,319	4,078,656	13,733	-1,289	9
2006-2008	(-.059)	1,271,319	3,977,084	12,713	(-2,365)	(19)
2009-2011	-.054	1,411,568	4,116,745	14,116	-2,242	16
Smaller Regions						
EU-27/EFTA NUTS-2						
All Migration						
2006-2016	-.049	429,081	1,277,356	4,291	-625	15
2006-2009	(-.017)	429,572	1,283,608	4,296	(-220)	(5)
2010-2016	-.061	428,753	1,273,780	4,288	-782	18
Only EU Citizens' Migration						
2006-2016	-.028	429,081	1,277,356	4,291	-358	8
2006-2009	(-.003)	429,572	1,283,608	4,296	(-38)	(1)
2010-2016	-.046	428,753	1,273,780	4,288	-591	14
Eurozone NUTS-2						
All Migration						
2006-2016	-.047	440,680	1,277,542	4,407	-604	14
2006-2009	(-.027)	434,336	1,280,675	4,343	(-347)	(8)
2010-2016	-.047	444,909	1,275,749	4,449	-600	13
Only Eurozone Citizens' Migration						
2006-2016	-.013	440,680	1,277,542	4,407	-172	4
2006-2009	(-.013)	434,336	1,280,675	4,343	(-162)	(4)
2010-2016	(-.009)	444,909	1,275,749	4,449	(-121)	(3)
USA SuperPUMA						
All Migration						
2006-2016	-.053	304,518	904,398	3,045	-477	16
2006-2008	-.087	281,901	881,875	2,819	-766	27
2009-2016	-.044	313,000	912,844	3,130	-399	13
Only US Citizens' Migration						
2006-2011	-.054	304,518	904,398	3,045	-488	16
2006-2008	-.094	281,901	881,875	2,819	-832	30
2009-2016	-.043	313,000	912,844	3,130	-396	13

Note: Values in brackets are not within significance level of $p<0.1$.

Source: European Labour Force Survey, Eurostat Regional Database, American Community Survey.