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**Returns to Migration,  
Education, and Externalities  
in the European Union**

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### Returns to Migration, Education, and Externalities in the European Union

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#### Summary

Relatively little attention has been paid to the role that externalities play in determining the pecuniary returns to migration. This paper addresses this gap, using microeconomic data for more than 100,000 individuals living in the European Union (EU) for the period 1994-2001 in order to analyse whether the individual economic returns to education vary between migrants and nonmigrants and whether any observed differences in earnings between migrants and locals are affected by household and/or geographical (regional and interregional) externalities. The results point out that while education is a fundamental determinant of earnings, European labour markets – contrary to expectations – do not discriminate in the returns to education between migrants and non-migrants. The paper also finds that household, regional, and interregional externalities influence the economic returns to education, but that they do so in a similar way for local, intranational, and supra-national migrants. The results are robust to the introduction of a large number of individual, household, and regional controls.

**Keywords:** Individual Earnings, Migration, Educational Attainment, Externalities, Household, Regions, Europe

**JEL Classification:** J

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by

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# **Returns to Migration, Education, and Externalities in the European Union**

## **Abstract**

Relatively little attention has been paid to the role that externalities play in determining the pecuniary returns to migration. This paper addresses this gap, using microeconomic data for more than 100,000 individuals living in the European Union (EU) for the period 1994-2001 in order to analyse whether the individual economic returns to education vary between migrants and non-migrants and whether any observed differences in earnings between migrants and locals are affected by household and/or geographical (regional and interregional) externalities. The results point out that while education is a fundamental determinant of earnings., European labour markets – contrary to expectations – do not discriminate in the returns to education between migrants and non-migrants. The paper also finds that household, regional, and interregional externalities influence the economic returns to education, but that they do so in a similar way for local, intranational, and supra-national migrants. The results are robust to the introduction of a large number of individual, household, and regional controls.

**Keywords:** Individual earnings, migration, educational attainment, externalities, household, regions, Europe

## 1. Introduction

The economic and pecuniary returns to migration have been studied extensively in labour, household, and regional economics. In particular, numerous empirical studies have examined the determinants of migrants' wages in comparison to that of non-migrants (Borjas et al. 1992, Lanza 1998, Card 2007, Ottaviano and Peri 2008). The majority of the microeconomic studies focusing on the economic returns to migration have concentrated on the role of the individual and household characteristics of the migrant. Individual differences in education, gender, employment and other observable characteristics have been thoroughly scrutinized and tend to be relevant in determining the earnings of both migrants and non-migrants, although the size and dimension of the relationship is often contested.

However, other factors have tended to be overlooked by the literature. This is the case of geographical factors. Yet geography or place-based endowments and conditions can play an important role in determining a migrant's earning potential. Some territories may be more welcoming and may allow migrants to make the transition to jobs that are more suited to their skills earlier and faster than others, thus maximizing the economic returns of the migrant. Conversely, other environments may be more migrant averse and newcomers may find themselves stuck in jobs well below their potential and existing skills for longer. This paper represents an attempt to cover this gap in the literature by analysing whether and how place-based externalities (regional and interregional externalities) matter in determining the pecuniary returns to migration.

Using data from the European Community Household Panel (ECHP) survey covering the period 1994-2001, the paper addresses how geographical externalities affect the earnings of migrants in the regions of the European Union (EU). The aim is to determine, first, whether the *individual pecuniary returns to schooling* vary – after controlling for a series of individual background variables, such as occupational and employment status and health – between migrants and locals and between the two migrant groups considered: intranational and international migrants. Second, we aim to establish whether *household and geographical wage and education externalities* affect the individual earnings of migrants and locals in different ways, taking into account that other factors such as the

number of years a migrant has been living in any particular region or the level of development of the country of origin may also influence the earning potential of migrants.

We use a traditional Mincerian specification (Mincer 1974), to which a regional and interregional dimension is added, in order to capture wage and educational externalities not only within regions (regional externalities), but also across regions (interregional externalities). This allows us to examine whether any differences in individual earnings between migrants and non-migrants across regions in the EU are the result of (a) the educational attainment of the individual, (b) the educational attainment and wage of the other members of the household s/he lives in (household externalities), (c) the educational endowment and wage level of the region where the individual lives (regional externalities), and (d) the educational endowment and wage level of the neighbouring regions (interregional externalities).

In order to achieve this aim, the paper is structured in the following way: Section 2 reviews the relationship between returns to migration and externalities; Section 3 provides the econometric specification for the empirical analysis, discusses the data, and presents the descriptive analysis of the variables of our model; Section 4 displays and analyses the empirical econometric results and; Section 5 concludes.

## **2. Theoretical considerations: migration and externalities**

### ***2.1 Migration and individual characteristics: the role of individual returns to schooling***

Since the work of Schultz (1961) and Becker (1962), education has been regarded as the main factor explaining differences in earnings among individuals. Education can be considered as an investment of current resources in exchange for future returns. Hence, the higher the level of education of an individual, the higher the expected economic returns, as education enhances an individual's innate skills, increases both his or her social and job opportunities and his or her productivity (Wolf 2002) and acts as a 'label' or 'signal' in the labour market (Spence 1973).

In principle, the individual pecuniary returns to education should be independent of whether the individual is a local or a migrant. Individuals with similar levels of

qualifications working in similar jobs should expect to earn a similar wage regardless of the region or country of origin. There are, however, a series of factors that may alter the relationship between education and earnings for migrants. Some of these factors may be positive for the migrants, others can be considered as negative.

On the positive side, the mere fact of migrating tends to single out individuals from the rest. Individuals who decide to migrate for economic reasons possess on average a higher level of innate ability than locals (Chiswick 1978) and also tend to be much more receptive to economic incentives than the rest of the population (Lanzona 1998, Nakosteen et al. 2008). Economic migrants leave their place of origin in order to try to maximize the value of their lifetime utility (Sjaastad 1962). Hence, economic migrants, for the sheer reason that their aim is to increase their lifetime earnings and gain better employment opportunities, can be considered as more dynamic and entrepreneurial than the average person in the territory of origin (Sjaastad 1962, Böheim and Taylor 2007, Nakosteen et al. 2008). Potential migrants are also more prone to weigh their expected income or career benefits against the financial and psychological costs – such as the psychological adjustments that have to be made when changing one's home and work environment – of moving to a certain region or country than non movers. This implies that they are also likely to move to those areas yielding the highest potential individual economic returns (Zhao 1999, Pekkala 2002). Migrants are also more likely to factor in any potential short-term initial loss in earnings linked to migration, as they would expect any decline in earnings to be followed in the medium- and long-run by eventual gains that depend on the success of their assimilation into the new environment and labour market (Borjas et al. 1992). Borjas et al. (1992), for instance, show that internal migrants in the US initially earn less than natives, but this wage differential disappears within a few years. From this perspective, migrants will have personal traits that may result, after an initial settling in period, in higher earnings than locals, at similar levels of education.

Other factors will, in contrast, undermine the earnings' potential of migrants. Lack of complete information – or the presence of biased information – about the place of destination and its labour market, about its norms and habits, or lack or deficient knowledge of the language are powerful barriers that limit the potential returns to

education for migrants (Borjas et al. 1992). Legal barriers, such as problems or delays in the recognition of degrees, also represent a serious impediment for the fulfilment of the earnings potential of a migrant, as does the valuation of the migrant's skills in the place of destination. The combination of these factors may result in a lower level of employment for migrants – and especially for the partners of initial migrants – after family reunification (Nivalainen, 2005). The geographical origin of migrants also determines the incidence of these negative forces. International migrants tend to be much more affected by imperfect knowledge of the local labour market and the general environment at the place of destination than intranational migrants. They will also be more disadvantaged as a group by legal obstacles and by a lack or imperfect knowledge of the language.

When both positive and negative factors are put in a balance, it is unclear whether the positive influences related to the greater entrepreneurship and dynamism of the average migrant outweigh the potential negative factors linked to a lack of adequate information and knowledge about the place of destination, and to legal and other types of barriers.

## ***2.2 Migration and household characteristics: the role of wage and education household externalities***

The earnings of any individual are, however, not only affected by his or her level of education, but also by a number of externalities. Within the household, these externalities include the level of education and the wages of the other members of the household. Interactions among household members create benefits that may be translated into higher earnings for individual members of the household. Positive household externalities (i.e. high level of education and wage of the other members of the household) may lead to higher wages for members of that household than for similarly educated individuals living outside that household or in households with negative educational and wage externalities (Basu et al. 2001, Lindelow 2008). This makes household background a powerful determinant of earnings.

Household externalities, in principle, are likely to affect locals and migrants in a similar way. There are, however, certain characteristics specific to migrant households that may affect the earning potential of individuals. First, decisions to migrate are not only

determined by the characteristics of any given individual, but also by the characteristics of the other members of the household where the individual lives. This, in turn, influences total household wage (Axelsson and Westerlund 1998).

One clear way through which this influence is exerted is by the fact that many migrants are what is known as ‘tied’ movers (Mincer 1978), that is individuals whose decision to migrate is determined by that of a partner, spouse, or another member of the household. The net gains of ‘tied’ movers are thus likely to be dominated by the gains (or losses) of their partner or spouse, making it more likely that certain members of a migrant household are, at least initially, likely to have lower earnings than similarly qualified members of local households. This means that the wages of ‘tied’ movers are less likely to increase and may, in most cases, be expected to fall at least in the short-run relative to their pre-migration wages (Böheim and Taylor 2007: 100). ‘Tied’ migration frequently reproduces and reinforces gender divisions, as women are more likely to be ‘tied’ movers than men (Nivalainen 2004). Cooke (2003: 340), for example, states that “wives sacrifice their own careers in order to support their husbands’ careers by following them as tied migrants, largely independent of their own relative economic power, socioeconomic status, or education level”. This normally results in a gender division of the household returns, with men’s earnings generally positively influenced by migration, while changes in women’s earnings generally dissociated from migration (Nilsson 2001). However, this is far from a universal view, as some scholars argue that women tend to be, at least in certain geographical contexts, more migratory than men (Détang-Dessendre and Molho 2000, Faggian et al. 2007b).

Once again, negative household externalities are more likely to affect international than intranational migrants. While ‘tied’ intranational movers will be more familiar with the new environment, have their skills and degrees recognised, and be in command in the local language, international ‘tied’ movers will tend to remain out of the labour force for longer and, once in the labour market, will take longer to get to jobs that match their level of skills.

### ***2.3. Migration and (inter)regional characteristics: the role of wage and education (inter)regional externalities***

Finally, the earnings potential of any individual depends not only on his/her own investments in education and the investments of the other members of his/her household, but also on a series of place-based (regional and interregional) conditions. The income of equally educated individuals varies significantly from one region to another. (Inter)regional wage and education spillovers are particularly interesting because of the prominent role they play in theories of economic development. The average human capital of workers in any given region is likely to increase productivity across the board. This increase in productivity will expand beyond regional borders. Knowledge, for instance, will leak from one worker to another and from one region to another (Easterly 2001, Tselios 2008).

More specifically, educational externalities, on the one hand, promote sharing of knowledge and encourage the exchange of ideas, imitation, and learning-by-doing, thus raising productivity (Acemoglu and Angrist 2001: 14). Pecuniary externalities, on the other, induce similar effects on productivity through prices. There are also strong links between education and pecuniary externalities: human capital endowment encourages more investment by firms and raises other workers' wages (Acemoglu and Angrist 2001: 15). Overall, the higher the educational endowment and the economic development of a region, the higher the probability that an individual will increase his/her productivity by interacting with others within the region. If wage and education spillovers are present through educational and pecuniary externalities, the individual in the rich and high educational endowment region will be more productive than a similarly qualified individual in a region with a poor educational endowment (Rudd 2000).

Moreover, complementarity effects matter for regional wage and education spillovers. Concentrations of poor and educationally disadvantaged groups within a region tend to lower the performance of all, while concentrations of rich and educationally advantaged groups have the opposite effects. For instance, the most educated workers may benefit more from knowledge spillovers, but the opposite occurs if the least educated workers have a higher learning capability (Di Addario and Patacchini 2008). In addition, if knowledge and skills have a big economic payoff, people will respond to this incentive by accumulating knowledge (Easterly 2001, Tselios 2008). Not only are the returns to

education inversely related to the number of people who get educated (Wolf 2002), but there is also a greater incentive to get educated in regions with a higher average level of education (Tselios 2008). Moreover, the high human capital endowment and economic development of a region is a crucial factor facilitating the adoption of new and more productive technologies which increase the earnings of those living in the region.

There is however limited empirical evidence of the impact of regional endowments on individual earnings. Most analyses on the topic have been estimated using Mincerian wage equations, complemented with a limited number of regional controls, such as the average regional wage and/or average human capital attainment (i.e. Rauch 1993, Acemoglu and Angrist 2001, Ciccone and Peri 2006). The results of these analyses are far from conclusive. Whereas Rauch (1993) finds that there are productivity gains from geographic concentration when estimating average-schooling externalities in a cross-section of U.S. cities in 1980, Ciccone and Peri (2006) report no evidence of significant average-schooling externalities in U.S. cities and states between 1970 and 1990.

The incidence of interregional educational externalities has, however, been mostly overlooked by the literature. The few studies that tangentially address it (Tselios 2008, Rodríguez-Pose and Tselios 2009) tend to find that interregional externalities contribute significantly to regional economic development. Nevertheless, this literature does not control for the externalities that may arise from individual educational and knowledge-based relationships across regional boundaries. However, non-monetary and monetary flows are not only stronger among regions that are geographically close to one another, but also more effective between homogeneous regions. As López-Bazo et al. (2004: 45) argue, neighbouring regions may share markets for labour and goods, and have similar capital or managerial talent at their disposal. If this is the case, externalities can result in the concentration of firms in macro-areas spanning several regions, thereby transferring externalities to the aggregate regional level. In addition, the diffusion of technology is often stronger between regions with the same socioeconomic characteristics (Bräuninger and Niebuhr 2005). Overall, location and proximity clearly matter in exploiting individual wages and therefore the omission of interregional characteristics in most

Mincerian analysis of the economic returns to education is likely to have resulted in a misleading picture of the sources of earnings of workers.

Do geographical externalities make a difference for migrants with respect to the rest of the population? One of the main causes of migration, and specifically of international migration, is the existence of wage differentials between areas (Cooper 1994). Wage differentials among regions create powerful signals to migrants to move (Krieg and Bohara 1999). And this type of incentive to migrate will occur provided that the perceived benefits exceed the costs both at an individual ('people-based' costs and benefits), but also at a territorial level ('place-based' costs and benefits). Differences in regional unemployment levels may play a similar role to that of wage differentials (Haapanen and Ritsila 2007).

Geographical externalities may also have more detrimental effects on migrants than on locals. As indicated earlier, lack of or inadequate knowledge of the local environment may act as a powerful barrier to insertion in the labour market and to achieving adequate pecuniary returns to education. Formal and, in most cases, more subtle and informal ways of discrimination may also operate in the labour market, with immigrants having to become assimilated or integrated in order to overcome these often invisible barriers to fulfilling their full educational potential in the labour market. And international immigrants are more likely to experience these barriers than intranational ones.

Yet despite the importance of these factors, the studies dealing with these issues from a quantitative perspective are few and far between. Although there are some studies which examine the link between regional labour market and migration decisions (Ritsilä and Ovaskainen 2001, Faggian et al. 2007b), far fewer dwell on the link between (inter)regional labour market and earnings of immigrants. This paper tries to address this gap in the literature.

### **3. Econometric specification, data and variables**

#### ***3.1 Econometric specification***

In order to test whether there are differences in the economic returns to education between different types of migrants and locals across regions in the EU, and whether

household and geographical externalities play a role in the presence or absence of such differences, we propose a Mincerian specification including not only individual variables, but also household-level, regional-level, and supra-regional-level variables as explanatory variables, in order to allow us to examine the influence of education and wage externalities on individual earnings. In our Mincerian specification, we include (a) the educational attainment of the individual, (b) the educational attainment and the wage of the other members of the household where an individual lives, (c) the educational endowment and the per capita wage of the region where s/he lives, and (d) the educational endowment and the per capita wage of the neighbouring regions. In the model, individual wages are determined according to the following equation:

$$\begin{aligned} \log w_{it} = & \beta_1 educ_{it} + \beta_2 heduc_{it} + \beta_3 \log hw_{it} + \beta_4 reduc_{st} + \beta_5 \log rw_{st} + \\ & + \beta_6 [Wreduc_t]_s + \beta_7 [W \log rw_t]_s + \beta_8 exp_{it} + \beta_9 exp_{it}^2 + \beta_{10} gender_{it} + \\ & + \gamma_1 x_{it} + \gamma_2 y_{it} + \gamma_3 z_{st} + \gamma_4 [Wz_t]_s + v_i + \phi_t + \varepsilon_{it} \end{aligned}$$

where  $\log w_{it}$  is the logarithm wage of individual  $i$  at time  $t$ ;  $educ_{it}$  is a measure of the educational attainment of individual  $i$  at time  $t$ ;  $heduc_{it}$  is the average educational attainment of the other household members for individual  $i$  at time  $t$ ;  $\log hw_{it}$  is the logarithm wage of the other household members for individual  $i$  at time  $t$ ;  $reduc_{st}$  is the educational endowment of region  $s$  at time  $t$ ;  $\log rw_{st}$  is the logarithm of the per capita wage of region  $s$  at time  $t$ ;  $[Wreduc_t]_s$  is the educational endowment of the neighbouring regions  $s$  at time  $t$ ; and  $[W \log rw_t]_s$  is the logarithm of the per capita wage of the neighbouring regions  $s$  at time  $t$ . The specification of the interregional education and income interaction is represented by a spatial weight matrix  $W$ . In our wage equation,  $W$  is a binary matrix ( $s \times s$  dimension) with elements equal to 1 in the case of the  $k$  –nearest neighbouring regions with  $k = 5, 7$  and  $9$ , and 0 otherwise.  $exp_{it}$  is a labour market experience measure and is included as a quadratic term in order to capture a potential concavity of the experience/earnings profile (Mincer 1974, Harmon et al. 2003).  $gender_{it}$  is a dummy variable for gender.

Three categories of workers are considered in the model: locals (those who were born and live in the region), intranational migrants (those born in other regions of the same country), and international migrants (those born abroad). To illustrate and test the differences among these groups, we resort to the use of interaction terms such as  $educ_{it}xD_1$ ,  $educ_{it}xD_2$  and  $educ_{it}xD_3$ , which denote educational attainment of locals, intranational migrants and international migrants, respectively. It can be argued that these three categories of workers are self-selected (Borjas 1987, Borjas et al. 1992, Dostie and Leger 2009). It is also worth noting that the characteristics of migrants and non-migrants and those of intranational and international migrants differ significantly (Greenwood 1975, Pekkala 2002). We address these issues by using leverage treatment effects while controlling for a large number of observables driving migration. These controls include a series of individual, household, regional, and interregional variables aimed at minimising selection bias in the model (Ottaviano and Peri 2006).

As highlighted in the previous section, we expect, following Borjas et al. (1992), that the number of years a migrant has lived in any particular region will be relevant for his or her earning prospects. Hence the introduction of the variable number of years in region  $s$  (years since migration), as a means to capture the influence on earnings of settling in periods for migrants. Similarly the level of development – proxied by GDP per capita – of the country of origin of international migrants is also included as it may have an influence on their job and earnings prospects and plays a non-negligible role in the initial decision to migrate (Ritsilä and Ovaskainen 2001).<sup>1</sup>

The coefficient  $\beta_1$  represents the internal (private) returns to education, the coefficients  $\beta_2$ ,  $\beta_4$  and  $\beta_6$  represent the external returns to education and the coefficients  $\beta_3$ ,  $\beta_5$  and  $\beta_7$  represent the external returns to wages. In particular,  $\beta_2$ ,  $\beta_4$  and  $\beta_6$  capture the household, regional, and interregional education externalities, respectively; while  $\beta_3$ ,  $\beta_5$  and  $\beta_7$  capture the household, regional, and interregional wage externalities, respectively. A significant coefficient of the average educational attainment of the other household members, of the regional education endowment, or of the educational

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<sup>1</sup> The level of development of the country of origin can be regarded as a kind of national externality.

endowment of the neighbouring regions will in all likelihood signal the presence of external effects to education, while a significant coefficient of the average wage of the other household members, of the regional per capita wage, or of the per capita wage of the neighbouring regions will do the same with wage externalities. It has to be born in mind, however, that these effects may not reflect ‘true’ educational and wage externalities. Instead any significant coefficients may be largely the result of household, regional, and neighbouring region characteristics that may be correlated with the educational attainment at a household, regional, and broader geographical level, respectively (Rudd 2000). In order to minimise this potential risk, we include a vector of individual-specific  $x_{it}$ , household- (and individual-) specific  $y_{it}$ , regional-specific  $z_{st}$  and interregional-specific  $[Wz_t]_s$  characteristics.  $\gamma_1$ ,  $\gamma_2$ ,  $\gamma_3$  and  $\gamma_4$  are the coefficients of those specific characteristics. By adding this set of control variables, we are able to capture some relevant structural individual, household, regional, and interregional features, while simultaneously dealing with important sources of heterogeneity and, as mentioned earlier, addressing part of the problem of selection bias. Finally,  $u_i$  depicts the unobserved time-invariant characteristics of individual  $i$  (such as innate ability),  $\varphi_t$  represents time-dummies, and  $\varepsilon_{it}$  is the disturbance term.

In the model a measure of the logarithmic earnings  $w$  for an individual is projected on the intrinsic characteristics of the individual, the characteristics of the other members of the household he/she lives in, the socioeconomic conditions of his/her region, and the broader geographical influences of neighbouring regions. Hence, in our model household and geographical externalities are expected to affect earnings.

The analysis uses fixed effects estimators as they allow us to control for time-invariant individual characteristics  $u_i$ , which are essential factors in any decision to migrate.

### **3.2 Data and variables**

The data used in this paper fundamentally stem – as in previous papers on related topics (i.e. Rodríguez-Pose and Tselios 2009) – from the ECHP dataset.<sup>2</sup> These micro data can be aggregated regionally, depending on countries, at NUTS I or II level for the EU. All cases with errors and missing values in the variables of educational attainment, work experience, and gender, as well as individuals without a wage or a salary were removed from the dataset. This left a final panel dataset covering 321,026 individuals living in 80 regions and 12 European countries for the period 1994-2001. The countries in our study include the following: Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Portugal, Spain, The Netherlands, and the United Kingdom.<sup>3</sup> The ECHP is, however, not problem free. Some of the limitations of the database for this type of analysis include (a) the fact that as some countries consist of only one region (Denmark, Finland, Ireland, and The Netherlands), and (b) the level of attrition. Attrition is nevertheless is a problem common to virtually all panel surveys and existing studies show that the level of attrition of analyses based on the ECHP – which is mainly random rather than selective attrition (Watson 2003) – has a negligible impact on results (Watson 2003).

The variable ‘*wage and salary earnings*’ from the ECHP is used as the source for the individual earnings of workers. We measure real wages instead of nominal ones in order to control for differences in living costs (Axelsson and Westerlund 1998). 72.69 per cent of those included in our panel sample are ‘locals’ (stayers), that is, people born in the country of present residence who live in the same region since birth (no migration). 21.63 per cent are intranational migrants – people born in the country of present residence who had lived in a different region of the country before moving to their present place of residence. Finally, 5.68 per cent is made of international migrants, that is individuals who were born or had lived abroad. This latter category is, in turn, divided into three subgroups: (a) those were born in the country of residence, but had lived abroad before

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<sup>2</sup> The surveys were conducted regularly during the period 1994-2001 at approximately one-year intervals. In these surveys approximately 100,000 individuals were interviewed about their socioeconomic status and information is collected about their income changes, job changes, education status, living places, age, etc. For a review of the ECHP, see Peracchi (2002).

<sup>3</sup> Appendix 1 displays the pooled regional distribution of the observations.

moving to their current region (1.90 per cent); (b) those born abroad before coming to the country of present residence (3.35 per cent); and (c) those born abroad and who lived in another foreign country before coming to the country of residence (0.43 per cent). 86.48 per cent of the sample is made of normally working individuals (15+ hours/week), while 5.24 per cent and 8.14 per cent is made of unemployed and inactive, respectively. The rest of our sample (0.14 per cent) is non-respondents. Finally, 208,485 individuals (64.94 per cent of our sample: 64.88 per cent for locals, 65.80 per cent for intranational immigrants and 62.45 per cent for international immigrants) share a house with at least one other member. The distribution of our sample across migration status is shown in Figure 1.

**Insert Figure 1 around here**

The education variables at individual, regional, and interregional level are calculated using the microeconomic ECHP variable '*highest level of general or higher education completed*'. Individuals are classified into one of the following three educational categories: recognised third level education completed, second stage of secondary level education completed, and less than second stage of secondary level education completed. The use of this educational proxy is based on the assumption that any increment in education level completed, undertaken either by a primary or by a secondary student, adds a constant quantity to human capital stock, but that the acquisition of further knowledge at postgraduate level does not, as both graduate and postgraduate degrees belong to the same category ('recognised third level education') (Psacharopoulos and Arriagada 1986, Ram 1990). The three levels of formal education included in the proxy are defined by the International Standard Classification of Education and, thus, are mutually exclusive and allow for international comparisons. This, however, does not imply that their use is problem free, as important cross-country differences in the requirements and quality for the completion of any particular educational category remain in Europe (Centre for Educational Research and Innovation and Organisation for Economic Co-operation and Development 1998, Rodríguez-Pose and Tselios 2007). Furthermore, the education systems and structures of each country vary in terms of

resources, duration, and the preparation of students (Sianesi and Van Reenen 2003, Rodríguez-Pose and Vilalta-Bufi 2005, Rodríguez-Pose and Tselios 2007).<sup>4</sup>

In order to get rid of the problems linked to cross-country comparability, we normalise all the educational variables by the national average. In addition, as we are fundamentally interested in the size, sign, and significance of the coefficients of the association between educational attainment at individual, household, regional, and interregional level, and earnings, the normalised estimated coefficients are directly comparable. At the risk of some oversimplification, the educational attainment of individual  $i$  is given the value of 1 for less than second stage of secondary education, 2 for second stage of secondary level education, and 3 for recognised third level education. The educational endowment of the neighbouring regions of  $s$  is calculated by means of a weights matrix of the normalised regional education endowment ( $k$  – nearest neighbouring regions, with  $k = 5, 7$  and  $9$ ).

Figure 2 shows the distribution of the normalised wage and of the educational attainment across migration status. This figure displays the following: in our sample (a) migrants have higher wages and a higher average educational attainment than locals, while, among migrants, the wages and educational status of intranational migrants are superior to those of international migrants; (b) the wage and educational attainment of the other members of the household where an immigrant lives are on average higher than those of members of local households; (c) the per capita wage and educational endowment of regions with a high concentration of migrants are higher than those of regions without such concentration; and (d) the per capita wage of neighbouring regions is higher in regions without a high concentration of migrants or with above average gatherings of intranational migrants than for those with a high density of international immigrants, while the educational endowment of neighbouring regions is roughly similar for migrants and non migrants. Overall, the results stemming from the ECHP confirm the fact that, by and large, immigrants have a higher level of education than ‘locals’ and that this may be an important factor in determining their earnings.

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<sup>4</sup> A drawback of this measurement of educational attainment is that we are not able to distinguish between years of schooling and degrees obtained in order to estimate ‘sheepskin effects’ (Ferrer and Riddell 2008). The ECHP data survey does not provide data for years of schooling and includes only three educational categories, making it also impossible to test if there is a flatter education-wage profile at higher levels of education (Borjas 2005).

## **Insert Figure 2 around here**

Labour market experience and gender are used as control variables. Labour market experience does not represent actual experience (typically recorded as the weighted sum of the number of years of part-time and full-time work since leaving full time education), but it is proxied by potential experience calculated as the age minus the education leaving age (Harmon et al. 2003). The results of the descriptive statistics show that the average work experience of locals included in the sample is 19.15 years, 22.48 for intranational migrants, and 21.60 for international migrants. The migrants included in the sample have a greater work experience than locals and this may influence their greater earning power unveiled by Figure 2. Men tend to dominate the sample. They constitute 57.32 per cent of all locals, 53.96 per cent of international immigrants, and 56.07 per cent of international immigrants. We use women as the base category for our specifications. The descriptive statistics of our main variables are presented in Appendix 2.

Of the controls used exclusively for migrants, the number of years in the region is extracted from the ECHP data survey, while the level of economic development of the country of origin – proxied by its GDP per capita – from the World Bank World Development Indicators dataset.

## **4. Regression Results**

Running the model with interaction terms for our three categories of individuals – locals, intranational migrants, and international migrants – allows us to identify whether across the regions of the EU for the period of analysis there are differences in the economic returns to education between different types of migrants and locals and whether any such differences are the result of household or geographical externalities or of any other type of factors.

### ***4.1. Testing the Mincerian specification with educational and wage externalities***

Table 1 presents the results of the main model, where the economic returns of education for our three different categories are tested (Regression 1). We then control for

educational and wage externalities at the level of the household, the region, and the geographical context where the region is located, as well as for work experience and for gender, which tend to be two of the most important determinants of earnings (Regressions 2-5). In successive regressions we introduce the number of years living the region (Regression 6) and the level of development in the country of origin (only for international migrants) (Regression 7) as a means of controlling for two additional factors that, as stated earlier, will in all likelihood influence the earnings of migrants.

**Insert Table 1 around here**

The results indicate that even though on the surface the pecuniary returns to education for migrants are marginally higher than those of locals (Regression 1). these higher returns for migrants virtually disappear when effects when the externalities and other controls are included in the regressions (Table 1, Regressions 2 through 7). Indeed, when household and geographical educational and wage externalities are included, there is a marginal difference in the economic returns to education for locals and international migrants (in favour of the latter), while the returns for intranational migrants tend to hover around ten percentage points above those of locals (Table 1). These results are robust to the inclusion of household (Regression 2), regional (Regression 3), interregional (Regression 4) education and wage externalities, respectively, and of all types of externalities together (Regression 5). This means that, contrary to expectations, there is little sign of discrimination against migrants in the European labour market. Indeed, if there is any form of discrimination this is against intranational rather than international migrants.

The different types of externalities included in the analysis matter for wages. Both household and place-based effects generally work in a similar direction for migrants and locals. Wage household externalities are negatively associated with wages in all three categories of individuals (Regression 2). This signals a fundamentally gender-based division of tasks within the household.<sup>5</sup> Members of the household with lower earnings – generally women – are more likely to sacrifice their career prospects and aspirations in order to fulfil other tasks, i.e. raising a family and being the main carers for children

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<sup>5</sup> This argument has been successfully tested using the interaction term of household wage externalities with a male dummy.

and/or other members of the family. Although this phenomenon is observed across our three categories of individuals, the dimension of the coefficient is marginally larger for locals and intranational immigrants than for international ones. This highlights that, for the European case, the negative effect of household wage externalities tends to be similar across categories or even somewhat lower for international migrants, making the issue of lower economic returns for 'tied' movers, in general, and for women who follow their husbands when they migrate, in particular, much less relevant than expected by the theory. Female international immigrants seem to be, in terms of their personal wages, less discriminated by household externalities than intranational migrants and locals (Regression 2). This is likely to show that migrants are either more concerned with maximising household income or even more flexible in the distribution of household chores, allowing international women migrants to reap greater returns in the labour market than local women or intranational women migrants. Once household wage externalities are controlled for, household educational externalities are positive, with the coefficient for intranational migrants the highest in all categories analysed. The results highlight that, at least in the local and international migrant category, women tend to sacrifice their career prospects in order to raise a family or fulfil other tasks in a very similar way, regardless of their initial level of education. The use of an interaction term of household education externalities with male dummy confirms this argument.

Geographical (regional and interregional) externalities also matter for wages (Regressions 3-5). Across the board wage externalities are more relevant than educational externalities. Individuals living in regions with high average earnings and surrounded by regions with similar wage patterns tend to have higher earnings than individuals with similar educational characteristics living in regions and supra-regional areas with lower average earnings (Regressions 3-5). Regional and interregional wage externalities vary, however, across our individual categories. International immigrants' wages tend to benefit more from regional wage externalities (Regression 3), but when interregional externalities are included (Regression 5) the coefficient for intranational immigrants is highest. In the case for interregional wage externalities, the coefficient for international immigrants is the highest (Regression 4), but once again this is not robust (Regression 5). When considering educational externalities, regional educational externalities are

negative (Regression 3), but when other externalities are included in the specification, this effect disappears (Regression 5). Interregional educational externalities are, in contrast, marginally positive for both categories of migrants, but not for locals (Regression 5).

The introduction of the number of years living in the region (Regression 6) is statistically irrelevant for international immigrants and positive and significant for intranational migrants. This suggests a relatively swift integration in the labour market for international migrants. Hence, the settling in effect identified by Borjas et al. (1992) does not seem to apply for international migrants in the case of Europe. The number of years living in the region by intranational migrants is, in contrast, rewarded in economic terms. As pointed out by Faggian and McCann (2006) and Faggian et al. (2007a) for the case of the United Kingdom, these migrants are likely to have moved into the region in order to get further education, making the number of years in the region function in a similar way to work experience (Regression 6). The level of development of the country of origin does not affect wages of international migrants, once other factors are controlled for (Regression 7).

Finally the gender and work experience controls introduced in the model have the expected coefficients. All other things being equal, men tend to earn significantly more than women, confirming the well documented gender discrimination in the labour market and, in relatively rigid markets like those across Europe, work experience makes a difference for wages. The relationship between experience and wages is, however, non linear (Regressions 1-7).

#### ***4.2 Sensitivity of the results***

In order to evaluate the robustness of the results of Table 1, we experiment with a number of alternative individual-specific, household-specific and (inter)region-specific specifications of the model.<sup>6</sup> The results of these analyses are presented in Tables 2, 3, and 4 and underscore the robustness of the results.

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<sup>6</sup> The definition, descriptive statistics, and sources of the control variables are presented in Appendix 3.

Table 2 controls for a vector of individual characteristics, including overeducation, the sector of employment of the individual, the type of job performed, and the health of the individual. The results presented in Table 1 are robust to the introduction of additional individual controls. The controls also have the expected signs. Overeducation makes a difference for earnings (Regression 1), industrial workers earn higher wages than service workers and these than agricultural workers, and individuals employed in the public sector earn more than those in private employment (Regression 2). In addition, legislators, senior officials and managers, professional, and technicians tend to have the highest earnings, while agricultural and fishery workers the lowest (Regression 3). As expected, individuals with poor health have the lowest earnings (Regression 4).

**Insert Table 2 around here**

In the regressions reported in Table 3, we introduce a vector of other household characteristics. Once again the results of the main analysis are extremely robust, with coefficients with signs and dimensions that hardly change from those reported in Table 1. The results presented in Table 3 indicate some interesting dimensions. First, the earnings of individuals decrease with household size, while the impact of the number of adults living in the household is unclear (Regressions 1 and 3). The results also show that the earnings of different types of households vary (Regressions 1 and 2). Couples without children have the highest earnings, although they are not significantly different from those of couples with one child. The lowest earnings are found among couples with three or more young children and, above all, among the elderly.

**Insert Table 3 around here**

Finally, the introduction of regional controls once again reinforces the robustness of the results (Table 4). The coefficients for the returns to education and for household, regional, and supra-regional externalities are similar to those reported in Table 1. Regarding the additional geographical controls, the results of Table 4 suggest that the sectoral specialisation of the region tends to matter for earnings (Regression 1). Innovation matters for earnings only if it is measured by total intramural R&D expenditure as a percentage of GDP (Regression 3), but not if it is measured by patent

applications (Regression 2), Finally, public infrastructure has a positive impact on individual earnings and population density a negative one (Regressions 2 and 3).<sup>7</sup>

**Insert Table 4 around here**

## **5. Concluding Remarks**

This paper set out to analyse whether the individual economic returns to education varied between migrants and non-migrants and whether any observed differences in earnings between migrants and locals were affected by household and/or the less commonly examined geographical externalities. According to the literature, it was predicted that not only would education determine wages, but that any differences in wages would be affected by externalities. It was also expected that both household and geographical externalities would be more detrimental for migrants than for locals, because of their greater chance of being ‘tied’ migrants – negative household externalities – or their lower knowledge of the local environment and labour markets – negative regional and supra-regional externalities. International migrants were also expected to be disadvantaged vis-à-vis intranational migrants because of legal barriers in the recognition of titles, lower knowledge of the language, and general discrimination with respect to locals in the labour market.

The results of the analysis for a large number of individuals across regions of the EU for the period between 1994 and 2001 have confirmed some of these expectations, but not others. First, education matters for earnings. Gaining additional formal education pays off in the labour market. And this happens across the board. Once other factors are controlled for there is little difference in the returns to education for locals and for different types of migrants.

Second, household and geographical externalities make a difference for earnings, but their influence, with very few exceptions, tends to be similar across different categories of individuals. Geographical wage externalities have a positive impact on earnings for migrants and non-migrants, whereas educational externalities tend to be largely

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<sup>7</sup> The results presented in this analysis are robust to the use of alternative methods, such as random effects. These results can be provided upon request.

irrelevant, both at household and geographical level, once wage externalities are controlled for.

Third, contrary to expectations from the literature, there is little evidence in the case of Europe that settling in periods represent a dent for the earnings of migrants. They do not seem to make a difference for international immigrants and are of marginal importance for intranational migrants.

Fourth, gender and experience matter for earnings and have a similar impact across categories. Gender is one of the most important factors behind differences in earnings, revealing a widespread gender bias in the labour market for locals and immigrants alike.

Finally, the results are robust to the introduction of additional individual, household, and geographical controls.

Overall, the most important finding is that, contrary to expectations, there seems to be – at least during the period of analysis – virtually no discrimination against migrant workers in the European labour market and that this fact is robust to the introduction of household and geographical externalities. Locals and migrants with similar levels of education tend to command similar wages. Gender discrimination, in contrast, is a more pervasive and relevant feature of the European labour market.

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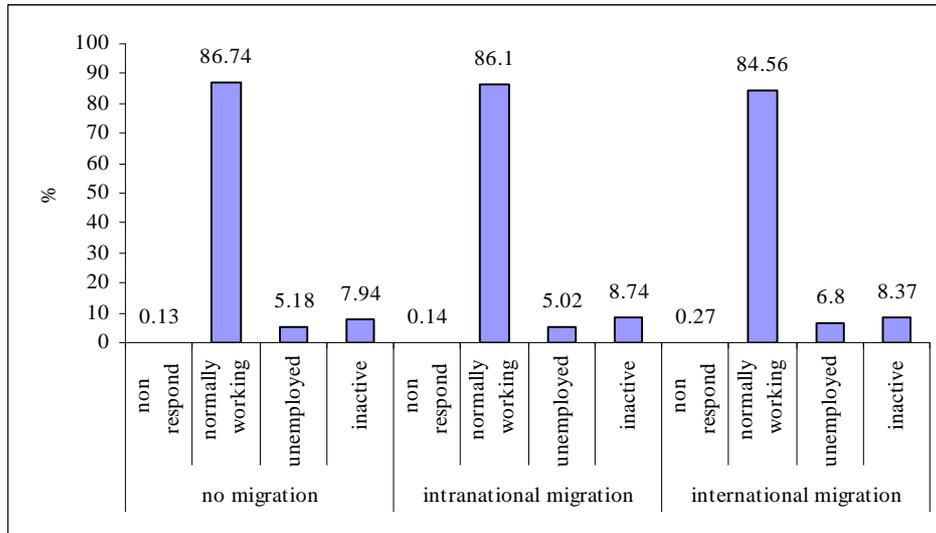
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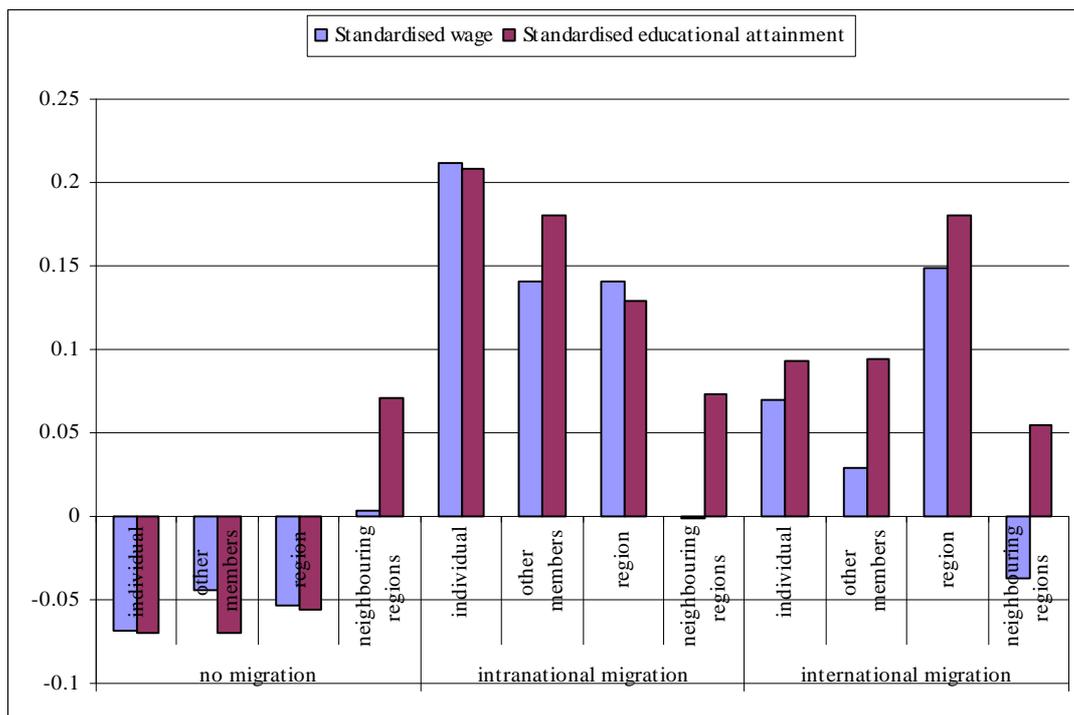
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**Figure 1: Distribution of sample across migration status**



**Figure 2: Distribution of standardised wage and educational attainment across migration status**



**Table 1: Fixed effects regression results: Mincerian specification with educational and wage externalities**

Dependent variable: log of wage of individuals

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Educational attainment of individual	Locals	0.1460 (0.0026)***	0.1257 (0.0032)***	0.1447 (0.0026)***	0.1450 (0.0026)***	0.1223 (0.0031)***	0.1230 (0.0032)***	
	Intranational immigrants	0.1608 (0.0044)***	0.1396 (0.0049)***	0.1603 (0.0043)***	0.1617 (0.0044)***	0.1357 (0.0049)***	0.1373 (0.0049)***	
	International immigrants	0.1594 (0.0082)***	0.1272 (0.0092)***	0.1536 (0.0083)***	0.1548 (0.0083)***	0.1266 (0.0091)***	0.1281 (0.0093)***	0.1436 (0.0179)***
Educational attainment of the other members	Locals		0.0124 (0.0033)***			0.0090 (0.0033)***	0.0092 (0.0033)***	
	Intranational immigrants		0.0364 (0.0048)***			0.0382 (0.0048)***	0.0401 (0.0049)***	
	International immigrants		0.0168 (0.0089)*			0.0176 (0.0090)*	0.0188 (0.0092)**	0.0110 (0.0173)
Log of wage of the other members	Locals		-0.4290 (0.0024)***			-0.4305 (0.0028)***	-0.4314 (0.0028)***	
	Intranational immigrants		-0.4371 (0.0026)***			-0.4665 (0.0041)***	-0.4664 (0.0042)***	
	International immigrants		-0.4142 (0.0034)***			-0.4267 (0.0091)***	-0.4231 (0.0092)***	-0.2797 (0.0127)***
Educational endowment of region	Locals			-0.0201 (0.0050)***		-0.0015 (0.0064)	0.0007 (0.0064)	
	Intranational immigrants			-0.0133 (0.0077)*		-0.0071 (0.0095)	-0.0040 (0.0096)	
	International immigrants			-0.0232 (0.0122)*		-0.0130 (0.0149)	-0.0064 (0.0151)	0.0369 (0.0434)
Log of wage per capita of region	Locals			0.8034 (0.0192)***		0.9612 (0.0313)***	0.9646 (0.0317)***	
	Intranational immigrants			0.7958 (0.0192)***		1.1186 (0.0399)***	1.1244 (0.0404)***	
	International immigrants			0.8154 (0.0194)***		1.0966 (0.0658)***	1.0931 (0.0668)***	1.2472 (0.1691)***
Educational endowment of neighbouring regions	Locals				-0.0048 (0.0083)	0.0081 (0.0101)	0.0095 (0.0102)	
	Intranational immigrants				0.0092 (0.0100)	0.0419 (0.0118)***	0.0454 (0.0119)***	
	International immigrants				0.0515 (0.0233)**	0.0726 (0.0282)***	0.0707 (0.0284)**	0.0924 (0.0533)*
Log of wage per capita of neighbouring regions	Locals				0.5587 (0.0180)***	0.2891 (0.0292)***	0.2804 (0.0296)***	
	Intranational immigrants				0.5502 (0.0181)***	0.1633 (0.0375)***	0.1497 (0.0379)***	
	International immigrants				0.5695 (0.0182)***	0.1658 (0.0642)***	0.1566 (0.0652)**	0.2553 (0.1248)**
Number of years in the region	Intranational immigrants						0.0026 (0.0009)***	
	International immigrants						0.0026 (0.0016)	0.0053 (0.0042)
Log of GDP per capita of country of origin	International immigrants							-0.0400 (0.0400)
Work experience	Locals	0.0759 (0.0006)***	0.0604 (0.0006)***	0.0759 (0.0006)***	0.0759 (0.0006)***	0.0610 (0.0006)***	0.0609 (0.0006)***	
	Intranational immigrants	0.0867 (0.0009)***	0.0728 (0.0013)***	0.0912 (0.0013)***	0.0914 (0.0013)***	0.0694 (0.0013)***	0.0684 (0.0014)***	
	International immigrants	0.0694 (0.0014)***	0.0451 (0.0023)***	0.0606 (0.0022)***	0.0615 (0.0022)***	0.0438 (0.0024)***	0.0440 (0.0024)***	0.0435 (0.0040)***
Work experience squared	Locals	-0.0014 (0.0000)***	-0.0011 (0.0000)***	-0.0014 (0.0000)***	-0.0014 (0.0000)***	-0.0012 (0.0000)***	-0.0012 (0.0000)***	

	Intranational immigrants	-0.0016 (0.0000)***	-0.0014 (0.0000)***	-0.0017 (0.0000)***	-0.0017 (0.0000)***	-0.0013 (0.0000)***	-0.0013 (0.0000)***	
	International immigrants	-0.0013 (0.0000)***	-0.0008 (0.0000)***	-0.0011 (0.0000)***	-0.0011 (0.0000)***	-0.0008 (0.0001)***	-0.0008 (0.0001)***	-0.0008 (0.0001)***
Male	Locals	0.4585 (0.0037)***	0.2729 (0.0039)***	0.4581 (0.0038)***	0.4581 (0.0038)***	0.2748 (0.0039)***	0.2736 (0.0040)***	
	Intranational immigrants	0.4370 (0.0070)***	0.2571 (0.0071)***	0.4424 (0.0070)***	0.4419 (0.0071)***	0.2430 (0.0072)***	0.2446 (0.0073)***	
	International immigrants	0.5208 (0.0146)***	0.3042 (0.0151)***	0.5014 (0.0150)***	0.5034 (0.0150)***	0.2983 (0.0156)***	0.2981 (0.0159)***	0.4146 (0.0244)***
Constant		7.8407 (0.0062)***	11.8859 (0.0229)***	0.4680 (0.1762)***	2.7066 (0.1658)***	0.3987 (0.2371)*	0.4579 (0.2396)*	-2.8666 (1.5311)*
Observations		321026	208485	321026	321026	208485	203355	7494
R-squared		0.1989	0.3480	0.2042	0.2021	0.3574	0.3574	0.2401

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 2: Fixed effects regression results: Mincerian specification with externalities and individual control variables**

Dependent variable: log of wage of individuals

		(1)	(2)	(3)	(4)
Educational attainment of individual	Locals	0.1006 (0.0032)***	0.0895 (0.0029)***	0.0913 (0.0030)***	0.1198 (0.0031)***
	Intranational immigrants	0.1028 (0.0047)***	0.0949 (0.0047)***	0.0939 (0.0048)***	0.1320 (0.0049)***
	International immigrants	0.0989 (0.0087)***	0.0980 (0.0087)***	0.0878 (0.0089)***	0.1247 (0.0091)***
Educational attainment of the other members	Locals	-0.0099 (0.0033)***	-0.0111 (0.0030)***	0.0039 (0.0031)	0.0082 (0.0033)**
	Intranational immigrants	0.0176 (0.0046)***	0.0078 (0.0046)*	0.0313 (0.0047)***	0.0361 (0.0049)***
	International immigrants	-0.0128 (0.0086)	-0.0183 (0.0085)**	0.0035 (0.0087)	0.0165 (0.0090)*
Log of wage of the other members	Locals	-0.3310 (0.0030)***	-0.3168 (0.0028)***	-0.3498 (0.0028)***	-0.4269 (0.0028)***
	Intranational immigrants	-0.3618 (0.0043)***	-0.3505 (0.0044)***	-0.3702 (0.0043)***	-0.4561 (0.0042)***
	International immigrants	-0.3231 (0.0095)***	-0.3199 (0.0094)***	-0.3485 (0.0093)***	-0.4236 (0.0091)***
Educational endowment of region	Locals	-0.0051 (0.0071)	-0.0048 (0.0058)	-0.0074 (0.0061)	-0.0017 (0.0063)
	Intranational immigrants	-0.0073 (0.0095)	-0.0101 (0.0087)	-0.0093 (0.0092)	-0.0018 (0.0094)
	International immigrants	-0.0097 (0.0147)	-0.0114 (0.0141)	-0.0195 (0.0146)	-0.0112 (0.0149)
Log of wage per capita of region	Locals	0.9403 (0.0337)***	0.9102 (0.0282)***	0.9032 (0.0292)***	0.9715 (0.0311)***
	Intranational immigrants	1.0237 (0.0403)***	1.0146 (0.0367)***	1.0388 (0.0379)***	1.0787 (0.0399)***
	International immigrants	1.0518 (0.0646)***	1.0447 (0.0624)***	1.0388 (0.0639)***	1.0921 (0.0659)***
Educational endowment of neighbouring regions	Locals	-0.0090 (0.0100)	-0.0149 (0.0092)	-0.0039 (0.0095)	0.0114 (0.0102)
	Intranational immigrants	0.0253 (0.0111)**	0.0239 (0.0110)**	0.0226 (0.0112)**	0.0318 (0.0120)***
	International immigrants	0.0436 (0.0272)	0.0281 (0.0266)	0.0698 (0.0273)**	0.0705 (0.0284)**
Log of wage per capita of neighbouring regions	Locals	0.2290 (0.0282)***	0.2737 (0.0264)***	0.2964 (0.0273)***	0.2745 (0.0291)***
	Intranational immigrants	0.1727 (0.0354)***	0.2014 (0.0346)***	0.1812 (0.0356)***	0.1931 (0.0376)***
	International immigrants	0.1218 (0.0613)**	0.1554 (0.0608)**	0.1772 (0.0622)***	0.1665 (0.0643)***
Work experience	Locals	0.0557 (0.0007)***	0.0563 (0.0006)***	0.0600 (0.0006)***	0.0604 (0.0006)***
	Intranational immigrants	0.0575 (0.0014)***	0.0559 (0.0014)***	0.0613 (0.0014)***	0.0682 (0.0014)***
	International immigrants	0.0393 (0.0024)***	0.0399 (0.0024)***	0.0408 (0.0024)***	0.0434 (0.0024)***
Work experience squared	Locals	-0.0010 (0.0000)***	-0.0010 (0.0000)***	-0.0011 (0.0000)***	-0.0011 (0.0000)***
	Intranational immigrants	-0.0010 (0.0000)***	-0.0009 (0.0000)***	-0.0011 (0.0000)***	-0.0013 (0.0000)***
	International immigrants	-0.0007 (0.0001)***	-0.0007 (0.0001)***	-0.0007 (0.0001)***	-0.0008 (0.0001)***
Male	Locals	0.2249 (0.0039)***	0.2418 (0.0038)***	0.2475 (0.0041)***	0.2749 (0.0039)***

	Intranational immigrants	0.2340 (0.0068)***	0.2343 (0.0071)***	0.2144 (0.0072)***	0.2463 (0.0073)***
	International immigrants	0.2822 (0.0149)***	0.2723 (0.0149)***	0.2564 (0.0153)***	0.2972 (0.0157)***
Overeducation		-0.0167 (0.0035)***			
Industrial sector <sup>a</sup>			0.4233 (0.0115)***		
Service sector			0.3281 (0.0115)***		
Public sector			0.1138 (0.0046)***		
Legislators, senior officials and managers <sup>b</sup>				0.6922 (0.0153)***	
Professionals				0.6608 (0.0148)***	
Technicians and associate professionals				0.5811 (0.0142)***	
Clerks				0.5261 (0.0141)***	
Service workers and shop and market sales workers				0.3405 (0.0139)***	
Craft and related trades workers				0.4659 (0.0137)***	
Plant and machine operators and assemblers				0.5099 (0.0142)***	
Elementary occupations				0.2880 (0.0137)***	
Health: very good <sup>c</sup>					0.1669 (0.0231)***
Health: good					0.1659 (0.0228)***
Health: fair					0.1269 (0.0229)***
Health: bad					0.0524 (0.0242)**
Constant		0.4725 (0.2949)	-0.1895 (0.2125)	-0.2203 (0.2202)	0.2537 (0.2367)
Observations		158478	169716	178548	206325
R-squared		0.3328	0.3544	0.3779	0.3561

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

<sup>a</sup> Base category: Agricultural sector

<sup>b</sup> Base category: Skilled agricultural and fishery workers

<sup>c</sup> Base category: Health: very bad

**Table 3: Fixed effects regression results: Mincerian specification with externalities and household control variables**

Dependent variable: log of wage of individuals

		(1)	(2)	(3)
Educational attainment of individual	Locals	0.1225 (0.0031)***	0.1216 (0.0034)***	0.1216 (0.0034)***
	Intranational immigrants	0.1359 (0.0049)***	0.1338 (0.0051)***	0.1338 (0.0051)***
	International immigrants	0.1267 (0.0091)***	0.1236 (0.0099)***	0.1235 (0.0099)***
Educational attainment of the other members	Locals	0.0093 (0.0033)***	0.0067 (0.0035)*	0.0068 (0.0035)*
	Intranational immigrants	0.0385 (0.0048)***	0.0392 (0.0050)***	0.0391 (0.0050)***
	International immigrants	0.0178 (0.0090)**	0.0224 (0.0097)**	0.0225 (0.0097)**
Log of wage of the other members	Locals	-0.4301 (0.0028)***	-0.4491 (0.0030)***	-0.4490 (0.0030)***
	Intranational immigrants	-0.4662 (0.0041)***	-0.4875 (0.0043)***	-0.4874 (0.0043)***
	International immigrants	-0.4261 (0.0091)***	-0.4555 (0.0098)***	-0.4555 (0.0098)***
Educational endowment of region	Locals	-0.0012 (0.0064)	0.0007 (0.0067)	0.0004 (0.0067)
	Intranational immigrants	-0.0069 (0.0095)	0.0009 (0.0100)	0.0006 (0.0100)
	International immigrants	-0.0130 (0.0149)	-0.0098 (0.0156)	-0.0102 (0.0156)
Log of wage per capita of region	Locals	0.9622 (0.0313)***	0.9866 (0.0329)***	0.9869 (0.0329)***
	Intranational immigrants	1.1203 (0.0399)***	1.1553 (0.0416)***	1.1562 (0.0416)***
	International immigrants	1.0988 (0.0658)***	1.1906 (0.0696)***	1.1917 (0.0696)***
Educational endowment of neighbouring regions	Locals	0.0076 (0.0101)	0.0069 (0.0107)	0.0057 (0.0107)
	Intranational immigrants	0.0425 (0.0118)***	0.0335 (0.0122)***	0.0331 (0.0122)***
	International immigrants	0.0718 (0.0282)**	0.0866 (0.0298)***	0.0851 (0.0298)***
Log of wage per capita of neighbouring regions	Locals	0.2832 (0.0292)***	0.2796 (0.0306)***	0.2753 (0.0306)***
	Intranational immigrants	0.1567 (0.0375)***	0.1460 (0.0390)***	0.1410 (0.0390)***
	International immigrants	0.1585 (0.0643)**	0.0998 (0.0678)	0.0949 (0.0679)
Work experience	Locals	0.0613 (0.0006)***	0.0628 (0.0007)***	0.0630 (0.0007)***
	Intranational immigrants	0.0699 (0.0013)***	0.0700 (0.0014)***	0.0701 (0.0014)***
	International immigrants	0.0442 (0.0024)***	0.0419 (0.0027)***	0.0421 (0.0027)***
Work experience squared	Locals	-0.0012 (0.0000)***	-0.0012 (0.0000)***	-0.0012 (0.0000)***
	Intranational immigrants	-0.0013 (0.0000)***	-0.0013 (0.0000)***	-0.0013 (0.0000)***
	International immigrants	-0.0008 (0.0001)***	-0.0007 (0.0001)***	-0.0007 (0.0001)***
Male	Locals	0.2749	0.2705	0.2706

		(0.0039)***	(0.0042)***	(0.0042)***
	Intranational immigrants	0.2434 (0.0072)***	0.2331 (0.0075)***	0.2332 (0.0075)***
	International immigrants	0.2990 (0.0156)***	0.2980 (0.0170)***	0.2982 (0.0170)***
Household size		-0.0249 (0.0042)***		-0.0245 (0.0069)***
Number of adults in the household		0.0100 (0.0045)**		0.0015 (0.0059)
Couples without children (at least one person aged 65 or more)			-0.5856 (0.0418)***	-0.5811 (0.0418)***
Couples with one child (child aged less than 16)			-0.0292 (0.0100)***	-0.0074 (0.0116)
Couples with two children (all children aged less than 16)			-0.1022 (0.0118)***	-0.0620 (0.0162)***
Couple with three children or more (all children aged less than 16)			-0.1482 (0.0176)***	-0.0962 (0.0227)***
Couple with one or more children (at least one child aged 16 or more)			-0.1115 (0.0108)***	-0.0739 (0.0145)***
Constant		0.5026 (0.2378)**	0.5198 (0.2511)**	0.6121 (0.2522)**
Observations		208485	179235	179235
R-squared		0.3576	0.3750	0.3750

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

<sup>a</sup> Base category: Couples without children (both persons aged less than 65)

**Table 4: Fixed effects regression results: Mincerian specification with externalities and regional control variables**

Dependent variable: log of wage of individuals

		(1)	(2)	(3)
Educational attainment of individual	Locals	0.1278 (0.0035)***	0.1350 (0.0048)***	0.1334 (0.0053)***
	Intranational immigrants	0.1367 (0.0051)***	0.1410 (0.0060)***	0.1413 (0.0064)***
	International immigrants	0.1304 (0.0096)***	0.1512 (0.0125)***	0.1584 (0.0141)***
Educational attainment of the other members	Locals	0.0150 (0.0037)***	0.0172 (0.0050)***	0.0117 (0.0055)**
	Intranational immigrants	0.0470 (0.0050)***	0.0558 (0.0059)***	0.0570 (0.0064)***
	International immigrants	0.0224 (0.0095)**	0.0458 (0.0123)***	0.0371 (0.0139)***
Log of wage of the other members	Locals	-0.4560 (0.0032)***	-0.4836 (0.0041)***	-0.4970 (0.0047)***
	Intranational immigrants	-0.4896 (0.0043)***	-0.4982 (0.0048)***	-0.5088 (0.0051)***
	International immigrants	-0.4473 (0.0100)***	-0.4811 (0.0120)***	-0.4859 (0.0135)***
Educational endowment of region	Locals	-0.0126 (0.0084)	0.0182 (0.0109)*	-0.0034 (0.0136)
	Intranational immigrants	-0.0184 (0.0110)*	0.0022 (0.0148)	-0.0292 (0.0187)
	International immigrants	-0.0254 (0.0164)	0.0014 (0.0249)	-0.0072 (0.0318)
Log of wage per capita of region	Locals	1.1026 (0.0429)***	0.9682 (0.0542)***	1.1021 (0.0684)***
	Intranational immigrants	1.2581 (0.0498)***	1.0979 (0.0607)***	1.2679 (0.0751)***
	International immigrants	1.1774 (0.0768)***	1.1104 (0.0954)***	1.1338 (0.1162)***
Educational endowment of neighbouring regions	Locals	-0.0557 (0.0133)***	0.0362 (0.0133)***	-0.0501 (0.0167)***
	Intranational immigrants	-0.0034 (0.0130)	0.0503 (0.0145)***	-0.0166 (0.0158)
	International immigrants	-0.0112 (0.0337)	0.0559 (0.0346)	-0.0377 (0.0379)
Log of wage per capita of neighbouring regions	Locals	0.4039 (0.0377)***	0.2159 (0.0401)***	0.3071 (0.0489)***
	Intranational immigrants	0.2750 (0.0442)***	0.0940 (0.0505)*	0.1454 (0.0588)**
	International immigrants	0.3305 (0.0733)***	0.0916 (0.0882)	0.2843 (0.1047)***
Work experience	Locals	0.0587 (0.0007)***	0.0668 (0.0010)***	0.0682 (0.0012)***
	Intranational immigrants	0.0689 (0.0014)***	0.0784 (0.0017)***	0.0807 (0.0018)***
	International immigrants	0.0460 (0.0025)***	0.0414 (0.0035)***	0.0438 (0.0041)***
Work experience squared	Locals	-0.0011 (0.0000)***	-0.0013 (0.0000)***	-0.0013 (0.0000)***
	Intranational immigrants	-0.0013 (0.0000)***	-0.0015 (0.0000)***	-0.0016 (0.0000)***
	International immigrants	-0.0008 (0.0001)***	-0.0007 (0.0001)***	-0.0008 (0.0001)***
Male	Locals	0.2455 (0.0044)***	0.2396 (0.0061)***	0.2364 (0.0071)***

	Intranational immigrants	0.2294 (0.0075)***	0.2233 (0.0084)***	0.2204 (0.0092)***
	International immigrants	0.2859 (0.0166)***	0.3035 (0.0212)***	0.3091 (0.0245)***
Gross value added of industry per capita <sup>a</sup>		-0.5617 (0.3396)*		
Gross value added of services per capita		-1.1362 (0.3314)***		
Patent applications to the EPO by priority year (per million of inhabitants)			0.0000 (0.0002)	
Total intramural R&D expenditure as a % of GDP				-0.0736 (0.0242)***
Logarithm of motorways (km) per square kilometer			0.1858 (0.0310)***	0.0752 (0.0388)*
Logarithm of railway lines (km) per square kilometer			0.5737 (0.1352)***	0.5002 (0.1556)***
Population density			-0.0014 (0.0002)***	-0.0009 (0.0003)***
Constant		-0.5706 (0.4002)	4.4172 (0.8017)***	1.5304 (0.9718)
Observations		167976	111974	89180
R-squared		0.3646	0.3688	0.3768

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

<sup>a</sup> Base category: Gross value added of agriculture per capita

### Appendix 1: Regional distribution of observations

a/a	Country	Region	Observations	Percent	a/a	Country	Region	Observations	Percent
1	Austria	AT1	8,414	2.62	41	Portugal	PT11	7,365	2.29
2	Austria	AT2	4,970	1.55	42	Portugal	PT12	7,320	2.28
3	Austria	AT3	7,229	2.25	43	Portugal	PT13	4,551	1.42
4	Belgium	BE1	2,317	0.72	44	Portugal	PT14	3,672	1.14
5	Belgium	BE2	9,042	2.82	45	Portugal	PT15	3,819	1.19
6	Belgium	BE3	8,892	2.77	46	Portugal	PT2	4,905	1.53
7	Denmark	DK0	24,078	7.5	47	Portugal	PT3	4,655	1.45
8	Spain	ES1	4,939	1.54	48	United Kingdom	UK11	637	0.2
9	Spain	ES2	6,334	1.97	49	United Kingdom	UK12	499	0.16
10	Spain	ES3	4,462	1.39	50	United Kingdom	UK13	688	0.21
11	Spain	ES4	5,665	1.76	51	United Kingdom	UK21	545	0.17
12	Spain	ES5	9,209	2.87	52	United Kingdom	UK22	398	0.12
13	Spain	ES6	7,517	2.34	53	United Kingdom	UK23	759	0.24
14	Spain	ES7	2,440	0.76	54	United Kingdom	UK24	942	0.29
15	Finland	FI	25,536	7.95	55	United Kingdom	UK31	1,463	0.46
16	France	FR1	5,613	1.75	56	United Kingdom	UK32	659	0.21
17	France	FR2	6,146	1.91	57	United Kingdom	UK33	319	0.1
18	France	FR3	2,151	0.67	58	United Kingdom	UK40	1,146	0.36
19	France	FR4	3,329	1.04	59	United Kingdom	UK51	617	0.19
20	France	FR5	4,482	1.4	60	United Kingdom	UK52	1,598	0.5
21	France	FR6	3,118	0.97	61	United Kingdom	UK53	1,042	0.32
22	France	FR7	3,880	1.21	62	United Kingdom	UK54	809	0.25
23	France	FR8	3,189	0.99	63	United Kingdom	UK55	2,531	0.79
24	Greece	GR1	7,410	2.31	64	United Kingdom	UK56	895	0.28
25	Greece	GR2	5,221	1.63	65	United Kingdom	UK57	707	0.22
26	Greece	GR3	7,786	2.43	66	United Kingdom	UK61	1,389	0.43
27	Greece	GR4	3,081	0.96	67	United Kingdom	UK62	384	0.12
28	Ireland	IE	22,607	7.04	68	United Kingdom	UK63	802	0.25
29	Italy	IT1	3,768	1.17	69	United Kingdom	UK71	616	0.19
30	Italy	IT2	5,242	1.63	70	United Kingdom	UK72	1,177	0.37
31	Italy	IT3	5,924	1.85	71	United Kingdom	UK73	827	0.26
32	Italy	IT4	2,419	0.75	72	United Kingdom	UK81	615	0.19
33	Italy	IT5	5,052	1.57	73	United Kingdom	UK82	1,116	0.35
34	Italy	IT6	2,972	0.93	74	United Kingdom	UK83	582	0.18
35	Italy	IT7	2,429	0.76	75	United Kingdom	UK84	500	0.16
36	Italy	IT8	3,760	1.17	76	United Kingdom	UK91	642	0.2
37	Italy	IT9	5,376	1.67	77	United Kingdom	UK92	756	0.24
38	Italy	ITA	2,840	0.88	78	United Kingdom	UKA1	1,285	0.4
39	Italy	ITB	2,380	0.74	79	United Kingdom	UKA2	1,054	0.33
40	The Netherlands	NL	5,241	1.63	80	United Kingdom	UKA4	280	0.09

## Appendix 2: Descriptive statistics of main variables

	Obs	Mean or %	Min	Max
<b>No migration</b>				
Logarithm of individual wage	233347	9.000357	-0.0566245	13.58844
Educational attainment of individual	233347	-0.0699448	-1.880914	7.789069
Logarithm of wage of the other members	151404	9.01963	0.2042155	13.58844
Educational attainment of the other members	151404	-0.0694893	-2.055209	7.772726
Logarithm of regional wage	233347	9.321016	8.365101	10.1219
Regional education attainment	233347	-0.0556309	-2.818571	2.770054
Logarithm of wage of the neighbouring regions	233347	9.342622	8.550203	10.00858
Educational attainment of the neighbouring regions	233347	0.070566	-0.931677	1.177966
Work experience	233347	19.15434	0	75
Sex	233347			
Male	133759	57.32		
Female	99588	42.68		
<b>Intranational migration</b>				
Logarithm of individual wage	69431	9.324205	0.4441986	12.72051
Educational attainment of individual	69431	0.2081711	-1.880914	7.789069
Logarithm of wage of the other members	45686	9.261203	0.443784	12.61348
Educational attainment of the other members	45686	0.1797947	-2.055209	7.772726
Logarithm of regional wage	69431	9.500577	8.365101	10.1219
Regional education attainment	69431	0.1289316	-2.818571	2.770054
Logarithm of wage of the neighbouring regions	69431	9.422453	8.550203	10.00858
Educational attainment of the neighbouring regions	69431	0.073205	-0.931677	1.177966
Work experience	69431	22.48304	0	73
Sex	69431			
Male	37464	53.96		
Female	31967	46.04		
<b>International migration</b>				
Logarithm of individual wage	18248	9.069917	1.02623	12.92563
Educational attainment of individual	18248	0.0934078	-1.880914	7.789069
Logarithm of wage of the other members	11395	9.013014	0.9463045	12.81562
Educational attainment of the other members	11395	0.0942609	-2.055209	7.772726
Logarithm of regional wage	18248	9.364764	8.365101	10.1219
Regional education attainment	18248	0.1796714	-2.818571	2.770054
Logarithm of wage of the neighbouring regions	18248	9.347154	8.550203	10.00858
Educational attainment of the neighbouring regions	18248	0.0549548	-0.931677	1.177966
Work experience	18248	21.6039	0	68
Sex	18248			
Male	10231	56.07		
Female	8017	43.93		

### Appendix 3: Definition, descriptive statistics and sources of control variables

	no migration		intranational migration		international migration	
	Obs.	Mean or %	Obs.	Mean or %	Obs.	Mean or %
<b>CONTROL: INDIVIDUAL</b> (Source: ECHP)						
<i>Overeducation</i>	172,457		56,492		14,612	
Yes	90,912	0.527	32,974		8,252	
No	81,545	0.473	23,518		6,360	
<i>Main activity of the local unit of the business or organisation in current job</i>	198,651		55,502		14,968	
Agricultural sector	8,146	0.041	1,163	0.021	444	0.030
Industrial sector	62,902	0.317	13,655	0.246	4,512	0.301
Service sector	127,603	0.642	40,684	0.733	10,012	0.669
<i>Current job in private or public sector</i>	196,529		58,855		14,915	
Private sector, including non-profit private organisations	139,838	0.712	34,451	0.585	10,673	0.716
Public sector, including para-statal	56,691	0.288	24,404	0.415	4,242	0.284
<i>Occupation in current job</i>	199,907		57,717		15,198	
Legislators, senior officials and managers	10,203	0.051	4,471	0.077	899	0.059
Professionals	20,314	0.102	12,230	0.212	2,305	0.152
Technicians and associate professionals	24,551	0.123	10,588	0.183	2,025	0.133
Clerks	33,480	0.167	7,532	0.130	1,842	0.121
Service workers and shop and market sales workers	27,596	0.138	7,040	0.122	1,958	0.129
Skilled agricultural and fishery workers	5,580	0.028	750	0.013	325	0.021
Craft and related trades workers	34,543	0.173	6,347	0.110	2,277	0.150
Plant and machine operators and assemblers	19,632	0.098	4,158	0.072	1,392	0.092
Elementary occupations	24,008	0.120	4,601	0.080	2,175	0.143
<i>How is your health in general?</i>	231,868		68,256		18,084	
Very good	65,288	0.282	21,568	0.316	5,226	0.289
Good	115,152	0.497	31,907	0.467	8,498	0.470
Fair	43,015	0.186	12,760	0.187	3,657	0.202
Bad	7,102	0.031	1,646	0.024	572	0.032
Very bad	1,311	0.006	375	0.005	131	0.007
<b>CONTROL: HOUSEHOLD</b> (Source: ECHP)						
Household size	233,347	3.479	69,431	3.196	18,248	3.437
Number of adults in the household	233,347	2.728	69,431	2.391	18,248	2.591
<i>Household type (couples)</i>	179,313		55,186		13,893	
Couples without children (at least one person aged 65 or more)	2,833	0.016	1,266	0.023	266	0.019
Couples without children (both persons aged less than 65)	34,803	0.194	13,857	0.251	2,805	0.202
Couples with one child (child aged less than 16)	25,082	0.140	7,473	0.135	1,918	0.138
Couples with two children (all children aged less than 16)	27,464	0.153	9,552	0.173	2,326	0.167
Couple with three children or more (all children aged less than 16)	8,104	0.045	3,313	0.060	898	0.065
Couple with one or more children (at least one child aged 16 or more)	81,027	0.452	19,725	0.357	5,680	0.409

<b>CONTROL: REGIONAL</b> (Source: Eurostat)						
<i>Sectoral composition</i>	181,465		60,229		15,505	
Gross value added of agriculture per capita	8,497	0.047	2,390	0.040	659	0.042
Gross value added of industry per capita	51,348	0.283	17,278	0.287	4,296	0.277
Gross value added of services per capita	121,620	0.670	40,561	0.673	10,550	0.680
Patent applications to the EPO by priority year (per million of inhabitants)	216,634	80.374	68,635	137.375	17,658	88.717
Total intramural R&D expenditure as a % of GDP	128,692	1.229	53,045	1.942	10,983	1.503
Logarithm of motorways (km) per square kilometer	189,548	-4.186	63,964	-4.727	15,074	-4.384
Logarithm of railway lines (km) per square kilometer	153,174	-3.190	62,893	-3.291	13,359	-3.105
Population density	203,013	335.935	60,595	221.955	16,572	411.331

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