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Abstract

We consider how two groups of regions, which differ in productivity and public good endowments, compete in tax and public goods to attract or reject migrants. In our framework the less productive regions receive public transfers which increase their panoply of public goods. We find that, whenever public transfers are sufficiently high, migration to the less productive regions is observed only in the case when the productivity gap between regions is not extremely wide. We then employ a regression discontinuity design to empirically assess the causal relationship between the reception of large amounts of public funds and migration flows in the EU-15 regions. The theoretical predictions are broadly confirmed as we find a wide expansion in the share of foreign citizens in the highly-subsidized regions, when compared to low-subsidized regions with similar pre-treatment characteristics.

Keywords: migration, fiscal competition, EU Cohesion Policy, regression discontinuity design

JEL codes: C21, F22, H20, R11

1 Introduction

From an economic point of view, migrations are the empirical expression of factor mobility across international borders and, therefore, globally increase the efficiency of production processes. However, from a social point of view, they are complex events, often costly and wasteful, which require resources and flexibility both from those emigrating and from those who welcome immigrants. Faced

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with a dramatic increase in migratory flows to high-income countries (United Nations, 2017), the economic literature has asked itself what the mechanisms are that guide the choice to migrate and the final destination, in order to help developed countries to govern this complex phenomenon.

Our study focuses on attraction factors, often named "pull" factors, which concern economic, social and even personal aspects of migrations. The starting point is the simple framework presented in Hatton and Williamson (2005), where an individual is more likely to migrate, the higher the compensating differential is, i.e. the net wage in the destination country minus the net wage in the home country, and the lower the fixed migration cost is. In such a framework, there is a clear role for government intervention. Since the 1960s, it has been well-established that local governments strategically set taxes in order to prevent migration outflows and to attract mobile factors of production, thereby generating the so-called race-to-the-bottom, in which taxes are set lower and lower (Oates, 1968; Gordon, 1983; Wilson, 1986, 1992; Edwards and Keen, 1996). More recently, however, the individual-specific compensating differential, including welfare benefits, has been identified as a more comprehensive driver of migration (see, inter alia, Boeri et al., 2002; Facchini and Mayda, 2009). In fact, the availability of public goods and public assistance is now considered to greatly influence migration decisions. Borjas (1999) shows that generous welfare programs offered by many U.S. states have become a "magnet" for immigrants. Concerning the EU-15 countries, which also represent the focus of our empirical analysis, De Giorgi and Pellizzari (2009) estimate the extent to which welfare generosity affects the location decisions of migrants. The conclusions are that these welfare magnets are positive but relatively weak, compared to the role of labor market conditions, such as the unemployment rate and the level of wages.[1] However, the paper suggests that the important issue is to what extent the variation in the welfare institutions across the countries of the EU will generate changes and distortions in the flows of migration. Migrations are also shaped by the availability of public goods such as education, health, infrastructure and public services. In a recent report by the World Economic Forum (Schwab, 2017), inadequate or limited urban services and infrastructure are indicated among the causes of migration (push factors), whereas affordable and accessible urban services (including health care, education, utilities and transport) are among the pull factors.

The supply of welfare benefits and of public goods and services is strongly differentiated in quantity and quality among European regions (see, among others, de Jong et al., 2016). De Giorgi and Pellizzari (page 354, 2009) conclude that "even if the process of economic and social integration has led to harmonization of several policy dimensions across Europe, very little has been done on the welfare side, most likely because of political impediments". Concerning transport infrastructure, the Fifth report on economic, social and territorial cohesion by the European Commission (page 57, 2010), indicates that the "endowment of transport infrastructure varies widely across the EU, especially in terms of

[1] Kennan and Walker (2010) find an even weaker relationship for the U.S.

roads. Density of motorways is three times the EU average in the Netherlands and Luxembourg but is below 10% of average in Romania". The same report shows the presence of large disparities in health risks between regions, reflecting different levels of health care quality. Furthermore, access to basic services, such as compulsory schools, primary health care and banking differ both between and within countries. The reduction in economic and social disparities among regions, enshrined in Article 174 of the Treaty, is the main objective of the EU Cohesion Policy. This policy, based on the Structural Funds and the Cohesion Fund (EUF), is the most extensive and long-lived regional policy across regions and countries worldwide. It mostly finances large-scale infrastructure investment in transport, environment, education and other important sectors such as culture, health, energy or ICT (see European Commission, 2014). A number of studies have demonstrated that investments in infrastructure, education and R&D, financed by the EU Cohesion Policy, have had a positive effect on economic performance and on the convergence in income and wealth among European regions (see, among others, Basile et al., 2008; Becker et al., 2010, Pellegrini et al., 2013). The conclusion is that the Cohesion Policy contributes directly to the supply of public goods in European regions, and therefore affects, through this channel, the decision to migrate and the final destination of migration toward Europe.

The scope of our analysis is twofold. First, we investigate the effects of asymmetries among European regions on the choice of migration. In particular, we embrace a positive approach of analysis and consider how two (groups of) regions, which differ in productivity and public good endowments, compete in tax and public goods to attract or reject migrants, who are also taxpayers. We assume that the less productive regions receive EUF which increase the panoply of their public goods. The higher the level of public goods in a region, the lower the corresponding private expenditure for basic services. Providing public goods and services is costly. Individuals in each jurisdiction are heterogeneous with respect to the cost of migration. Each jurisdiction seeks to maximize its revenue in a three-stage game, where governments first select the optimal level of public goods and then, at the second stage, the optimal taxation. Citizens decide where to live at the third stage. We find that, if the productivity gap between regions is not extremely wide, migration from the more productive region to the one receiving public transfers can be observed whenever regional funds are sufficiently high, which is in line with the history of the recent flow of immigration to many European regions.

Then, we empirically assess the relationship between the EU Cohesion Policy and migration flows in the EU-15 regions. We identify such a causal relationship by adopting the regression discontinuity design (RDD), which is a quasi-experimental method with a very high internal validity (Lee and Lemieux, 2010). Comparing the economic scenario arising under the policy intervention with a counterfactual situation (what would have happened if the policy had not been implemented), this method isolates the impact of the EU Cohesion Policy from the confounding effects induced by other factors (see Mohl and Hagen, 2010). To this end, we exploit the allocation rule of regional EU transfers: less developed regions, with per capita GDP (in Purchasing Power Standards) below 75 per cent of the EU average, qualify for Objective 1 (Ob.1) status, i.e. they receive most of the EUF (called "treated" regions). We assume that non-eligible regions, with a per capita GDP level just above the 75 per cent threshold (called "non-treated" regions), represent a very good counterfactual scenario to those just below the threshold (Cerqua and Pellegrini, 2018). We find a wide expansion in the share of foreign citizens in Ob.1 regions due to EUF and mostly driven by the increase in the number of non-European migrants. The results are robust to different specifications of the RDD and hold even when we take into account that regions having at least a border with access to the sea or sharing a border with countries not belonging to the EU-15, that might be more vulnerable to the arrival of legal and illegal migrants.

Our paper makes three contributions. First, we combine fiscal policy, public goods and migration in a unified setting. Indeed, we consider the effects of tax competition among regions with heterogeneous public goods to attract labor migration flows, while taking into account the role of a regional policy. Our approach is related to the literature which observes how governments strategically set their taxation to make the net income of residents particularly attractive (Epple and Romer, 1991; Gabszewicz et al., 2016; Razin, 2013; Wildasin, 2006). Nonetheless, as regional policies can hugely enhance the provision of public goods, we complement this literature considering these policies as a tool for improving public goods and services, in shaping the optimal taxation. Second, although there is a vast empirical literature on the economic impact of EUF (see the meta-analysis by Dall'Erba and Fang, 2017), the link between the EU regional policy and migration is arguably an under-researched topic, and regional data on migration are scarce. The two most relevant exceptions are Kessler et al. (2011), who adopt a model of residential and political choice, and Egger et al. (2014), whose analysis is based on a new economic geography model. However, the empirical analyses of these papers are based on country level data, which - considering the regional nature of the policy and the large regional inequalities within most EU countries - lead to a limited explanatory power of the empirical models used. In our empirical analysis, we have created a new dataset containing migration flows among European regions at the NUTS 2 level[2] for the years 2001 and 2011, considering intra- and extra-European migration flows. To the best of our knowledge, it is the first time that a similar dataset has been set up. Finally, the causal relationship between EUF and final destination is evaluated for the first time, using an RDD. Given the increasing share of the EU budget devoted to the Cohesion Policy since the mid-1970s and the dramatic increase in migratory flows to Europe, the policy's contribution to the attraction of migrants is crucial information to EU policy makers in shaping the regional distribution of EUF.

The paper is structured as follows. Section 2 describes the theoretical model, while the data and the evaluation method are discussed in Section 3. The results

[2] NUTS stands for "Nomenclature of Statistical Territorial Units". NUTS-2 regions are defined by minimum and maximum population thresholds of 800 thousand to 3 million inhabitants and correspond to administrative divisions in EU Member States.

of the empirical analysis are presented in Section 4, while Section 5 assesses the robustness of the estimates. The final section concludes the paper.

2 The theoretical model

We analyze a model with two jurisdictions A and B which differ in productive efficiency and public good endowments. Following Pieretti and Zanaj (2011), a jurisdiction is viewed here as a region having the power to tax.[3] The population in each region is uniformly distributed in the interval $[0, 1]$. No significant difference is observed between regions in terms of size and population density, so that, denoting with l_i the population density in country i, $l_A = l_B = l$. Following Mansoorian and Myers (1993), in this unit interval, types are ranked according to the cost of migrating from one's own country to the other. This cost is assumed to be equal to x for individuals of type x, $x \in [0, 1]$and constitutes the only source of heterogeneity among people. Each type of resident offers one unit of labor on a national competitive labor market. Labor demand is expressed by a continuum of firms. They produce with constant return to scale and offer a competitive wage of $w_i = \alpha_i$ where α_i is labor productivity in country i , $i = A, B$. Given w_i, residents incur a private expenditure S for basic services such as healthcare, education and training, or property rights protection. This private expenditure is however reduced by the panoply of public goods and services provided by each jurisdiction.[4] In order to keep the focus on the role of regional policy in enhancing public services and thus affecting migration, we assume that $S_A = S_B = S$.[5] The expenditure-reducing effect of public goods is grasped by k_i, which is jurisdiction-specific. Region B which is supposed to be less productive than region A ($w_A > w_B$) receives EUF. Due to these transfers, this jurisdiction extends its transport network, invests in education and supports public access to healthcare, *inter alia*. Accordingly, in

[3] The structure of our model is formally related to the contributions by Gabszewicz et al. (2016). In that paper, the authors study labor migration flows between two countries (regions) with different-sized populations and different levels of productive efficiencies and evaluate the effects of such flows on income taxation. Departing from them, our key assumption is that one of the two jurisdictions, which do not differ in dimension on average, receives EUF and, thus, increases the panoply of its public goods and services.

[4] A similar approach is adopted by Pieretti and Zanaj (2011) where a private component of productivity is combined with a public input – public good – supplied by a jurisdiction. Although their focus is on competition among jurisdictions to attract foreign capital rather than labor, we are close to them in that they interpret the panoply of public goods in a jurisdiction as public inputs that enhance firms' productivity. Also, in Hauptmeier et al. (2012), the public input raises the marginal productivity of the private input. It somehow resembles the assumption on the complementarity between private capital and public investment in the fiscal equalization literature (see, for instance, Hindriks et al., 2008), too.

[5] Assuming that S is jurisdiction-specific, namely $S_A \neq S_B$ would make the analysis more complicated and would prevent us from grasping the role of public goods and services, and wage gap in affecting migration, since it would add a further driver to the migration choice. Alternatively, one could drop the component S from the analysis and interpret w_i as the wage, net of private expenditure. In this case, *a priori* this wage could be different between jurisdictions also due to a heterogeneous level of private expenditure.

jurisdiction B, the private expenditure S is reduced by $k_B(1+s)$, where s captures the impact of EUF on S.[6]

The government in each region aims to maximize tax revenues. Residents are supposed to be free to migrate from their own place to the other, after comparing the net income that they will obtain in each region.[7] This in turn is determined by wages, net of taxes, and private expenditure for public services. The latter component is lower, the wider the public services that are guaranteed by the jurisdiction. Accordingly, the government defines the optimal taxation and the amount of public goods and services, while taking into account that migration – with a consequent possible change in the tax base – will be observed as a reaction to fiscal pressure and public endowment.

2.1 The game

In order to capture the above ingredients of the model, we describe a three-stage game where governments first select the optimal level of public goods and then, at the second stage, the optimal taxation. Citizens decide where to live at the third stage. Further, we introduce a cost for the provision of public goods and services. This cost is assumed to be quadratic.[8] We mainly analyze the role of EUF in affecting the optimal investment in public goods and services, and, *through* this, migration. We start by considering the case when migration occurs from region A to region B. Then, we move to the reverse case of migration from B to A.

Migration from A to B

In this scenario, the resident who is indifferent between staying in the origin country or moving abroad is given by the solution of the following equation

$$w_A - (S - k_A) - t_A = w_B - (S - k_B(1+s)) - t_B - x$$

so that

$$x = k_B(1+s) - k_A + (w_B - w_A) - (t_B - t_A). \quad (1)$$

Notice that, given taxes t_A and t_B the benefit of moving from A to B increases with the wage gap $(w_B - w_A)$ and the differential in the contribution of public goods and services $(k_B(1+s) - k_A)$ to private expenditure S.

The set of residents migrating from A to B is thus given by the interval $[0, x]$, while the complementary interval $]x, 1]$ represents the set of people deciding to live in country A. It is immediate to see that migration takes place at equilibrium if and only if x at equilibrium is strictly positive.

[6] Formally, the expenditure-reducing role of public goods can be also related to the paper by Zissimos and Wooders (2008), where public goods reduce firms' production costs.

[7] This is line with Tiebout's (1956) idea that since "consumers are fully mobile, they will move to the community where their preference patterns, which are set, are best satisfied".

[8] A convex cost function grasps the increasing difficulty in providing public goods. See Hauptmeier et al. (2012) for a brief discussion on this point.

In this scenario, maximizing the payoff functions in regions A and B, $\Pi_A = t_A(l_A(1-x)) - \frac{1}{2}k_A^2$ and $\Pi_B = t_B((l_B + l_A x) - \frac{1}{2}k_B^2$ with respect to t_A and t_B, respectively, given x as in (1), namely

$$\Pi_A = lt_A(k_A - t_A + t_B + w_A - w_B - k_B(s+1) + 1) - \frac{1}{2}k_A^2$$
$$\Pi_B = t_B(l - l(k_A - t_A + t_B + w_A - w_B - k_B(s+1))) - \frac{1}{2}k_B^2 \ ,$$

we obtain the equilibrium configuration at the second stage of the game[9]:

$$t_A(k_A, k_B) = \tfrac{1}{3}(k_A - (1+s)k_B + w_A - w_B) + 1,$$
$$t_B(k_A, k_B) = \tfrac{1}{3}(((1+s)k_B - k_A) - (w_A - w_B)) + 1 \ \text{and}$$
$$x(k_A, k_B) = \tfrac{1}{3}((1+s)k_B - k_A) - \tfrac{1}{3}(w_A - w_B) \ .$$

The corresponding payoffs of each government in region A and B are, respectively:[10]

$$\Pi_A(k_A, k_B) = \frac{1}{9}l((1+s)k_B - k_A - w_A + w_B - 3)^2 - \frac{1}{2}k_A^2 \qquad (2)$$
$$\Pi_B(k_A, k_B) = \frac{1}{9}l((1+s)k_B - k_A - w_A + w_B + 3)^2 - \frac{1}{2}k_B^2. \qquad (3)$$

It is worth noticing that the optimal taxation in each region is negatively affected by the access to public goods and services in the rival region, as in Pieretti and Zanaj (2011).[11] This negative strategic effect is further magnified by the parameter s, so that a significant amount of EU transfers to jurisdiction B tends to dampen the optimal tax in jurisdiction A, while pushing that in B upward.

[9] From the best-reply functions

$$t_A(t_B) = \frac{1}{2}t_B + \frac{1}{2}(k_A - k_B) + \frac{1}{2}(w_A - w_B) - \frac{1}{2}sk_B + \frac{1}{2}$$
$$t_B(t_A) = \frac{1}{2}t_A - \frac{1}{2}(k_A - k_B) - \frac{1}{2}(w_A - w_B) + \frac{1}{2}sk_B + \frac{1}{2} \ ,$$

taxes are strategic complements and these functions have slope less than one. See Appendix for details on this system of best-reply functions.

[10] Details on these equilibrium values are shown in the Appendix.

[11] This result is emphasized by Pieretti and Zanaj (2011). As the authors state, it can be related to the inefficient supply of public goods which emerge in Hindriks et al. (2008) and Zissimos and Wooders (2008).

When moving at the first stage of the game, we derive from the maximization of (2) and (3) with respect to k_A and k_B, respectively, the best-reply function $k_i(k_j)$, with $i, j = 1, 2$ and $i \neq j$:

$$k_A(k_B) = \frac{1}{8}w_A - \frac{1}{8}(1+s)k_B - \frac{1}{8}w_B + \frac{3}{8}$$

$$k_B(k_A) = \tfrac{1}{8-2s-s^2}(3s - (1+s)k_A - w_A + w_B - sw_A + sw_B + 3) \; .$$

Notice that, while taxes are strategic complements, public goods are strategic substitutes: the higher the panoply of public goods and services in jurisdiction i, the lower that in the rival jurisdiction i.

Thus, we can solve for the first stage of the game where each government defines the optimal plan for public goods. From the profit maximization of $\Pi_i(k_A, k_B)$ with respect to $k_i, i = A, B$, we obtain

$$\begin{aligned} k_A^* &= \frac{(2s^2 + 4s - 3w_A + 3w_B - 7)}{3s^2 + 6s - 21} \\ k_B^* &= \frac{1}{3}\frac{(3w_A - 3w_B - 7)(s+1)}{2s + s^2 - 7} \; . \end{aligned}$$

Plugging these optimal values k_A^* and k_B^* in $t_i(k_A, k_B)$ and $\Pi_i(k_A, k_B)$, $i =$ A,B, we characterize the equilibrium configuration of the game as:

$$\begin{aligned} t_A^* &= \frac{7 - 4s + 3w_A - 3w_B - 2s^2}{7 - 2s - s^2} \; , \\ t_B^* &= \frac{7 - 3w_A + 3w_B}{7 - 2s - s^2} \;\; \text{and} \\ x^*(t_A^*, t_B^*, k_A^*, k_B^*) &= \frac{2s - 3w_A + 3w_B + s^2}{7 - 2s - s^2} \; . \end{aligned}$$

Migration from B to A

In the case with migration from country B to country A, payoff functions write as

$$\begin{aligned} \Pi_A = &\quad t_A(l_A + l_B x) = t_A(l_A + l_B(k_A - t_A + t_B + w_A - w_B - k_B(s+1))) - \frac{1}{2}k_A^2 \\ \Pi_B = &\quad t_B l_B(1-x) = l_B t_B(t_A - k_A - t_B - w_A + w_B + k_B(s+1) + 1) - \frac{1}{2}k_B^2 \; , \end{aligned}$$

since the last citizen willing to leave country B comes from the solution to the following equation the condition

$$w_B - t_B + k_B(1+s) = w_A - t_A + k_A - x \ .$$

In line with the above, we can characterize the equilibrium configuration as follows

$$\begin{gathered} t_A^{**} = t_A^* \text{ and } t_B^{**} = t_B^* \\ k_A^{**} = k_A^* \text{ and} \\ x^{**}(t_A^{**}, t_B^{**}) = \frac{2s - 3w_A + 3w_B + s^2}{2s + s^2 - 7} \ . \end{gathered}$$

We restrict our attention to the case where $s^2 + \frac{4}{3}s + w_B - \frac{7}{3} < w_A < w_B + \frac{7}{3}$ since this inequality guarantees that $t_A^* > 0$ and $t_B^* > 0$.

First of all, we notice that migration from A to B is positive for $s > s'$, with $s' = \sqrt{3w_A - 3w_B + 1} - 1$, where s' increases with w_A. Thus, migration from the region with higher productivity can be observed if and only if regional funds are very significant. Moreover, from standard algebra, whenever $w_B > \hat{w}_B \equiv w_A - \frac{7}{3}$, namely in the case where the wage in country B is not so low with respect to the wage in region A, migration x^* from A to B (resp. x^{**} from B to A) increases (resp. decreases), while k_A^* and t_A^* (resp. k_B^* and t_B^*) decreases (resp. increase) with s.[12] The reason for this finding can be expressed as follows. Whenever productivity in region B is sufficiently high ($w_B > \hat{w}_B$), a higher level of s determines higher equilibrium taxes in region B. These taxes however do not prevent citizens from migrating to B, due to the corresponding equilibrium amount of public goods that is observed in this region. Moreover, since the wage differential does not significantly penalize jurisdiction B, region A uses fiscal policy as a strategic means to be relatively less unattractive: a lower taxation in A could prevent its own residents from migrating to B . Of course, due to this lower level of taxation, the investment in public good in region A is poor.[13]

Considering these characterizations, we can state that:

Proposition 1 *Under regional funds to region B, there exists a unique SPNE with migration from the more productive region A to the less productive region B (resp. B to A) iff regional funds are sufficiently high, namely $s > \breve{s}$ (resp. $s \leq \breve{s}$).*

Proof. $x^*(t_A^*, t_B^*, k_A^*, k_B^*) \gtreqless 0 \Leftrightarrow s \gtreqless s' \equiv \sqrt{3w_A - 3w_B + 1} - 1$. ∎

Finally, let us denote by $w_A' = \frac{1}{3}s^2 + \frac{2}{3}s + w_B$. Then, $s^2 + \frac{4}{3}s + w_B - \frac{7}{3} < w_A$.

[12] We found that at $w_B \leq \hat{w}_B$, $t_B^* = 0$.

[13] This rationale ceases to hold in the case when the wage in region A was far higher than that in region B, or $w_B + \frac{7}{3} \leq w_A$. As we stated above, in this scenario $t_B^* = 0$. In this circumstance, the flow of migrants from A to B does not raise with s: neither the nil taxation nor regional funds make region B attractive, due to its extremely poor productivity.

Remark 2 *When $w_A < w'_A$, then jurisdiction B taxes more than the rival A and offers a better access to public goods and services.*

Proof. From standard algebra, $t^*_A < t^*_B \Leftrightarrow w_A < w'_A = \frac{1}{3}s^2 + \frac{2}{3}s + w_B$. ■

The key point of our analysis is thus clearly disentangled by the above statements. Regional funds can significantly affect the flow of migration between regions. For example, migration to region B can be observed even in the case with $t^*_A - t^*_B < 0$, provided that the impact of regional funds is sufficiently strong $(s > s^{'})$. Still, in the scenario when the productivity gap between regions is extremely large $(w_A > w_B + 1)$, these funds do not suffice to determine migration from A to B: in this case, migration is only observed from B to A. Moreover, these funds raise the taxation gap whenever $t^*_A < t^*_B$.

3 Data and Methodology

3.1 Data and descriptive statistics

The territorial level of interest in our analysis is the one defined by the EU 2010 nomenclature NUTS-2. To account for net migration, we use census data provided by Eurostat on the composition of the population in 2001 and 2011 in the EU-15 NUTS-2 regions.[14] This allows us to glean significant differences in the composition of the population that can be ascribed, at least in part, to the effect of local policies financed by the EUF, e.g. to the increased public facilities supply in the highly-financed regions. Eurostat data provide accurate information on the number of citizens from the reporting country, other EU-countries, other European countries (those that do not belong to the EU) and non-European countries. Using census data allows us to escape from problems regarding the fragmented definition of migrant across EU countries that often constitute a limiting factor for this kind of analysis. While data concerning the year 2011 were fully available, for the year 2001 data regarding Greece, Belgium, Germany and French overseas-departments were not available: for the first two countries, missing data have been retrieved using the figures provided by the Hellenic Statistical Authority (https://panorama.statistics.gr/en/) and Statistics Belgium (http://www.vub.ac.be/en/), respectively. Regarding Germany, although the collection of census data in 2001 was not implemented, the German Federal Statistics Office collected data on a micro-census covering 800,000 persons, i.e. a sample size of 1% of German population[15] (see Schwarz, 2001). For the purpose of our analysis, the 2001 micro-census enables us to retrieve an accurate estimate of German population data by nationality and thus fill in the missing census data. Lastly, data on the four French overseas territories (Guadeloupe,

[14] We do not consider the accession countries (EU-12) of 2004 that did not receive EUF before 2004. This is due to both the peculiarities of our evaluation strategy and to the lack of citizenship data for most EU-12 countries in 2001.

[15] Data from the micro-census of 2001 allows us to trace out information in the time interval between two population censuses. Due to reunification of Germany that occurred in 1989, the most recent census before 2011 was taken in 1987.

Martinique, Reunion and Guyane) have been gathered from the *Atlas National des Populations Immigrées* of each region published by the *Institut National de la Statistique et des Etudes Economiques*.

The availability of data relative to two censuses allows us to calculate the percentage difference in the share of citizens coming from the reporting country, other European countries and non-European countries as well as the absolute differences for each of the above groups. Such variables represent our main outcome variables. Unfortunately, it is not possible to directly calculate the change in the share of people with other EU citizenship as data in 2001 refer to EU-15 while data in 2011 refer to EU-27. However, we use the share of EU-27 citizens and the absolute number of EU-27 citizens in 2011 as additional outcome variables. We have also collected data on other relevant pre-treatment covariates using the regional databases of Cambridge Econometrics and Eurostat. These variables are: the population density, the share of the population over 65, the total employment divided by the active population,[16] labor productivity (GVA per hour worked), the number of hours worked per employee, the share of employment in the primary sector and the share of employment in the secondary sector.

As for the EUF, we split the EU-15 regions into "treated" and "untreated" following the Ob.1 status assignment process relative to the 2000-2006 programming period.[17] We focus empirical analysis on the split between Ob.1 and non-Ob.1 regions because Ob.1 expenditures account for more than two thirds of the Cohesion Policy budget. Furthermore, we collected NUTS-2 regional data on EUF payments from 2001 to 2010 (see Roemisch, 2016). This continuous measure of treatment allows us to test the sensitivity of the binary analysis and gain more insights on the causal relationship between EUF and migration flows. It also allows us to verify that EUF have been used in accordance with the regional policy objectives. Although the EU regional policy objectives have slightly changed over the last thirty years, there has always been a focus on compensating lagging regions for the absence of some preconditions for growth – infrastructure,[18] accessibility, education, and health care (Camagni and Capello, 2015). Figure 1 shows that there is a clear relationship between the EUF and education (Panel A - Participation in education and training; Panel B - Share of citizens with a lower secondary education or below), health system (Panel C - Available beds per thousand inhabitants), and infrastructure (Panel D - Motorway density) outcomes during the period under analysis.

[16] This variable can take on values above 1 as it represents the number of individuals working in the region divided by the number of active individuals (in employment or looking for employment) residing in the region.

[17] Although our data starts in 2001, i.e. one year after the beginning of the programming period under analysis, this is not a concern as the bulk of EUF are spent in the final years of the programming period, including up to two years after the end of the programming period.

[18] Almost one in two euros invested in trying to prop up the EU's less-developed regions has targeted infrastructure deficits, particularly those in transport infrastructure (Crescenzi and Rodríguez-Pose, 2012).

INSERT FIGURE 1

Before carrying out the main analysis, we map and plot the population variables to start investigating possible patterns. Figure 2 illustrates the geographic distribution of the regional foreigner share deciles in 2001 (Panel A) and in 2011 (Panel B). For instance, in 2001, the first decile of regions consists of the regions with foreigner shares between 0.6% and 1.3%. The regions in the first decile are indicated in light blue. The tenth decile consists of regions with shares between 9.2% and 26.6%. They are indicated in dark navy. The intermediate deciles are indicated by intermediate shades of blue. In 2001 the highest shares of foreigners were localized at the core of the EU, in the UK, and in Ireland. Ten years later we observe a somewhat different pattern with a steep increase in the share of foreigners in many Italian, Portuguese, and Spanish regions. Panel C of Figure 2 depicts the percentage point difference between the percentage of foreigners in 2001 and the same variable in 2011 allowing us to clearly identify the differences in migration trends among regions. A striking feature of this figure is the extent to which the top decile regions (the ones marked in dark orange) are concentrated in the periphery of the EU-15.

INSERT FIGURE 2

Figure 3 reports the Ob.1 status assignment for the 2000-2006 programming period (Panel A) and the EUF per capita during the 2001-2010 period (Panel B). Both panels show a pattern very similar to the one arising in Figure 2. This means that the graphical analysis shows the presence of a positive relationship between EUF and the change in the share of foreigners. Indeed, peripheral regions tend to have both a higher share of foreigners and a higher EUF per capita for the period under consideration.

INSERT FIGURE 3

This positive relationship is even clearer in Figure 4 where we plot the relationship between the change in the share of foreigners from 2001 to 2011 and the EUF per capita for the 2001-2010 period using a kernel-weighted local polynomial smoothing regression. The green line shows that there is a positive relationship between EUF and percentage of foreigners which flattens out only at the right-hand side of the fund distributions. Nevertheless, only a rigorous econometric model can determine whether this relationship is causal or due to a spurious correlation. This can be achieved comparing regions with similar characteristics but that have received a large difference in the share of EUF due to an exogenous assignment rule. This is what we do in the rest of the paper.

INSERT FIGURE 4

3.2 Methodology

We perform an empirical evaluation of the relationship between the EU regional policy and migration flows in the EU-15 regions based on the theoretical framework presented in Section 2. Our identification strategy exploits the allocation rule of regional EU transfers: only regions with a per capita GDP in PPS below 75 per cent of the EU average (calculated as an average of three years before the beginning of the programming period) are qualified for Ob.1 funds, i.e. receive a considerable amount of the EUF. This means that regions with a per capita GDP level just above 75% of the EU average (which did not receive the Ob.1 funds) can be considered good comparisons to those just below the cutoff (which did receive the Ob.1 funds). Indeed, economies at similar per capita income levels share many structural attributes, including their levels of education, science and technology endowments, infrastructure quality, and institutional quality (Iammarino et al., 2018). This sharp discontinuity can be exploited via the RDD (see, inter alia, Hahn et al., 2001; Lee and Lemieux, 2010), an econometric method which compares regions lying closely on either side of the threshold and delivers an estimation of the local average treatment effect (LATE), i.e. the average treatment effect around the threshold. For those regions in the interval just above and below this threshold, the assignment of the treatment (i.e. Ob.1 funds) is to be considered as good as randomized. In other words, the RDD is equivalent to a local random assignment around the cut-off point. Lastly, the use of the RDD overcomes the inverse causality problem, which implicitly affects this kind of analysis.

Given that the Ob.1 status assignment for the 2000-2006 programming period followed a clear assignment rule,[19] we adopt the sharp RDD framework:

$$Y = a + f(x) + D[\tau + f(x)] + \varepsilon$$

where Y is the dependent variable (e.g. the percentage-points change in the share of foreigners with European citizenship between 2001 and 2011), x is the forcing variable (GDP per capita (EU-15=100, PPS) in 1994-1996), D is the treatment dummy and $f(\cdot)$ is a smooth polynomial functions of x. In our case, $f(\cdot)$ is a second-order polynomial allowed to have different parameters to the left and the right of the threshold. Consistent with the RDD approach, in the main analysis we do not include the richest regions, defined as those regions with a pre-treatment GDP per capita of more than twice the Ob.1 assignment threshold.

[19] In our sample there is only one NUTS-2 region receiving the Ob.1 status (only on part of the territory) despite a pre-treatment per capita GDP level above the 75% threshold. This is the Finnish region of Pohjois-Suomi (FI1A). However, due to a change in borders of some regions across nomenclatures we were forced to merge the Ob.1 region Itä-Suomi (FI13) with the partially Ob.1 region Pohjois-Suomi (FI1A) into the region Pohjois- ja Itä-Suomi (FI1D). We include this region in the main analysis taking the forcing variable value of FI13 which is below the 75% threshold. Alternatively, if we considered a weighted average of the two forcing variable values, we would get a forcing variable value that exceeds the 75% threshold, making it a non-complier region. Nevertheless, we will consider this alternative of the forcing variable value in the sensitivity analysis, where we adopt a fuzzy RDD.

We then repeat the same analysis with the addition of the pre-treatment covariates **X** described in Section 3.1 to the RDD model. This addition increases the precision of the RDD estimator, accounting for the potential bias due to pretreatment differences (see Frölich and Huber, 2018):

$$Y = a + f(x) + D[\tau + f(x)] + \gamma X + \varepsilon$$

Besides, the use of percentage and absolute differences of the three main dependent variables allows us to lower the variance in the RDD estimator (Lee and Lemieux, 2010) and to take into account pre-treatment differences in the dependent variable.

4 Results

The estimation procedure begins with some graphical evidence as suggested by Lee and Lemieux (2010). A simple way to evaluate the effect of EUF on migration is to plot the relationship between each dependent variable and the forcing variable (pre-treatment GDP per capita) for regions on either side of the 75% cut-off point.

Figure 5 plots each of the main dependent variables for the period from 2001 to 2011 for Ob.1 regions against non-Ob.1 regions. In each graph, the cut-off line sharply separates the treated and untreated regions. Each figure superimposes the fit of a nonparametric flexible polynomial regression model (estimated separately on each side of the cut-off point), together with the 95% confidence bands. Figure 5 clearly shows that, on average, the share of foreigners in Ob.1 regions increased more than in non-Ob.1 regions. This change seems to be due to both European and non-European citizens.

INSERT FIGURE 5

Although the graphical evidence is important in showing possible differences between treated and untreated regions around the Ob.1 assignment threshold, a formal RDD regression allows us to calculate the extent of the observed differences and whether they are statistically different from zero. The results are presented in Table 1. Columns 1 and 2 report the EUF impact on the share of citizens with host country citizenship with and without pre-treatment covariates **X**. This impact is negative and statistically significant at the 5% level in both specifications. The extent of the difference in the share of citizens with host country citizenship over the period from 2001-2011 is -2.09 percentage points in Ob.1 regions. This corresponds to a large increase in the share of foreigners as in EU-15 NUTS-2 regions the average share of foreigners was 4.84% in 2001 and 6.45% in 2011. In the remaining columns we investigate whether this increase is mostly due to foreigners with European citizenship (columns 3 and 4) or to extra-Europeans (columns 5 and 6). Although all coefficients are positive, only the one concerning the increase in the share of non-Europeans citizens is statistically significant from zero at the 5% level in both specifications. This means that in the period under analysis there was a wide expansion in the share of foreign citizens in Ob.1 regions due to EUF and mostly driven by the increase in non-Europeans. Lastly, although we do not have data on the pre-treatment value for the share of people with other EU citizenship referring to EU-27, in columns 7 and 8 we check whether there are significant differences in the share of individuals with EU-27 citizenship in 2011. We find no statistically significant effect confirming that most of the immigrants come from non-Europeans countries.

INSERT TABLE 1

So far, we have looked at the difference in shares of groups of citizens with different citizenships, i.e. host country, European and non-European. Although this analysis is informative in showing the migration trends among regions, in the following we complement it looking at the actual flows of citizens in and out of the regions as differences in shares of individuals might conceal other patterns. For instance, an increase in the share of foreigners might derive from a migration of citizens from the host country rather than from an actual increase in the number of migrants from other countries. Table 2 replicates the analysis above looking at the net migration changes between 2001 and 2011 for each group of individuals under analysis.

INSERT TABLE 2

The estimates reported in Table 2 show that our findings are mainly driven by the arrivals of foreign migrants - especially those coming from non-European countries - rather than by a reduction of individuals with a host country citizenship. The average increase of over 30,000 individuals from non-European countries for Ob.1 regions is sizable especially considering that the average number of individuals with a non-European citizenship living in Ob.1 regions close to the Ob.1 threshold (with a per capita GDP in PPS) in 2011 was 50,251.[20]

5 Robustness and sensitivity checks

We begin this section testing whether the pre-treatment covariates of the Ob.1 regions are similar to those of the control group at the threshold. As shown in the first two columns of Table 3, Ob.1 and non-Ob.1 regions are quite different - on average - with respect to pre-treatment values on population, citizenship composition, education and economy. However, the third column of Table 3 shows that there is no evidence of statistically significant pre-treatment differences around the cut-off point between Ob.1 and non-Ob.1 regions in terms of

[20] This finding is economically relevant as the increase in migration stocks positively affects firms' performance (see Borelli et al., 2017).

citizenship composition, population density, share of the population over 65, labor productivity, hours worked, share of employment in the primary and secondary sectors and education level. On the other hand, we find that non-Ob.1 regions have a higher ratio of total employment divided by the active population (10% statistical significance). These results confirm that Ob.1 and non-Ob.1 regions around the Ob.1 status assignment threshold are quite similar with respect to pre-treatment covariates but also that some slight differences remain. This is the main reason why we control for these variables in the main analysis.

INSERT TABLE 3

We then check the sensitivity of the estimates in several regards and summarize the results of interest in Table 4. For the sake of brevity, we focus on sensitivity checks for the RDD model with covariates reported in columns 2, 4 and 6 of Table 1. Table 4 contains five blocks of results in a vertical dimension, numbered (I)-(V).

One concern with our empirical analysis is that we split regions according to the Ob.1 status assigned for the programming period 2000-2006 even if our migration variables refer to a longer time period. The availability of data on EUF per capita during the 2001-2010 period allows us to check whether our results depend on this choice. Dropping all non-Ob.1 regions which received EUF per capita larger than the least treated Ob.1 region, we obtain the estimates reported in block (I) of Table 4. The extent of these estimates suggests that EUF had an even larger impact on Ob.1 regions after we dropped the 11 "most financed" non-Ob.1 regions. This result is consistent with our finding that the larger the EUF per capita, the higher the increase in the share of foreigners.

Regions having at least one border with access to the sea might be more vulnerable to the arrival of legal and illegal migrants. The same rationale might apply to regions sharing a border with regions not belonging to the EU-15. We checked the sensitivity of our results adding a dummy for each of the above factors to the RDD regressions. Results are reported in block (II) of Table 4 and show that our main findings hold.

Block (III) reports three sensitivity checks on the RDD specification. We start by checking whether our results depend on the chosen order of polynomial of $f(\cdot)$ by repeating the analysis for the 1^{st} and the 3^{rd} order polynomials. The estimates turn out to be very close to those reported in Table 1 even though if the ones obtained with the 3^{rd} order polynomials are even larger. We also check whether using a non-parametric estimator we get similar estimates. Using a local polynomial non-parametric regression, we select an optimal bandwidth that minimizes the mean squared-error using the bias-corrected RDD estimator with robust confidence intervals developed by Calonico et al. (2014). Besides, we use a triangular kernel and control for pre-treatment covariates $\mathbf{X}$ (see Calonico et al., 2018). All estimated coefficients are larger than those reported in Table 1 and also turn out to be statistically significant for citizens with European passports. Block (III) findings suggest that a more flexible specification of the forcing variable leads to larger estimates which reinforce the hypothesis of enhanced attractiveness of treated regions close to the threshold engendered by improved infrastructure, health system and education outcomes via EUF.

Although we are in a quasi-experimental evaluation framework, we have already seen that controlling for relevant pre-treatment covariates affects the extent of the estimates. Therefore, it is possible that the addition of other relevant covariates might change our results. Eurostat provides data on average education levels of citizens aged 25-64 in all NUTS-2 regions except for the four French overseas-departments in 2001. Adding the share of citizens with low-level education (defined as lower secondary education or below) and the share of citizens with low medium-level education (defined as upper secondary or post-secondary non-tertiary education) we obtain the estimates reported in row 5 of Table 4. Again, these estimates are very close to those reported in Table 1. It is also possible that EUF take a long time before showing any impact on migration flows, as it takes a long time to improve infrastructures, health system and education system. This is why we add to $\mathbf{X}$ the per capita EUF that each region received during the period 1994-2000. As shown in block (IV), this additional covariate does not affect significantly our estimates.

Lastly, in block (V) we check whether data and sample choices impacted on the estimates. First, as anticipated in footnote 18, we check whether considering the Finnish region Pohjois- ja Itä-Suomi (FI1D) as a non-complier alters our results. To do so we adopt the fuzzy RDD estimator. We then verify that the results do not depend on the exclusion of the nine regions whose level of per capita GDP in the period 1994-1996 was at least twice as large as the Ob.1 assignment threshold. Nevertheless, both sensitivity checks result in estimates which are in the range of those of columns 2, 4 and 6 of Table 1.

INSERT TABLE 4

6 Conclusions

Europe is nowadays welcoming a large flow of migrants, mostly from Asian countries and the southern Mediterranean coast. European policy makers need the tools to understand and manage these migration flows, in order to operationalize the complex adjustment process of immigrants with the economic and social context of European regions. This paper has led to some results of interest for an evaluation of the forces that attract migrants. First, the welfare ensured by the EUF, in terms of access to education, health and other sources of well-being, appears to be an important motivation in the localization choices of migrants. This is demonstrated by an economic model that shows how in some cases the productivity differential, and therefore the wages differential, is not in itself sufficient motivation to direct the migratory flow, and welfare considerations matter. Second, the empirical analysis carried out supports the conclusions of the theoretical model: ceteris paribus, the EUF appear to strongly influence the direction of migratory flows. In particular, the EUF lead to a significant increase in the share of foreign citizens in the highly-subsidized regions of around 2 percentage points. This corresponds to a large increase in the share of foreigners as in EU-15 NUTS-2 regions the average share of foreigners was 4.84% in 2001 and 6.45% in 2011. Such an increase is mostly driven by non-European immigrants, while the increase in the share of European foreign immigrants connected to the EUF is positive but not significant, consistently with the result that the EUF tend to reduce labor mobility within Europe (see Schmidt, 2013). This implies that the use of EUF to offer a high-quality welfare, which includes education, health, infrastructure and facilities for welcoming immigrants, acts as a magnet for foreign workers and helps retain local workers by increasing the labor supply and therefore the potential growth. Our estimates suggest that previous empirical studies might have underestimated the importance of public goods and services in attracting immigrants. We argue that this is due to the use of detailed data at regional level and to the adoption of an evaluation strategy which allowed us to convincingly isolate the role of public goods and services from economic factors.

Our findings may guide policy makers in selecting the right interventions able to influence and canalize migration flows as a component of an integrated European regional development strategy (Mitze et al., 2017). While the rather low degree of geographical mobility within and across EU Member States has been a matter of concern for growth in past decades, the future question is how the new labor supply can be efficiently integrated into the local labor systems to sustain local development. An efficient use of public transfers can help in this direction.

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7 Appendix

Hereafter, formal details on the tax game are provided.

7.1 A1 Migration from A to B

Let us consider migration occurring from region A to region B, this latter being the recipient of *EUF*. In this scenario, from the maximization of Π_A with respect to t_A, we get $t_A = \frac{1}{2}k_A - \frac{1}{2}k_B + \frac{1}{2}t_B + \frac{1}{2}w_A - \frac{1}{2}w_B - \frac{1}{2}sk_B + \frac{1}{2}$.

Since migration requires $x > 0$, namely

$$x(t_A, t_B, k_A, k_B) = k_B(1 + s) - k_A + w_B - w_A - (t_B - t_A)) > 0 \qquad \text{or}$$
$$t_A > k_A + t_B + w_A - w_B - k_B(s + 1) \ ,$$

then it must be that

$$\frac{1}{2}k_A - \frac{1}{2}k_B + \frac{1}{2}t_B + \frac{1}{2}w_A - \frac{1}{2}w_B - \frac{1}{2}sk_B + \frac{1}{2} > (k_A + t_B + w_A - w_B - k_B(s+1)) \quad \text{or}$$
$$t_B < k_B - k_A - w_A + w_B + sk_B + 1.$$

Thus,

$$\begin{aligned} t_A(t_B) &= \frac{1}{2}k_A - \frac{1}{2}k_B + \frac{1}{2}t_B + \frac{1}{2}w_A - \frac{1}{2}w_B - \frac{1}{2}sk_B + \frac{1}{2} \quad \text{if} \quad t_B < k_B - k_A - w_A + w_B + sk_B + 1 \\ t''_A(t_B) &= k_A + t_B + w_A - w_B - k_B(s+1) \quad \text{if} \quad t_B > k_B - k_A - w_A + w_B + sk_B + 1 \end{aligned}$$

with the corresponding payoff being

$$\begin{aligned} \Pi_A(t_A, t_B, k_A, k_B) &= \frac{1}{4}l(-k_A + k_B - t_B - w_A + w_B + sk_B - 1)^2 \\ \Pi''_A(t_A, t_B, k_A, k_B) &= l(k_A - k_B + t_B + w_A - w_B - sk_B) \end{aligned}$$

We focus then on region B. In line with the above, from the maximization of Π_A with respect to t_A we get that $t_B(t_A) = \frac{1}{2l}(l - k_A l + k_B l + l t_A - l w_A + l w_B + sk_B l)$. Recall that for migration from A to B, it must be that

$$\begin{aligned} &x(t_A, t_B, k_A, k_B) = (t_A - t_B) - (w_A - w_B) + k_B(1+s) - k_A > 0 \\ &\qquad \text{or} \quad t_B < k_B - k_A + t_A - w_A + w_B + sk_B \end{aligned}$$

Then, the following holds:

$$\begin{aligned} t_B(t_A) &= \frac{1}{2}(-k_A + k_B + t_A - w_A + w_B + sk_B + 1) \quad \text{if} \quad t_A > (1 + k_A - k_B + w_A - w_B - sk_B) \\ t_B(t'_A) &= k_B - k_A + t_A - w_A + w_B + k_B s \quad \text{if} \quad t_A \leq (1 + k_A - k_B + w_A - w_B - sk_B) \end{aligned}$$

with the corresponding payoff being

$$\begin{aligned} \Pi_B(t_B(t_A), k_A, k_B)) &= \frac{1}{4}l(1 - k_A + k_B + t_A - w_A + w_B + sk_B)^2 \quad \text{and} \\ \Pi_B(t'_B(t'_A), k_A, k_B) &= l(-k_A + k_B + t_A - w_A + w_B + sk_B) \quad . \end{aligned}$$

7.2 A.2 Migration from B to region A

In this case, payoff functions write as

$$\begin{aligned} \Pi_A &= t_A(l + lx) = t_A(l_A + l_B(k_A - t_A + t_B + w_A - w_B - k_B(s+1))) \\ \Pi_B &= t_B l_B(1 - x) = l_B t_B(t_A - k_A - t_B - w_A + w_B + k_B(s+1) + 1) \end{aligned}$$

and x comes from the condition $w_B - t_B + k_B(1+s) = w_A - t_A + k_A - x$ so that

$$x(t_A, t_B, k_A, k_B) = k_A - t_A + t_B + w_A - w_B - k_B(s+1)$$

From the FOC, we obtain

$$t_A(k_A, k_B) = \frac{1}{2}(1 + k_A - k_B + t_B + w_A - w_B - sk_B) \quad .$$

Since $x > 0$ iff

$$\begin{gathered} k_A - t_A + t_B + w_A - w_B - k_B(s+1) > 0 \qquad \text{or} \\ t_A < k_A + t_B + w_A - w_B - k_B(s+1) \end{gathered}$$

it must be that

$$\begin{gathered} k_A + t_B + w_A - w_B - k_B(s+1) - (\frac{1}{2}(1 + k_A - k_B + t_B + w_A - w_B - sk_B)) < 0 \qquad \text{or} \\ t_B > (1 - k_A + k_B - w_A + w_B + sk_B) \quad . \end{gathered}$$

Accordingly, we can write:

$$\begin{aligned} t_A(t_B, (k_A, k_B)) &= \frac{1}{2}(1 + k_A - k_B + t_B + w_A - w_B - sk_B) \\ &\text{if} \qquad t_B > \frac{1}{l_B}(l_A - k_A l_B + k_B l_B - l_B w_A + l_B w_B + sk_B l_B) \\ t'_A(t_B, (k_A, k_B)) &= k_A + t_B + w_A - w_B - k_B(s+1) \\ &\text{if} \qquad t_B < \frac{1}{l_B}(l_A - k_A l_B + k_B l_B - l_B w_A + l_B w_B + sk_B l_B) \end{aligned}$$

with the corresponding payoff being

$$\begin{aligned} \Pi_A &= \frac{1}{4} l((1+s)k_B - k_A - t_B - w_A + w_B - 1)^2 \\ \Pi'_A &= l(k_A - k_B + t_B + w_A - w_B - sk_B) \quad . \end{aligned}$$

So, combining the above analysis, we can write

$$\begin{aligned} t_A(t_B) &= \frac{1}{2}t_B + \frac{1}{2}(k_A - k_B) + \frac{1}{2}(w_A - w_B) - \frac{1}{2}sk_B + \frac{1}{2} \\ t_B(t_A) &= \frac{1}{2}t_A - \frac{1}{2}(k_A - k_B) - \frac{1}{2}(w_A - w_B) + \frac{1}{2}sk_B + \frac{1}{2} \quad . \end{aligned}$$

As far as the tax equilibrium configuration, let us remind that $\breve{s} = \frac{1}{k_B}(k_A - k_B + w_A - w_B)$. Then, we observe that:

- $t^*_A < w_A \Leftrightarrow s > s^*_A = \frac{k_A - k_B - 2w_A - w_B + 3}{k_B}$, with $\breve{s} > s^*_A$ iff $w_A > 1$ since $\breve{s} - s^*_A = 3\frac{w_A - 1}{k_B}$;

- $t_A^* > 0$ namely $\frac{1}{3}(k_A - k_B + w_A - w_B - sk_B) + 1 > 0$ iff $s < s_A'' = \frac{1}{k_B}(k_A - k_B + w_A - w_B + 3)$, with $s_A'' > \breve{s}$;

- $t_B^* < w_B \Leftrightarrow s < s_B^* = \frac{1}{k_B}(k_A - k_B + w_A + 2w_B - 3)$ with $s_B^* > \breve{s}$ iff $w_B > 1$ since $s_B^* - \breve{s} = 3\frac{w_B - 1}{k_B}$ and $s_B^* > s_A^*$ whenever $w_i > 1$, $i = A, B$;

- $t_B^* > 0 \Leftrightarrow s > s_B'' = \frac{1}{k_B}(k_A - k_B + w_A - w_B - 3)$ with $s'' < \breve{s} < s_B^*$.

- Finally, $t_A^* > 0$ and $t_B^* > 0$ can simultaneously hold since $s_B'' < s_A''$.

Finally, an equilibrium with migration from A to B (resp. B to A) cannot simultaneously be an equilibrium with migration from B to A. For this to be clear, it suffices to notice that $x^*(t_A^*(k_A, k_B), t_B^*(k_A, k_B)) = \frac{1}{3}((1+s)k_B - k_A) - \frac{1}{3}(w_A - w_B) > 0$ for any $s > s' = \frac{1}{k_B}(k_A - k_B + w_A - w_B)$, while $x_{s=s'}^{**}(k_A, k_B) = 0$ and $x^{**}(k_A, k_B)$ being decreasing in s.

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Table 1: RDD parametric estimates for migration shares net changes outcomes

	Dep. Var.: Percentage points change in the share of citizens with host country citizenship (2001-2011)		Dep. Var.: Percentage points change in the share of foreigners with European citizenship (2001-2011)		Dep. Var.: Percentage points change in the share of foreigners with non-European citizenship (2001-2011)		Dep. Var.: Percentage of foreigners with a EU-27 citizenship (2011)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy Ob.1	-2.36 (1.04)**	-2.09 (1.08)**	1.03 (0.59)*	0.49 (0.62)	1.33 (0.63)**	1.61 (0.68)**	0.79 (0.83)	0.56 (0.88)
Other covariates	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.0670	0.1635	0.0534	0.2523	0.0472	0.1218	0.1312	0.2177
Nb. of treated regions	54	54	54	54	54	54	54	54
Nb. of non-treated regions	150	150	150	150	150	150	150	150

Note: Heteroskedasticity-robust standard errors in parentheses. Parametric regressions include a second-order polynomial in the forcing variable. The polynomial functions are allowed to have different parameters to the left and the right of the threshold

Table 2: RDD parametric estimates for migration flows net changes outcomes

	Dep. Var.: Change in the number of citizens with host country citizenship (2001-2011)		Dep. Var.: Change in the number of foreigners with European citizenship (2001-2011)		Dep. Var.: Change in the number of foreigners with non-European citizenship (2001-2011)		Dep. Var.: Number of foreigners with a EU-27 citizenship (2011)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy Ob.1	21,025 (59,272)	226 (64,561)	30,255 (25,308)	17,647 (30,539)	34,104 (18,824)*	36,159 (19,690)*	59,568 (32,304)*	45,922 (35,203)
Other covariates	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.1139	0.2612	0.0404	0.1564	0.0627	0.1382	0.0914	0.1609
Nb. of treated regions	54	54	54	54	54	54	54	54
Nb. of non-treated regions	150	150	150	150	150	150	150	150

Note: See notes of Table 1

Table 3. RDD estimates of the pre-treatment differences in migration related covariates between Ob.1 and non-Ob.1 regions

Pre-treatment variable	Average in Ob.1 regions	Average in non-Ob.1 regions	Differences at the margin
Share of citizens with host country citizenship	96.06	94.84	-1.34 (1.36)
Share of citizens with EU-15 citizenship (different from host country)	0.61	1.42	0.10 (0.38)
Share of citizens with European citizenship (different from host country)	2.05	2.80	1.32 (0.99)
Share of citizens with a non-European citizenship	1.89	2.36	0.02 (0.78)
Population density	393	299	601 (399)
Share of population over 65	15.56	14.85	0.27 (1.58)
Total employment/Active population	0.87	0.94	0.05 (0.03)*
Productivity (GVA per hour worked)	22,142	32,895	-3,434 (2,865)
Share in the primary sector	10.68	3.34	-1.23 (1.94)
Share in the secondary sector	13.58	18.43	-0.06 (2.21)
Hours worked per employee	1.84	1.61	0.16 (0.11)
Share of population from 25 to 64 years with a low-level education	51.77	34.37	6.23 (6.04)
Share of population from 25 to 64 years with a medium-level education	30.99	43.39	-3.59 (4.74)

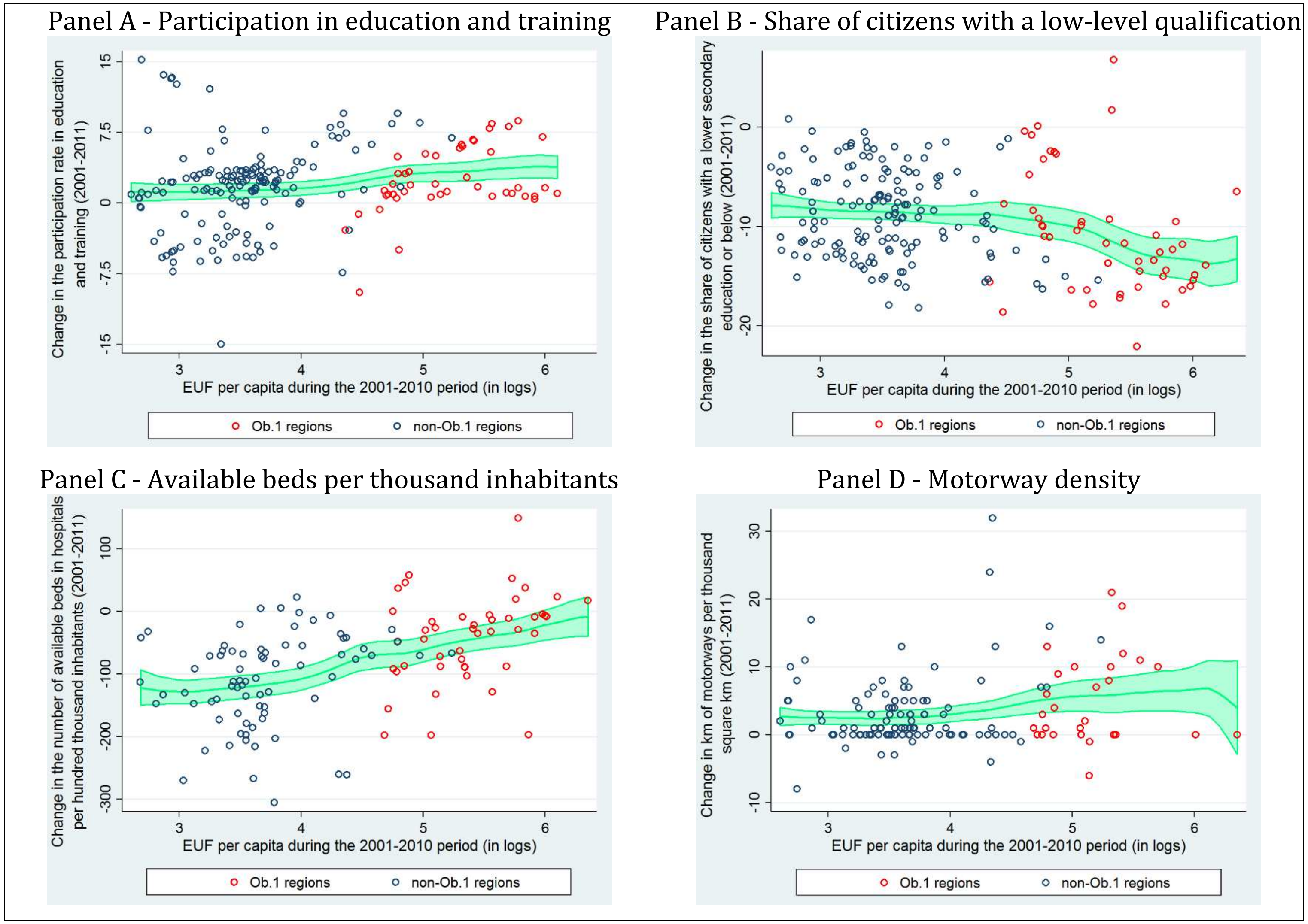
Note: The share of citizens with EU-15 citizenship and education variables are not available for the four French overseas-departments. Besides, we exclude Belgian regions for the share of citizens with EU-15 citizenship as Statistics Belgium provided the EU-27 value instead of the EU-25 value. Low-level education is defined as lower secondary education or below; medium-level education is defined as upper secondary or post-secondary non-tertiary education; high level education is defined as tertiary education or above. Statistics on the non-Ob.1 regions do not include the richest regions defined as those regions with a pre-treatment GDP per capita more than twice the Ob1 assignment threshold.

Table 4. Robustness and sensitivity checks

Type of sensitivity/robustness check	Percentage points change in the share of citizens with host country citizenship (2001-2011)	Percentage points change in the share of foreigners with European citizenship (2001-2011)	Percentage points change in the share of foreigners with non-European citizenship (2001-2011)
(1) Intensity of treatment			
- Drop non-Ob.1 regions receiving more per-capita money than the lowest paid Ob.1 regions	-2.64 (1.02)**	0.72 (0.63)	1.93 (0.65)***
(2) Border dummies			
- Add coastline dummy	-2.14 (1.08)**	0.49 (0.63)	1.65 (0.67)**
- Add dummy border with non-EU-15 countries	-2.28 (1.10)**	0.68 (0.63)	1.60 (0.69)**
(3) RDD specification			
- $f(\cdot)$ specified as 1st order polynomial	-2.23 (0.81)***	0.66 (0.44)	1.56 (0.53)***
- $f(\cdot)$ specified as 3rd order polynomial	-2.43 (1.35)*	0.71 (0.79)	1.72 (0.77)**
- Non-parametric RDD	-3.45 (1.63)**	1.92 (0.85)**	1.72 (1.03)*
(4) Add supplementary control variables			
- Add education variables	-2.11 (0.93)**	0.51 (0.55)	1.60 (0.61)***
- Add past intensity variables	-1.98 (1.05)*	0.44 (0.61)	1.54 (0.65)**
(5) Data and sample issues			
- Fuzzy RDD	-1.97 (1.06)*	0.45 (0.61)	1.52 (0.67)**
- Add the 9 richest regions	-2.43 (0.79)***	0.50 (0.43)	1.93 (0.54)***

Note: All specifications include control variables **X**. Education variables are not available for the four French overseas-departments.

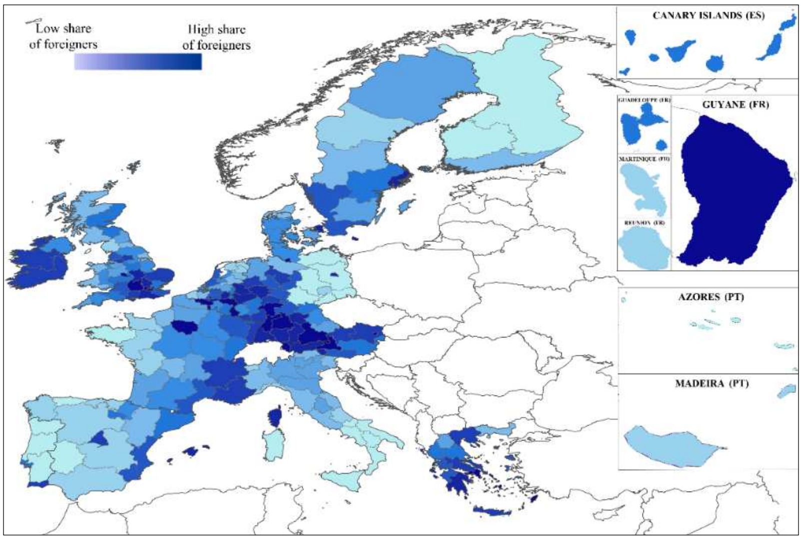
Figure 1. Relationship between EUF per capita during the 2001-2010 period and the change in education, health and infrastructure variables measured between 2001 and 2011



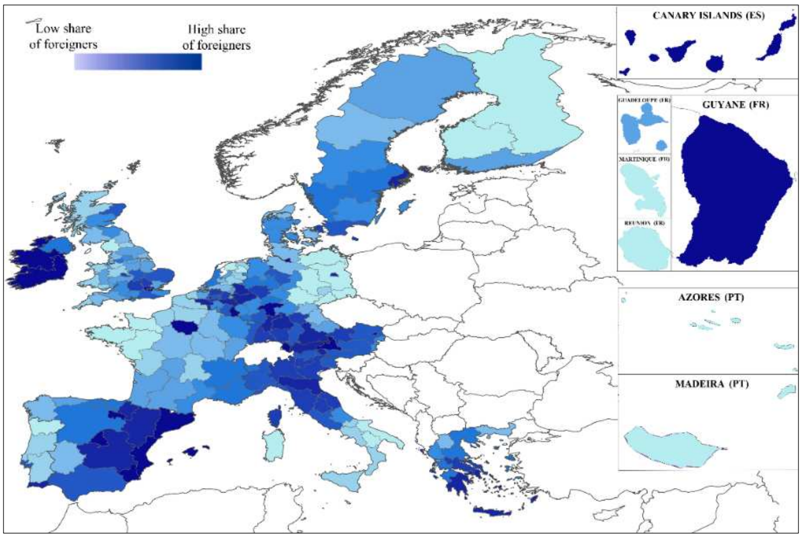
Notes: We used local polynomial smooth curves and their 95% confidence interval (computed using Stata's command lpolyci). We miss information on the four French overseas-departments in panels A and B; for the latter panel we miss information also on the two autonomous Portuguese regions and two Hellenic regions. In panels C and D we miss information on Denmark, most of the UK and Germany. In panel C we also miss information on Greece and some Portuguese regions, while in panel D we do not have data on the Netherlands and Ireland.

Figure 2. Share of the population with a nationality different from that of the host country (NUTS-2 regions in the EU-15)

Panel A - Year 2001



Panel B - Year 2011



Panel C - Growth in the share of foreigner population during the period 2001-2011

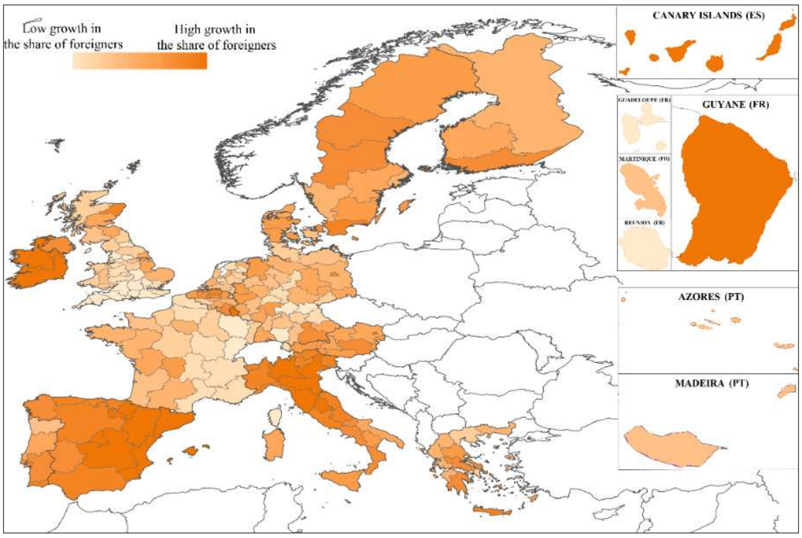
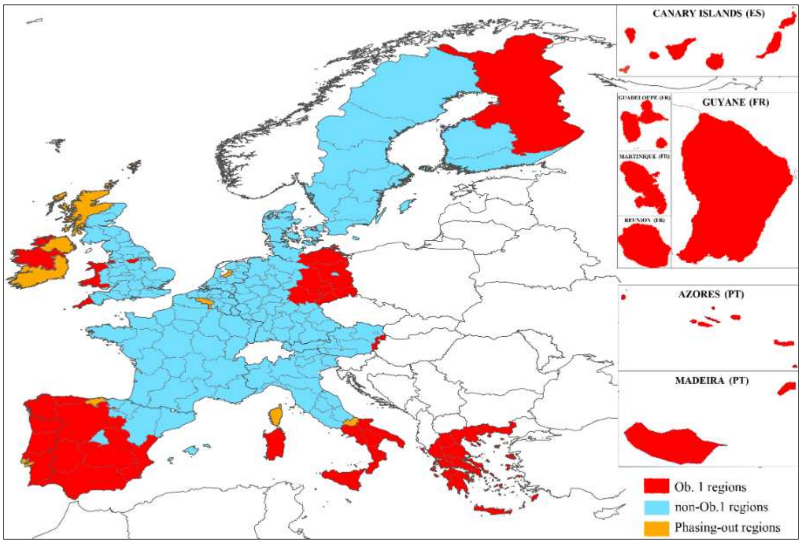
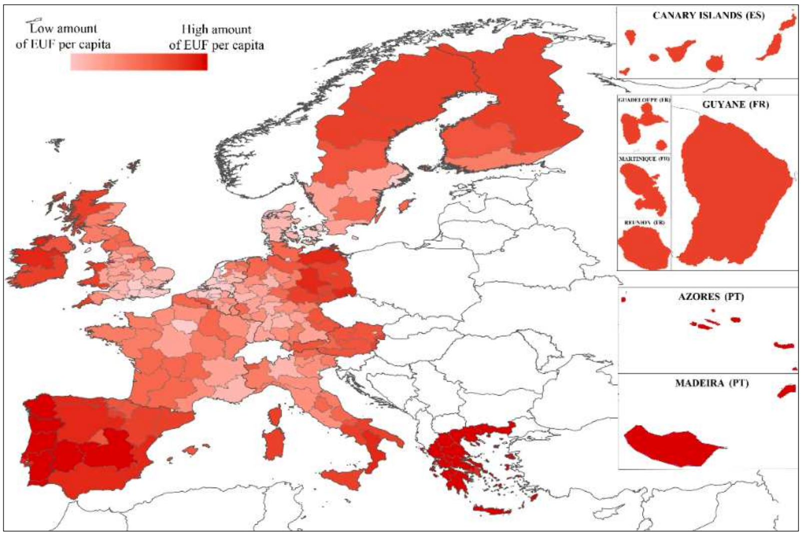


Figure 3. EUF per capita during the period 2001-2010 (NUTS-2 regions in the EU-15)

Panel A - EUF assignment status

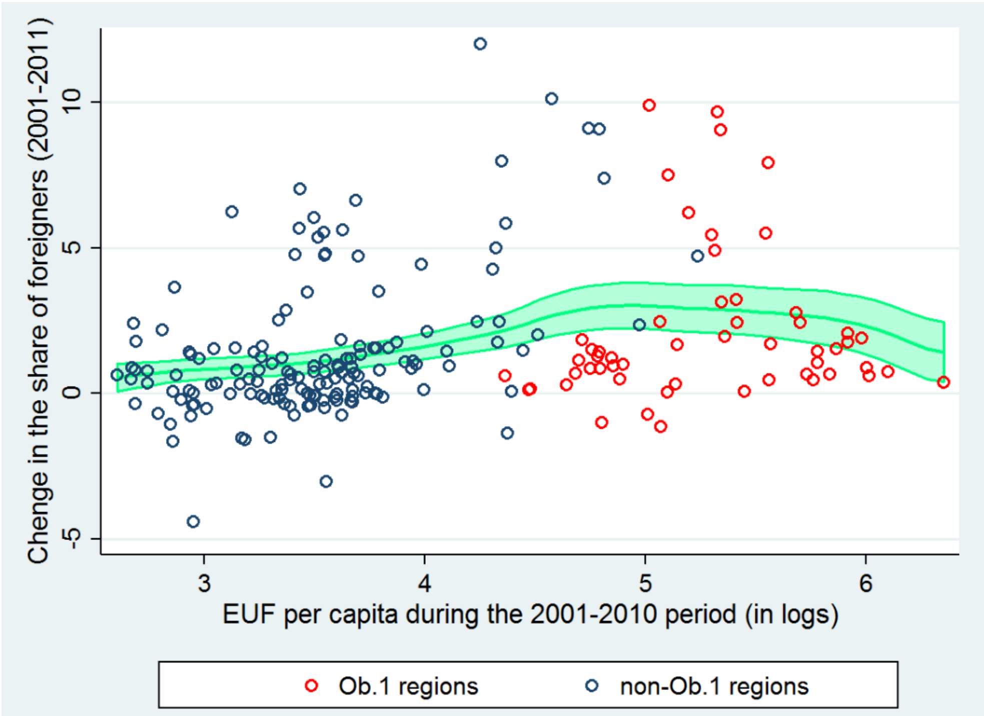


Panel B - EUF per capita during the period 2001-2010



Notes: A phasing-out system is granted to those regions which were eligible for Objective 1 funding in the previous programming period but that had a per capita GDP higher than 75 percent of the EU average for the 2000-2006 programming period.

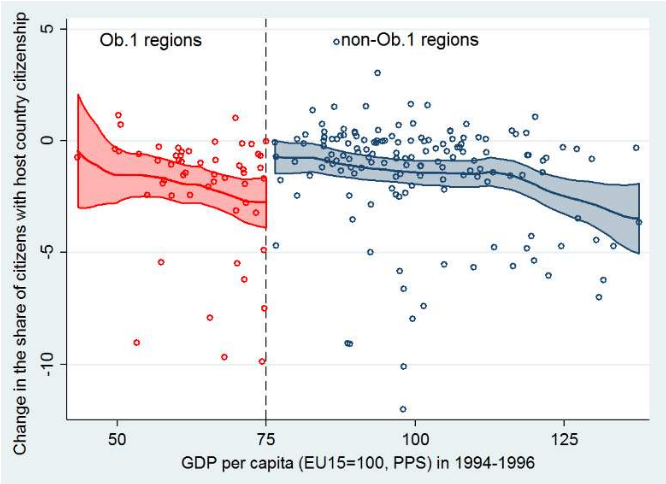
Figure 4. Relationship between EUF per capita during the 2001-2010 period and the percentage points change in the share of foreigners between 2001 and 2011



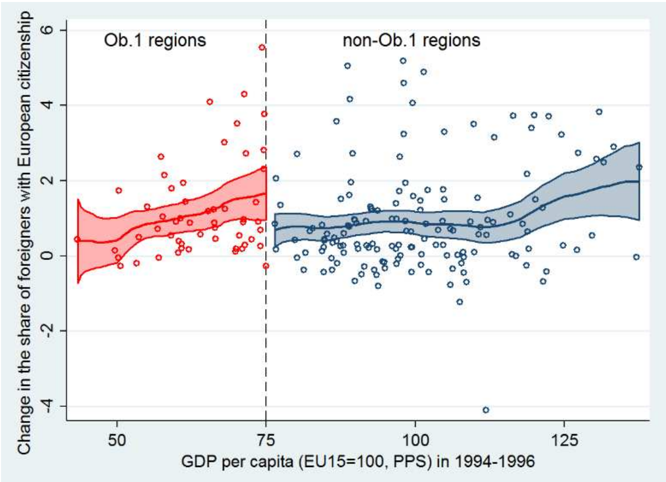
Notes: We used a local polynomial smooth curve and its 95% confidence interval (computed using Stata's command lpolyci).

Figure 5. Percentage points change in the share of citizens with host country citizenship, European citizenship and non-European citizenship at the discontinuity between Ob.1 and non-Ob.1 regions in EU-15 during the 2001-2011 period.

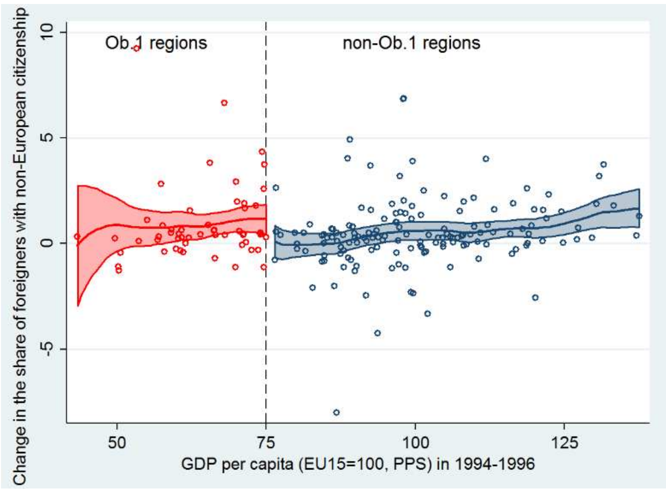
Panel A - Percentage points change in the share of citizens with host country citizenship



Panel B - Percentage points change in the share of foreigners with European citizenship (different from host country)



Panel C - Percentage points change in the share of foreigners with non-European citizenship



Notes: Each figure superimposes the fit of a nonparametric flexible polynomial regression model (estimated separately on each side of the cut-off point), together with the 95% confidence bands.