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Keywords: Multicutural Cities, Ethnic Diversity, Productivity

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Abstract

The paper investigates the determinants of cosmopolitan cities. The hypothesis tested empirically is whether gradual improvements in distant communication boost the generation of ethnically heterogeneous cities. Consequently to easier communication, movers increasingly rely on an enlarged community for identity transmission, rather than on localized peer effects of segregated environment. The empirical estimation provides support to the prediction of the model. A better access to the airports as well as improvements in internet communications are found to increase city ethnic diversity.

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1. Introduction

The issue of racial and ethnic segregation has been widely studied and the interest has been posed in the economic implications of marginalization, for both marginalised groups and for the society as a whole. Moreover the mechanisms that drive racial segregation have been investigated. A novel interest in the ethnic structure of a society has been recently introduced, where the crucial node has shifted from studying the costs of segregation to studying the benefits of integration. While in cross-countries analysis the relationship between diversity and economic performance is found to be quite mixed (Easterly and Levine, 1997; Collier, 2001; Easterly, 2001; Alesina and La Ferrara, 2005) in finer spatial units, such as cities, a positive link is reported (Glaeser et al., 1992; Ottaviano and Peri, 2005; 2006; Bellini et al., 2009; Sparber, 2010). This is because in a dense environment, where differences are more likely to interact, the scope for benefits related to diversity is larger. Individuals belonging to different cultures have different ways of addressing the same problem, possess complementary pieces of information, and by means of informal communication, available in a dense environment such as cities, reach better and quicker solutions. Jacobs (1969) emphasizes the powerful link between diversity and innovation. The author believes that important knowledge transfers arise from outside the core industry. Areas with highly diversified industries as opposed to geographically concentrated industries should display greater growth. Ashraf and Galor (2007) place the fortune of Europe in its heterogeneity, developed in many years of foreign people invasion. This cross-fertilization could have been responsible for the shift from an agriculture based regime to a production regime characterised by new manufacturing technologies. This may have contributed to the "reverse of fortunes" between Europe and China. The latter was historically richer than Europe, but its cultural homogeneity may have prevented China from maintaining this supremacy.

The existence of positive implications of multiculturalism has motivated the investigation of the determinants of cosmopolitan cities. This is the scope of the present paper. The intensification

of the emigration flows from less-developed to economic developed countries is not questionable and the current trend is likely to continue in the future. The enlargement of the community of foreigners is a characteristic of our cities, and will bring important economic implications. The question is whether host countries will face an increase in segregated settings or alternatively whether cosmopolitan environments will be more alike.

Cultural diversity fosters the exchange of ideas and knowledge, allowing steady growth to rise, and this produces a greater pay off to foreigners in terms of higher wages. At the same time however, the cultural identities of movers are likely to be preserved within the own ethnic enclave in the destination countries.[1] Migrants face the trade-off between an environment which maximizes their economic utility and an environment which maximizes their social utility. In other words, the migrants face the dilemma of choosing either a multicultural setting or a segregated enclave. A solution to this dilemma can be reached by means of communication improvements. Ottaviano and Prarolo (2009) formalize this hypothesis and predict that two ethnic groups integrate in multicultural cities when communication is easy, whereas they segregate in different cities when diaspora members find it hard to communicate at distance. Progress in transportation and communication helps offsetting the dilution of cultural identities, which occurs when one moves from a segregated to a more integrated environment. Improvements of this type reduce the cost of move, as help migrants maintaining contacts with friends and family of their own ethnic group, living in different cities of the same destination country. This in turn should increase the city heterogeneity, as individuals of different ethnicities eventually locate in a multicultural environment, rather than stay in a segregated context, in order to respond to the positive externalities generated by a culturally heterogeneous environment.

The objective of this paper is to provide an empirical test to the theoretical predictions of the Ottaviano and Prarolo model (2009), O-P hereafter, on the development of multicultural cities.

[1] Bisin et al. (2006) on the contrary report that ethnic identities are more intense in mixed rather than segregated neighbourhoods. They find that minority groups enhance their ethnic lifestyle, as a response to an hostile racial or ethnic environment, which characterise the mixed neighbourhood.

Given the substitutability between the concept of segregation and integration, this paper draws on the large empirical literature that studies the determinants of segregation. The paper assesses the relationship between gradual improvement in distant communication and the rise of multicultural cities.

The remainder of the paper is organized as follows. Section 2 presents a brief review of the literature. Section 3 describes the methodological structure and briefly sketches the O-P model. In Section 4 a description of the data is presented. Section 5 presents the empirical exercise. Section 6 adds some robustness checks. Section 7 provides a summary and the conclusions.

2. Literature

The upward trend in migration has introduced a rising interest in ethnic heterogeneity and its implication for economic performance. One aspect related to ethnic heterogeneity is that of segregation, as the different ethnic groups in a society may cluster in ethnic enclaves, posing serious challenges to governance.

This paper is related to two strands of literature, the first being the empirical studies that analyse the causes of residential segregation. The concept of segregation and integration are complements to one another, as segregation refers to a situation where the two types are concentrated in different cities, whereas integration corresponds to an even distribution of the groups between the cities. The analysis of residential segregation, despite being scarce for European cities, has been prominent in the research agenda of U.S. In this literature, two factors have been traditionally identified as responsible for racial segregation. The first is related to the discrimination of whites against the black or Hispanic minorities, while the second are the cultural ties that induce minorities to live in own-race abundant neighbourhood (Patterson, 1997; Thernstrom and Thernstrom, 1997; Ihlanfeldt and. Scafidi, 2002). Cultural identity is under strain in a heterogeneous environment and to preserve it, minorities chose to cluster in ethnic homogenous enclaves. This last view, however, has been challenged by Bisin et al (2006), where the identity of

an ethnic minority is found to be more intense, *ceteris paribus*, in mixed rather than segregated neighbourhoods.

A test on the two standard determinants of segregation has been offered by Cutler et al. (1999). The authors explore the evolution of racial segregation over time in American cities and test whether segregation is the result of the natives' or alternatively the immigrants' action. They find that the segregation of the black minority arises from discriminating actions taken by incumbent natives. The white majority either enforces separation through rising barriers to keep blacks out of white neighbourhood, or pursues the desire to live with other natives and therefore segregates itself. An additional motivation have been introduced by Cutler et al. (2008) to analyse the rising trend in immigrants' segregation, experienced by U.S. cities. They use the dissimilarity and isolation index, computed at ethnic and city level, to test the discrimination and the cultural theories against a transportation theory. According to the transportation theory, there might be class differences in commuting modes such that natives relocate in automobile-dependent urban periphery. On the contrary, immigrants locate in the urban core and rely on public transit as soon as this is a valid alternative to private means. They find that cultural reasons are responsible for increased segregation. In particular, lower experience in United States and linguistic distance between immigrants' native tongue and English increase segregation. They also provide support to the transportation hypothesis, as the metropolitan areas with larger reliance on public transport show greater segregation. This last mechanism introduces the possibility that exogenous factors, such as local government measures, can shape the residential segregation by race.

An alternative explanation for segregation is as well provided by Dawkins (2005), who tests whether increased local government fractionalization, the so called "Tiebout choice", is responsible for larger ethnic segregation, using both metropolitan level and household level data. The author reports first, a positive impact of the Tiebout choice on black-white residential segregation in U.S. and second, a larger effect for segregation across jurisdictions than across neighbourhoods. An extended version of the Tibeout model is tested in Rhode and Strumpf (2003). The authors

theoretically predict that a decline in mobility costs should result in a greater heterogeneity across communities, as the lower are mobility costs, the greater are the incentives of sorting in homogeneous communities. The empirical analysis however provides little evidence in favour of this mechanism. Along with a secular decline in mobility costs, the analysis reveals a tendency of communities to become more alike.

The second related literature is about the measurement of diversity. The economics literature in this field is still at an early stage, as only few diversity indices have been proposed and discussed on a theoretical background. The most widely used measure of diversity is the index of ethno-linguistic fractionalization (ELF), first proposed in a statistical context under the name of Gini-Simpson index. The index is a decreasing transformation of the Herfindahl index of concentration and is simply a function of the shares of the different ethnic groups in the population. This simplicity however, represents both its advantage and disadvantage. On the one hand, it is easy to compute and interpret, but on the other, given the limited information included in the index, it seems inadequate for a wide range of applications. Population shares alone, for examples, are not able to capture preferences or complementarities among different ethnic types. To overcome this limitation, different measures have been proposed. Bossert et al. (2008) suggest the Generalized Index of Fractionalization (GELF), which measures the expected dissimilarity between two randomly drawn individuals. Greenberg (1956) incorporates the degree of resemblance between different languages to produce a generalization of the ELF index. Rao (1982) produces a very similar indicator as the Greenberg's (1956) index, which is called the quadratic entropy index. Overall, these indexes try to embody the effective distance of the groups in terms of a rich array of characteristics, such as socio-economic factors and their interactions, which are widely responsible for the effect of diversity on the economic outcome. Desmet et al. (2009) compare the performance of different diversity and polarization indexes, some incorporating language distance between ethnic groups and some without distance, in explaining cross countries income redistribution. On an

empirical ground, the indexes that take into account the linguistic distance are found to be superior to the commonly used fractionalization index, which ignores it.

3. Methodology

The O-P model analyses the emergence of multicultural cities as the result of relocation of foreigners between different cities at destination countries. The model predicts that better communication drives foreigners to integrate in multicultural cities. On the one hand, foreigners face positive economic externalities generated by a culturally heterogeneous environment. On the other, an ethnically diversified environment generates social costs as people face the psychological strain of living with people having a different culture. Communication improvements lessen these costs as they offset the dilution of cultural identities, when foreigners move from a segregated to a more integrated environment. The main empirical test of the paper is whether gradual improvement in distant communication boosts the generation of multicultural cities, as movers increasingly rely on an enlarged community for identity transmission, rather than on localized peer effects of a segregated environment.

In order to measure the ethnic heterogeneity of cities, the index of ethno-linguistic fractionalization (ELF) is used. The index is computed as:

$$DIV_r = 1 - \sum_s (x_s)^2 \quad (1)$$

where x_s is the share of foreigners of the specific origin group *s* computed for each city *r*. The index measures the probability that two individuals, randomly drawn from the city population, have different ethnicities. This index allows me to measure not only the richness of a city in terms of ethnic groups, namely the number of groups that live in the city, but also the evenness of the groups abundance, captured by the relative population shares.

More sophisticated indexes exist, which do not only consider the population shares but also the distance of the groups in terms of specific characteristics. The ethno-linguistic fractionalization index can be modified, by incorporating linguistic distance between the ethnic groups (Greenberg,

1956). This extension can be very informative as it takes into account the degree of distinctiveness between different ethnic groups. This linguistic distance may influence the degree of social interaction between the different groups, which is finally responsible for the aforementioned productivity gains.

Given a matrix T that assigns a distance τ_{js} between the language spoken by the ethnic group j and s, the index is given by:

$$\text{Greenberg}_r = \sum_j \sum_s x_j x_s \tau_{js} \tag{2}$$

where the *x* denotes the shares of the different ethnic groups living in city r. The matrix T is a standardized matrix, with $\tau_{jj} = 0$ and $\tau_{js} = \tau_{sj}$. Following Desmet et al. (2009) and Fearon (2003), the distance between language group j and s is computed according to:

$$\tau_{js} = 1 - \left(\frac{l}{m}\right)^{\delta} \tag{3}$$

where l is the number of shared branches between j and s, m is the maximum number of shared branches of the languages in the sample, and δ captures the degree to which the distance declines as the number of shared branches increases.[2] Information about linguistic trees is taken from the Ethnologue project. In agreement with Desmet et al. (2009), the parameter δ is settled to 0.05.

A third index used is the Balassa specialization index, also known as Index of Revealed Comparative Advantage (Balassa, 1965). The index is:

$$\text{BAL}_{rs} = \frac{x_r^s / \sum_r x_r^s}{\sum_s x_r^s / \sum_s \sum_r x_r^s} \tag{4}$$

where x_r^s is the number of foreigners of the specific origin group *s* living in city *r*. In this context, the index compares the share of foreigners from a certain origin area s located in a specific city r with the average share of the same group in the country. The index ranges from 0 to + ∞ and a value greater than one identifies a situation of specialization, as the share of the specific foreigners

[2] See Fearon (2003) for a clarification of the concept of language distance.

in that city is greater than the same foreigners' share from the totality of the country.[3] This index has been widely used in international trade to explain comparative advantages.[4]

The empirical analysis is conducted using Italian data. Italy represents an interesting case for a variety of reasons. First, from being traditionally an example of labour exporting country, recently it became an important destination of the immigration flows. This implies that the analysis of migration issues has been under researched for Italy. Second, Italy has many gateways of entry which are ethnic specific as they reflect the proximity with the origin countries for migrants. Large communities of Albanian are found in Puglia; immigrants from Balkans are concentrated in the North-East provinces; Liguria hosts large communities from Ecuador and Peru, eventually entering Italy after an initial period in Spain; many migrants from Tunisia and North Africa are found in Sicily; Chinese are largely settled in Florence. These gateways are likely to represent important places where the ethnic enclaves historically formed and whose distribution in the territory is not driven by economic conditions. This makes Italy an interesting case to evaluate how the settlement of migrants changed in time. An additional advantage can be quoted. In the literature, the studies on segregation have been conducted primarily applying US data. These data allow to capture location details at the census tract level. On the contrary, for European countries, including Italy, the same level of disaggregation as for US is not possible as census data provide location information at only NUTS 3 level, which in Italy corresponds to provinces. Even if the theoretical model refers to cities, for data constraints the NUTS 3 level is the greatest level of disaggregation for the analysis proposed here. This limitation however is lessened by some specific features of the Italian demographic structure. First Italy hosts a large population in a limited geographical area, with an extremely high population density. [5] This makes the social interactions reasonably high even outside

[3] More precisely, the upper bound of the index is given by $\frac{\sum_s \sum_r x_r^s}{\sum_s x_r^s}$, which tends to ∞ when the weight of province r in terms of number of foreigners is marginal.

[4] See De Benedictis and Tamberi (2002) for a description of the properties of the index

[5] The population density is around 200 inhabitants per squared kilometres.

the urban area. Second, the capital cities of each province host about a third of the population of the entire province and the allocation of the foreigners between province and the main city reflects the allocation of the whole population. All these factors suggest that the use of the whole province rather than the capital city should not alter the empirical exercise. In fact, the chance of interactions, which justifies the use of the cities as territorial units, is preserved as well as the distribution of foreigners between cities and provinces.

4. Data Description

To collect data on the foreign population, two main sources are used. The first is represented by the Italian population Census conducted by the National Institute of Statistics (ISTAT). The Census records the total number of foreigners from main areas of origin.[6] The data are aggregated at NUTS 3 level (province). Nine areas of origin for the foreigners are available, namely EU, Central Eastern Europe, other Europe, Northern Africa, other Africa, North America, Latin America, Oceania and Asia. Table A1 in the Appendix provides details of the countries entering in the different groups. Two years are available: 1991 and the 2001. This information allows me to compute the ractionalization index in (1) for each spatial unit of analysis. A balanced panel is computed, which contains 95 different provinces for the two points in time.

The second source of data is the annual collection of information of the foreign population conducted by ISTAT.[7] The data are taken from the register offices of each Italian commune. The registers contain the number of resident foreigners at the beginning of the solar year classified by country of origin, along with the information of their movements, in terms of the new births, deaths, and relocation from different Italian towns or different countries. These data allow me a larger disaggregation of foreigners in terms of country origin, as information for each specific country of

[6] The official statistics used in this analysis only collect the stock of regular migrants. Unfortunately no official data are available regarding the number and the distribution of irregular migrants over time.
[7] Rilevazione sulla "Popolazione residente comunale straniera per sesso ed anno di nascita"

origin is available. This second dataset forms a balanced panel, which contains 103 provinces between 2002 and 2007.[8]

The use of different datasets is motivated by data issues. In the theoretical model, communication improvements are as relevant as transportation improvements. Migrants not only can rely on faster transportation modes to maintain social ties with the own ethnic group in different parts of the host country, but can benefit from strong improvements in telecommunication, such as the possibility to use internet connections. While the geographical information on transportation improvements is available for the period 1991-2001, variables related to telecommunication improvements are scant for this period and not disaggregated at geographical level. As it will be described below, telecommunication variables are available only for the most recent data set.

Italy has been historically a country of large emigration. From 1861 it produced nearly 30 million of emigrants. Only after 1970, the net balance of migration reversed, with the number of inflows exceeding the outflow. At present, Italy is an important host country, receiving an increasing number of migrants.

TABLE 1

The percentage of foreigners substantially increased between 1991 and 2007, being 0.5 in 1991 and raising to 5.5 in 2007 (Table 1). The geographical distribution of foreigners varied greatly and, among other factors, it is eventually influenced by the economic opportunities that the Italian regions offered. In 1991 North-Central Italy hosted 0.7 percent of immigrants, whereas in the South lived only 0.3 percent of foreigners. The disproportional contribution of the North-Central compared to the South not only emerges in the entire period but the gap even widens after 1991. In 2007 for example, more than seven percent of foreigners were in the North-Central and only 2.3 percent lived in the South.

TABLE 2

[8] In Italy the number of administrative provinces is not constant in time, as new provinces have been added during the years.

The increase in the number of foreigners has produced an increase in diversity in Italy, as indicated by the rising trend in the fractionalization index (Table 2). Moreover, the index of fractionalization is highly correlated with space, being higher in the Northern and Central Italian provinces, and lower in Southern provinces. The increase in diversity is also confirmed by the Greenberg index, which incorporates the distance between the languages spoken by the different foreigners' groups (Table 3).[9]

TABLE 3

In Figure 1 the index of fractionalization of the different provinces is grouped in quartiles. Interestingly, while in 1991 some provinces in the South were represented in the top quartile group, from 2001 onward all provinces in the South were disproportionately represented in the bottom two quartiles of the distribution of the index and the situation did not vary after 2001.

FIGURE 1

The analysis can be further conducted in terms of area of origin of the foreigners. The ethnic mix of the foreign population varied widely during the period considered. In 1991 the most represented macro-areas of origin were EU, followed by Northern Africa and Asia. These areas contributed with 21, 19 and 15 percent of total stock, respectively (Table 4). The situation changed in 2001, when countries of Central Eastern Europe became the largest source of migrants. Not surprisingly, the remarkable presence of foreigners from Central Eastern Europe continued also in the most recent period, when this group picked to more than half of the total stock of migrants. Northern Africa remains the second largest origin region, with a share varying between 17 and 24 percent in the different years. Migrants from EU experienced a stable drop during the years.

TABLE 4

A different perspective can be taken in what follows. Rather than using an index that captures the overall diversity at province level, it will be considered an index that varies both at

[9] Unfortunately the Greenberg index can be computed only with the 2002-2007 data as the information of the origin countries of foreigners in 1991 and 2001 is only available for highly aggregated areas. The languages spoken in such large areas are extremely different.

province and at ethnic level. The use of a specialization index, such as the Balassa Index in (4), allows me to identify if specific provinces host a disproportionately greater share of foreigners from a certain macro areas of origin. A value greater than one identifies a more than proportional incidence of these groups of foreigners in the specific province, compared to the average Italian incidence. For representation purposes the index has been averaged across the provinces for the different areas of origin. As indicated in Table 5, foreigners from other Africa and Asia display low levels of specialization in the entire period, as indicated by the less than unitary average value. On the contrary, foreigners from EU, other Europe, Northern Africa, North America and Oceania display greater degree of specialization, sometimes well above one. As selected examples, the high average level of the Balassa index for Oceania can be driven by the strong incidence of this group in Vibo Valentia, Benevento, Messina and Catanzaro, with values that reach 18, 13, 11 and 10, respectively; foreigners from other Europe have levels of specialization peaking to eight in Verbano-Cusio-Ossola, Rimini and Nuoro; the index for the group North America is six in Catania and Isernia and five in Cosenza. On the contrary, the index for other Africa and Asia is largely below these figures. The index peaks only to three in Catania for other Africa and in Prato for Asia. The latter figure is the consequence of the big community of Chinese in Prato, which is the second largest in the whole Italy. Table 6 reports the standard deviation of the index computed over all the provinces. An increase in the dispersion of the index identifies a situation of increasing specialization, namely the tendency of the foreigners to disproportionately localize in selected provinces and avoid some other locations. The group Central Eastern Europe display a reduction in the standard deviation between 1991 and 2007. On the contrary foreigners from EU, Latin America and Asia exhibit an overall rising trend in the period of analysis.

TABLE 5

To test the O-P theoretical model, the key explanatory variable should be a measure of the transportation and telecommunication improvements occurred in the Italian provinces, as a proxy for mobility and connection costs. Connections of individuals living in different cities became

easier, both because the time to travel from one city to the other declined, and because new technologies made it simpler to people to communicate at distance. The wide penetration of computers and internet connections is responsible for the drastic improvements in the communication.

TABLE 6

Different variables have been considered here. Regarding the transportation variables, the first option is the physical measure of the infrastructures, such as the kilometres of railroad available for 1991 and 2001.[10] Alternatively, it can be exploited the improvement that occurred between 1991 and 2001 in the access to some transportation infrastructures, such as the passenger airports. In Italy, in this period, many small airports that used to transport only goods, switched to passenger airports. This implied that during this time people significantly reduced the distance to the closest airport, with a relevant saving in terms of time for travel. Therefore, a measure of the distance from the single province to the closest airport and the total number of airports located at less than 100 Km, are the third and fourth variables used. Regarding the telecommunication variables, one measure is used here and it is the number of internet domains registered available for 2002, 2004 and 2007. The increasing number of internet domains reflects the expansion in the number of people using broadband access technologies and therefore the growth in the use of internet. Table A2 provides a detailed description of the variables and their source.

TABLE 7

Surprisingly, between 1991 and 2001 the investments in infrastructures in railroad in Italy are minimal as far as the physical measure is considered. As reported in Table 7, the overall kilometres of railroad increased annually by only 0.03 percent. Conversely, if one considers the

[10] An additional way to measure the level of infrastructures considers the monetary value of the capital, as suggested by Goldsmith (1951). Capital endowment is defined as the total sum of each annual investment in the specific capital good, with the number of years included in the computation capturing the average useful life of the good. For Italy a detailed estimation of the monetary value of the infrastructures has been computed by Picci (2002) at NUTS 3 level, considering the public spending of the provinces in the specific goods. For the purpose of this study however, these estimates suffer a major drawback, as the expenses for important infrastructures such as the speed rail line, are sustained at national level and are not imputed in the budget of the single provinces. For this reason, these measures of infrastructure are not considered in this study.

variables related to air transport, a large improvement occurred. For example, the accessibility to the airports improved annually by 3 and 5 percent, if one considers the distance to the closest airport and the number of near-by airports, respectively. Finally the variable internet domain adequately captures the large improvements in telecommunication means, which occurred recently. Between 2002 and 2007, the number of registered internet domain increased annually by 38 percent.

5. Empirical Estimation

To understand the determinants of the level of diversity across cities the index of fractionalization is estimated for 1991 and 2001, and for 2002, 2004 and 2007.[11] The units of observation are the Italian provinces. The concept of segregation and integration are complement to one another. Given two ethnic groups, segregation refers to a situation where the two types are concentrated in different cities, whereas integration corresponds to an even distribution of the groups between the cities. This implies that for an empirical purpose, the analysis of integration can build on the literature that studies the determinants of segregation, as described in Section 2. This strategy is followed here and the controls suggested by the theoretical model are integrated with the typical explanatory variables for segregation.

Different factors have been traditionally identified as responsible for the location sorting of ethnic groups. These are the self-segregation of minorities, the racial prejudice and discrimination as well as local level governmental factors. First, ethnic specific factors are important sources of location choice as they influence the personal propensity for segregation. For example, migrants, in particular newly arrived, may prefer to cluster with their own group, to find support in the destination countries and to recreate the social background of the place of origin. Immigrants choose to live with people that have similar tastes and speak the same language. These factors are likely to be more important, the greater the cultural distance of the foreign-born from natives. Second, segregation results from discriminating actions taken by the incumbent natives.

[11] Only selected years have been considered in the estimations as the key communication variable is available only in 2002, 2004 and 2007.

Discrimination and prejudice are influenced by socio-economic characteristics such as age, gender, household composition, education, marital status and family income. The following equation is therefore estimated:

$$DIV_{rt} = \alpha + \boldsymbol{\gamma}' \mathbf{DEMO}_{rt} + \beta\, pop_{rt} + \zeta\, act_{rt} + \phi\, growth_{rt} + \eta\, technology_{rt} + \boldsymbol{\lambda}' \mathbf{ORIGIN}_{rt} + \varepsilon_{rt} \quad (5)$$

$$\text{where } \varepsilon_{rt} = \mu_r + \lambda_t + \nu_{rt} \qquad r = 1, \ldots R;\ t = 1, \ldots, T$$

The dependent variable is the ethno-linguistic fractionalization index for the province *r* in year *t*. The vector of socio economic variables (DEMO) includes the percentage of the population in different age categories and education categories. These variables should proxy for discrimination factors. The total population (pop) captures the size of the city. The variables activity rate (act) and GDP growth (growth) proxy for economic factors such as job opportunities, which represent pull factors in the destination choice of migrants.[12] Technology improvements related to transportation and telecommunication (technology) are added. Unfortunately, these variables cannot be used jointly in the estimations, as the number of registered domains is available only for the most recent panel and *vice versa*. Finally the ethnic group variables (ORIGIN) include the total number of foreigners from the different areas of origin. This is an attempt to control for parental cultural transmission, which is likely to be ethnic specific and is found to influence the multiculturality of the cities in the O-P model. The paper finds that a multicultural environment is fostered when parental cultural transmission is relatively more important than the peer effect. Table A3 describes the variables and their source. The disturbance contains the province fixed effect, the time effect and the conventional stochastic disturbance term (Baltagi, 2005).

To take account for any within-group dependence, all models are estimated correcting standard errors for clustering (Moulton, 1986). The use of variables in the specification that vary at regional level would suggest a clustering by region. However, Cameron et al. (2008) report that

[12] Unfortunately, data on GDP growth at NUTS 3 level in 1991 are not available

when the number of clusters is limited, the t-statistics tend to be biased upward and therefore the tests over-reject. Given that Italy has 20 regions, to avoid the above problems, the standard errors are clustered by province.[13] The results of the two-way error component model in 1991 and 2001 are reported in Table 8. In column (1), a parsimonious specification with only the standard covariates suggested by the existing literature is estimated. The table reports a tendency toward rising diversity, experienced by the Italian provinces. The coefficient of the 2001 year dummy is positive and statistically significant and it suggests that the average diversity levels were three percent higher in 2001 than they were in 1991. The size of the city has a non-statistically significant effect on diversity. Economic opportunities exert a well determined effect on the location choice of foreigners. Cities with a higher rate of activity are, on average and ceteris paribus, more multicultural. Labour market features represent important pull factors, as far as foreigners effectively respond to the advantages offered by the economically vibrant cities, which offer greater job opportunities. Diversity is higher in provinces with a younger population. This again may indicate that foreigners avoid depressed cities, which are also abandoned by the native population in working age. The percentage of people with some education has a positive effect on diversity, even if only the coefficient of primary education is statistically significant.

Columns (2) to (5) add the key transportation variables. The first is the length of the railroad expressed in kilometres. This variable exerts a significant and positive effect on the level of diversity. The second variable is the distance to the closest airport, expressed in kilometres. The coefficient has the expected sign and it is statistically significant at conventional level. The interpretation of the coefficients suggests that ten additional kilometres of railroad or ten kilometres less to the closest airport increases diversity by 0.1 percent, on average and *ceteris paribus*. The coefficient of the variable number of airport, which is another proxy for the accessibility to airports, is positive and statistically significant. The magnitude of the coefficient suggests that an additional

[13] For robustness checks, the standard errors are also adjusted for regional clusters. These estimations have not been reported for space constraints but are available upon request. No major changes in the tests of the parameters of the key explanatory variables result.

airport located at close distance increases the fractionalization index by 0.4 percent. In the last column all transportation variables enter jointly. The coefficient of the variable distance is no more statistically significant, whereas the coefficients of railroad and number of airports do not display remarkable changes, both in terms of magnitude and significance.

In agreement with the theoretical model, these results suggest that transportation improvements increase the degree of multiculturality of the cities. Movers eventually respond to positive externalities generated by a culturally heterogeneous environment and increasingly rely on an enlarged community for identity transmission, rather than on localized peer effects of a segregated environment. Gradual improvements in distant communication allow this process to happen, as it becomes easier for foreigners to maintain their ethnic identity while living outside the ethnic enclave.

Table 9 reports the estimations for the second data set, relative to years 2002, 2004 and 2007. The estimations are overall in line with those reported for the previous panel. The year dummies are positive and statistically significant, and confirm that the rising trend in diversity continues till the recent years. The average diversity index is six percent higher in 2007 than it was in 2002. The largest increase in diversity occurred between 2004 and 2007, while before 2002 and 2004 the increase was less steep. Activity rate and GDP growth have positive and significant coefficients. Again in agreement with the previous findings, provinces with a younger and more educated population tend to be richer in terms of variety of ethnicities. In column (2) the telecommunication variable is introduced. The telecommunication variable exerts a positive and well determined effect on multiculturality. The number of internet domain is positively correlated with the level of diversity, providing a robust support to the theoretical prediction of the O-P model. Increasing the number of domain by ten units over 10’000 inhabitants, the fractionalization index augments by 0.1 percent.

A criticism can be raised on the validity of the transportation and communication variables as they may not be exogenous. More economically advanced provinces attract a larger number of

migrants and at the same time demand larger investments in transportation and telecommunication to support the business. This would result in an upward bias in the estimated coefficients of these variables. However, one should note that the specification controls for variables proxing for economic opportunities, and the coefficients of these variables resulted positive and statistically significant as expected. Second, large scale investments, such as those in airport and railroad, reflect national strategies, which may respond to the need to sustain depressed areas. For example, the largest decrease in airport distance occurred in Southern Italy, as in this part of the country a large number of small passenger airports has been created. This occurred despite the South of Italy is less economically developed. The same is true regarding the internet domains registered. Provinces in the South of Italy report a smaller number of registrations compared to Centre and North, but this area catches up quite rapidly as the largest increase in internet domains occurred in the South. This seems to suggest that the economic unobservables governing the distribution of foreigners in the provinces should be uncorrelated with the economic unobservables influencing the transportation and communication improvements.

6. Robustness checks

The second dataset has the advantage to be disaggregated by single country of origin. Up to now, the different countries have been aggregated by major areas of origin, to make the estimations as comparable as possible with the baseline specification in 1991-2001. However, this aggregation can mask important insights, as single country of origin can drive the result of the entire area and within the same aggregation there can be large differences in terms of single country of origin. To further exploit the information of the data set, the most important supply countries are distinguished. These countries overall accounted for nearly 90 percent of the total migration stock in 2007.[14] The

[14] It has been chosen to select the thirties most represented origin countries, which are, in descending order in terms of size, Romania, Albania, Morocco, China, Ukraine, Philippines, Tunisia, Poland, Macedonia, India, Ecuador, Peru, Egypt, Moldova, Serbia and Montenegro, Senegal, Sri Lanka, Bangladesh, Pakistan, Nigeria, Germany, Ghana, Brazil, Bulgaria, France, Bosnia-Herzegovina, UK, Algeria, Russia, Croatia.

empirical results for the alternative aggregation are reported in Table 10. As reported in column (1), the domain variable is robust to this alternative aggregation.

Diversity indexes that incorporate some measures of distance, such as the linguistic distance, are becoming popular in the empirical literature, as these indexes add a further dimension to capture the degree of distinctiveness between different groups. For this reason, the equation (5) is estimated using the Greenberg index (1959), as described in (2), as dependent variable.[15] Small changes are displayed in the new estimations, reported in column (2) of Table 10. The coefficient of the domain variable is still positive and statistically significant, albeit it decreases in magnitude.

As an additional robustness check, different values for the parameter δ in (3) are used. So far, in agreement with Desmet et al. (2009), the parameter is settled to 0.05, but it would be interesting to assess if the previous result is robust to the use of alternative values. The parameter δ discounts the relative distance of languages if they pertain to completely different families or if they belong to the same family. Desmet et al. (2009) find that high values of δ are no reasonable, as they tend to produce higher increase in distance between pairs of languages in the same family, compared to pairs in completely different branches. However, there is no *a priori* value for the parameter, and therefore different possibilities are tested. Two additional values are used, namely $\delta = 0.5$ and $\delta = 1$, the first in agreement with Fearon (2003) and the second with Esteban et al. (2010). As reported in columns (3) and (4) of Table 10, the significance of the coefficient of the domain variable is robust to these different values.

In an additional specification, provincial specific trends are introduced, to control for a possible trend in the diversity index experienced by the single province independently. The model is estimated in first differences augmented with province fixed effects. Again, in this alternative specification the key communication variable exerts a positive and statistically significant effect on the fragmentation index, as displayed in Table 11.

[15] For each group of migrants, a single language has been selected, namely the one spoken by the majority of the population. This is a strong assumption, in particular for countries such as India, where the number of official languages is extremely vast. However, the data set does not allow me to identify the linguistic groups the migrants belong to.

One last exercise can be computed, applying the 1991-2001 dataset. This dataset is computed from national census, which collects individual information on all respondents, including the foreign population. The personal characteristics of the foreign population are introduced in a new specification, which uses an ethnic specific index of specialization as dependent variable.[16] By computing an index that varies at ethnic level, important ethnic specific habits may emerge. Some groups may exert a greater tendency to concentrate in some areas for cultural or religious motivations. For example, they may need to follow religious practise, such as attending the Mosque, which are located only in specific cities. The index of specialization for each ethnic group *s*, described in (4), is used as dependent variable in the following specification:

$$BAL_{rst} = \alpha + \beta' \mathbf{X}_{rst} + \delta \, technology_{rs} \, t + \varepsilon_{rst} \qquad (6)$$

where $\varepsilon_{rst} = \mu_r + \kappa_s + \lambda_t + \nu_{rst}$, r=1, …., R; s= 1…, S; t=1, …, T

The vector X captures time-varying characteristics of the ethnic group s in province r and time t. In particular it includes the count of migrants from the different origin areas, a measure of the group economic status, computed as the percentage of occupied migrants, as well as different demographic variables, such as the percentage of migrants in the different age categories and the percentage of male migrants. The transportation variables described above are also included. The equation incorporates dummy fixed effects for origin and ethnic groups and a year dummy. The estimates are reported in Table 12.

The Balassa index ranges from 0 to + ∞, with a value greater than one identifying a situation of specialization. A positive coefficient indicates a positive effect of the variable on specialization, or in other words it indicates a more than proportional share of foreigners from the specific area of origin in the selected province. The first column of the table includes the demographic characteristics of the foreigners' groups, year and province fixed effects. Ethnic

[16] This exercise cannot be computed for the 2002-2007 dataset as it does not provide demographic information of the foreign population.

groups fixed effects are also added. This exercise explains if specific ethnic groups increased specialization between 1991 and 2001, relative to the base group, which is Oceania. According to the table, all groups except for North America decrease specialization, compared to immigrants from Oceania. Among the socio-economic characteristics, only the gender variable displays a significant coefficient. Increasing the proportion of male in the gender mix augments the ethnic specialization, on average and ceteris paribus. The key transportation variables are added in column (2). The kilometres of railroad are found to decrease the ethnic specialization whereas the other two transportation variables exert a null effect on specialization. In column (3), an interaction between the infrastructure variables and the ethnic group dummies are introduced, to detect if some groups respond adversely to specific improvements. In this specification, both the coefficient of kilometres of railroad and the number of airports are in line with the prediction of the theoretical model, as advances in transportation are associated with lower specialization. However, transportation improvements make foreigners from other Africa, other Europe and Northern Africa to increase ethnic specialization, as indicated by the interaction terms.

The dependent variable in equation (5) is an index that is bounded between 0 and 1, being the variable a proportion. The use of techniques that do not take into consideration this specific form can be problematic, as far as there is no guarantee that the fitted values of the regression lie within the admissible interval, and predictions larger than one or negative can result. To solve this problem, an alternative estimation is conducted, applying a logistic transformation to the dependent variable. The resulting variable, while mapping the original one, is no more constrained to lie between 0 and 1, and the fixed effect estimation can be applied.[17] This procedure has the pitfall that cannot produce a mapping if the original variable is exactly zero or one. This is not a problem here, as these extreme cases do not occur. The results of these alternative procedures for both the 1991, 2001 panel and the 2002-2007 panel are reported in Table 13. No relevant changes emerge in terms

[17] In a cross section, two additional solutions could have been used. The first one assumes that proportion follows a beta distribution and estimations are performed accordingly, while the second applies the fractional logit model, proposed by Papke and Wooldridge (1996). However, to my knowledge, the properties of these estimations in a panel context have not been studied.

of sign of the coefficients, whereas in some cases the significance of the coefficients is affected. The transformation of the dependent variable does not affect the coefficients of the transportation variables but it does influence the significance of the communication variable, which turns statistically insignificant.

6. Conclusion

The objective of this paper is to provide an empirical test to the theoretical predictions of the O-P model on the development of multicultural cities. In the model, communication improvements are found to enhance the ethnic diversity of cities, as they enable migrants to respond to the positive externalities generated by a culturally heterogeneous environment, while contrasting the dilution of cultural identities, when one moves from a segregated to a more integrated environment. Improvement in distant communication boosts the generation of multicultural cities, as movers increasingly rely on an enlarged community for identity transmission, rather than on localized peer effects of segregated environment.

The degree of heterogeneity of cities is measured by the well-known index of ethno-linguistic fractionalization (ELF), which captures both the richness in terms of number of ethnic groups, and the evenness of the groups' abundance. Multiculturalism is maximized by means of a rich mix and an even distribution of the different ethnic groups in the city. Moreover, the Balassa index is used to exploit the difference in specialization both at ethnic level and among provinces and it indicates the existence of a disproportional prevalence of some ethnic groups in specific provinces.

The preliminary description of the data reveals that Italy is increasingly becoming an important destination for foreigners. From being historically a country of large emigration, from the 1970 the net balance of migration reversed and nowadays the presence of foreigners continues to increase. Immigration and geography are highly correlated, as far as migrants are more likely found in North-Central Italy, and less in Southern Italy. The distribution of migrants along the Italian

territory influences the index of fractionalization. The index is higher in the Northern and Central Italian provinces, whereas Southern provinces show lower values of diversity. This implies that multicultural cities are disproportionately located in Northern and Central Italy.

The empirical estimations provide support to the prediction of the theoretical model and reveal that both transportation and telecommunication improvements represent a valid explanation for the birth of cosmopolitan cities. Moreover, progresses in transportation are likely to reduce ethnic specialization in provinces. The two-way error component models for the fractionalization index report that a reduction in the time for travelling increases the degree of multiculturality of the provinces. In particular, ten additional kilometres of railroad and ten kilometres less from the closest airport increases diversity by 0.1 percent, on average and *ceteris paribus*. An additional airport located at close distance to the provinces increases the fractionalization index by 0.4 percent. Second, easier communication, proxied by the number of internet domain registered, augments the level of multiculturality of the provinces. The positive and significant coefficient of the internet domain is robust to a larger disaggregation of the ethnic groups for migrants, to the incorporation of a measure of linguistic distance between the different groups, computed for different values of the discount factor and to the incorporation of province specific trends.

An estimation that exploits both the ethnic and the province variation in specialization, using the Balassa index, is performed. The results reveal that longer railroad and better access to airports are correlated with specialization in the expected direction, again providing support to the predictions of the theoretical model.

A final robustness check is performed applying a logistic transformation to the index of ethnic fractionalization. This is done to limit the implications connected to estimations where the dependent variable is bounded. The results regarding the transportation variables are overall robust to this alternative specification.

The empirical findings for Italy suggest that foreigners respond to economic opportunities available in the host countries. This mechanism is more likely to happen when the external

background facilitates them in pursuing such a strategy. Foreigners chose to locate outside the ethnic enclave, as far as the available technologies help them to maintain contacts with the own ethnic group. Assuming that an environment where foreigners are integrated is preferable to the one where they are segregated, this exercise suggests that an additional instrument – other than ethnic specific policies- is available to host countries to pursue the integration of migrants. It should be noted however that for data constraints this exercise considers only legal migrants. Illegal migrants are less able to benefit from the opportunities available at destination countries, given their status. They may need more extensively to live inside the ethnic enclave, as the ethnic network happens to be crucial in assisting illegal migrants in looking for a job or in other activities in destination countries. This result may not hold if the analysis includes those migrants who do not possess the permit to stay.

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Appendix

Table A1: Country classification by main area of origin

Origin Group	Countries
EU	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom
Central Eastern Europe	Albania, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Moldova, Poland, , Romania, Russia, Serbia, Montenegro, Slovakia, Slovenia, Turkey and Ukraine
other Europe	All other European countries
Northern Africa	Algeria, Egypt, Libya, Morocco, Sudan, Tunisia,
other Africa	All other African countries
North America	Canada, United States
Latin America	All other American countries
Oceania	All countries
Asia	All countries

Notes: in 1991 and 2001 group EU does not include Austria and Finland

Table A2: Description of transportation and telecommunication variables

Variable	Description
Railroad	Total length of motorways (Km). Source: EUROSTAT**,** Regional statistics (REGIO). NUTS2
Airport Distance	Euclidean distance to closest airport (Km), computed using latitude and longitude of main town of each NUTS3 and the airport. The list of italian airports is taken from "Conto Nazionale dei Trasporti" (2003), Ministero dei Trasporti and "Statistiche dei Trasporti-2001", (2003) ISTAT. NUTS3
Airports Number	Number of airports located at less than 100 Km. Source: "Conto Nazionale dei Trasporti" (2003). NUTS3
Domain	Number of domains registered over 10'000 inhabitants. Source: Institute for Informatics and Telematics, Italian National Research Council. NUTS 2

Table A3: Description of variables and source

Variable	1991; 2001 (1)	2002-2007 (2)	Description
Origin	Source: Census, ISTAT. NUTS 3	Source: register office. NUTS 3	Thousands of foreigners from main areas (1). Thousands of foreigners from countries of origin (2)
Pop	Source: Census, ISTAT NUTS 3	Source: register office. NUTS 3	Thousands of inhabitants
Less 14	Source: Census, ISTAT NUTS 3	Source: register office. NUTS 3	Percentage of people below 14 years of age.
15-64	Source: Census, ISTAT. NUTS 3	Source: register office. NUTS 3	Percentage of people between 15 and 64 years of age
Over 65	Source: Census, ISTAT. NUTS 3	Source: register office. NUTS 3	Percentage of people over 65 years of age
No education	Source: Census, ISTAT. NUTS 3	-	Percentage of people in schooling age who obtained no education (1).
Primary Education	Source: Census, ISTAT. NUTS 3	Source: EUROSTAT. NUTS 2	Percentage of people in schooling age who obtained primary education (1). Economically active population with pre-primary, primary and lower secondary education (2).
Secondary Education	Source: Census, ISTAT. NUTS 3	Source: EUROSTAT. NUTS 2	Percentage of people in schooling age who obtained secondary education (1). Economically active population with upper secondary and post-secondary non-tertiary education (2)
Tertiary Education	Source: Census, ISTAT. NUTS 3	Source: EUROSTAT. NUTS 2	Percentage of people in schooling age who obtained tertiary education (1). Economically active population with tertiary education (2)
Act	Source: Census, ISTAT. NUTS 3	Source: EUROSTAT. NUTS 2	Economic activity rates, age 15 and over
Growth	-	Source: EUROSTAT. NUTS 3	Growth of GDP per inhabitants, at current market price (2)

Table 1: The share of foreigners (%)

	1991	2001	2002	2003	2004	2005	2006	2007
TOTAL	0.5	2.1	2.5	3.3	3.9	4.3	4.7	5.5
North-Centre	0.7	3.0	3.4	4.4	5.1	5.7	6.2	7.2
South	0.3	0.9	1.0	1.3	1.5	1.6	1.8	2.3

Table 2: The average index of fractionalization

	1991	2001	2002	2003	2004	2005	2006	2007
TOTAL	0.011	0.043	0.050	0.064	0.075	0.083	0.090	0.105
North-Centre	0.013	0.057	0.066	0.085	0.099	0.110	0.119	0.137
South	0.007	0.020	0.019	0.025	0.029	0.032	0.035	0.044

Table 3: The average index of Greenberg

	2002	2003	2004	2005	2006	2007
TOTAL	0.019	0.023	0.026	0.029	0.031	0.034
North-Centre	0.024	0.029	0.035	0.038	0.041	0.044
South	0.008	0.010	0.011	0.012	0.013	0.015

Table 4: Macro area of origin (%)

	1991	2001	2002	2003	2004	2005	2006	2007
EU	21.0	10.8	9.0	7.5	6.7	6.3	6.0	5.2
Central Eastern Europe	5.8	30.9	37.6	42.4	44.2	45.0	45.6	51.8
Other Europe	14.0	2.0	1.1	0.9	0.7	0.7	0.6	0.5
Northern Africa	19.4	20.2	24.0	21.5	20.8	20.3	19.9	17.4
Other Africa	10.3	9.0	7.2	6.9	6.6	6.5	6.5	5.9
North America	4.9	1.6	1.1	0.9	0.8	0.7	0.7	0.6
Latin America	8.8	9.2	6.8	7.1	6.9	6.8	6.7	5.9
Asia	15.2	16.2	12.9	12.6	13.1	13.5	13.8	12.6
Oceania	0.6	0.3	0.2	0.2	0.2	0.1	0.13	0.1

Notes: before 2002 the area EU does not include Austria and Finland

Table 5: Balassa Specialization Index, mean

	1991	2001	2002	2003	2004	2005	2006	2007
EU	1.04	1.03	1.10	1.10	1.15	1.16	1.17	1.12
Central Eastern Europe	0.91	1.16	1.12	1.10	1.09	1.09	1.09	1.10
Other Europe	1.26	1.04	1.27	1.27	1.31	1.33	1.38	1.32
Northern Africa	1.15	1.10	1.12	1.10	1.09	1.09	1.09	1.04
Other Africa	0.80	0.80	0.79	0.81	0.83	0.84	0.85	0.84
North America	1.12	1.35	1.19	1.17	1.24	1.22	1.23	1.15
Latin America	1.05	0.87	0.82	0.82	0.77	0.75	0.74	0.72
Asia	0.61	0.69	0.75	0.78	0.81	0.83	0.83	0.82
Oceania	1.20	1.56	1.65	1.57	1.63	1.64	1.60	1.40

Notes: before 2002 the area EU does not include Austria and Finland

Table 6: Balassa Specialization Index, standard deviation

	1991	2001	2002	2003	2004	2005	2006	2007
EU	0.47	0.61	0.64	0.67	0.72	0.74	0.76	0.72
Central Eastern Europe	1.02	0.47	0.44	0.38	0.36	0.34	0.34	0.28
Other Europe	0.79	0.84	1.46	1.42	1.48	1.49	1.58	1.49
Northern Africa	0.71	0.58	0.63	0.61	0.60	0.61	0.60	0.54
Other Africa	0.68	0.61	0.61	0.60	0.61	0.61	0.60	0.60
North America	0.89	1.28	0.96	0.86	0.95	0.91	0.93	0.85
Latin America	0.50	0.51	0.55	0.59	0.61	0.60	0.60	0.63
Asia	0.41	0.45	0.50	0.50	0.50	0.50	0.48	0.50
Oceania	1.57	1.94	2.39	2.01	1.93	2.02	2.03	1.60

Notes: before 2002 the area EU does not include Austria and Finland

Table 7: Improvements in transportation

	Annual percentage change (%)
Railroad (Km)	0.03
Airport Distance (Km)	3.38
Airports Number	4.97
Domain	38

Table 8: Two-way Error Component Model. Census data

Dependent Variable: Index of fractionalization *100

	(1)	(2)	(3)	(4)	(5)
Year 2001	3.015***	2.832***	3.970***	3.256***	3.461***
	[1.070]	[1.066]	[1.088]	[0.932]	[1.035]
Population	0.007	0.007	0.003	0.006	0.005
	[0.006]	[0.007]	[0.005]	[0.006]	[0.006]
Activity Rate	0.284***	0.280***	0.277***	0.276***	0.272***
	[0.0364]	[0.0343]	[0.0364]	[0.0341]	[0.033]
Less 14	0.697***	0.739***	0.715***	0.580***	0.650***
	[0.156]	[0.147]	[0.158]	[0.149]	[0.147]
15_64	0.111	0.154	0.168	0.126	0.182
	[0.153]	[0.152]	[0.145]	[0.141]	[0.137]
Primary Education	0.157*	0.182**	0.0737	0.0827	0.085
	[0.0904]	[0.0820]	[0.0807]	[0.0778]	[0.066]
Secondary Education	0.163	0.200*	0.105	0.0611	0.090
	[0.112]	[0.102]	[0.104]	[0.0980]	[0.092]
Tertiary Education	0.314	0.389	-0.00624	0.174	0.130
	[0.234]	[0.236]	[0.248]	[0.197]	[0.217]
Rail		0.006**			0.005*
		[0.003]			[0.003]
Airport			-0.007***		-0.003
Distance			[0.002]		[0.003]
Airports Number				0.437***	0.336***
				[0.095]	[0.122]
EU	-0.475***	-0.416***	-0.464***	-0.526***	-0.461***
	[0.139]	[0.134]	[0.136]	[0.123]	[0.122]
Central-Eastern	0.159***	0.137***	0.147***	0.162***	0.138***
Europe	[0.041]	[0.040]	[0.037]	[0.037]	[0.037]
Other Europe	0.167	0.092	0.150	0.134	0.073
	[0.236]	[0.219]	[0.243]	[0.261]	[0.248]
Northern Africa	0.134*	0.150*	0.100	0.053	0.070
	[0.080]	[0.080]	[0.071]	[0.078]	[0.071]
Other Africa	0.052	0.042	0.127	0.082	0.099
	[0.160]	[0.159]	[0.147]	[0.149]	[0.147]
North America	0.845	0.686	0.927	0.917	0.804
	[1.193]	[1.050]	[1.231]	[1.365]	[1.237]
Latin America	-0.109	-0.122	-0.116	-0.035	-0.065
	[0.104]	[0.106]	[0.083]	[0.074]	[0.069]
Asia	0.099	0.101	0.132*	0.118	0.129*
	[0.074]	[0.070]	[0.067]	[0.072]	[0.066]
Oceania	4.930	3.015	2.146	6.099	3.050
	[6.212]	[5.612]	[6.283]	[6.502]	[5.844]
Constant	-49.630***	-61.570***	-42.890***	-41.370***	-50.210***
	[14.510]	[13.160]	[14.580]	[14.260]	[13.190]
Observations	190	190	190	190	190
Number of code	95	95	95	95	95
R-squared	0.963	0.964	0.968	0.971	0.972

Notes: robust standard errors in parenthesis. Standard Errors adjusted for 95 clusters. * significant at 10%; ** significant at 5%; *** significant at 1%. The excluded variables are the 1991 year dummy, the percentage of people over 65 years of age and the percentage of people with no education

Table 9: Two-way Error Component Model. Register Office

Dependent Variable: Index of fractionalization *100

	(1)	(2)
Year 2004	2.209***	1.589***
	[0.233]	[0.325]
Year 2007	5.620***	3.934***
	[0.435]	[0.743]
Population	-0.003	-0.004
	[0.005]	[0.005]
Activity Rate	0.153**	0.070
	[0.065]	[0.074]
GDP growth	0.030*	0.024
	[0.016]	[0.016]
Less 14	2.953***	2.655***
	[0.267]	[0.281]
15_64	1.545***	1.443***
	[0.292]	[0.276]
Secondary Education	0.064	0.073
	[0.044]	[0.045]
Tertiary Education	0.277***	0.221***
	[0.070]	[0.069]
Domain		0.013***
		[0.005]
EU	-0.288	-0.633*
	[0.387]	[0.373]
Central-Eastern Europe	0.023*	0.031**
	[0.012]	[0.012]
Other Europe	1.559	2.582
	[4.358]	[4.597]
Northern Africa	0.252***	0.217***
	[0.054]	[0.054]
Other Africa	0.158	0.168
	[0.161]	[0.153]
North America	3.527**	2.853*
	[1.527]	[1.561]
Latin America	-0.159***	-0.123***
	[0.044]	[0.044]
Asia	-0.019	-0.020
	[0.0897]	[0.085]
Oceania	8.446	10.260
	[7.684]	[7.535]
Constant	-153.0***	-137.5***
	[23.78]	[22.89]
Observations	309	309
Number of code	103	103
R-squared	0.965	0.967

Notes: robust standard errors in parenthesis. Standard Errors adjusted for 103 clusters. * significant at 10%; ** significant at 5%; *** significant at 1%. The least recent year dummy is always the one removed from regression. The other excluded variables are the percentage of people over 65 years of age and the percentage of people with primary education.

Table 10: Two-way Error Component Model. Register Office. Alternative aggregation and alternative fragmentation index- Greenberg index

	Fragmentation*100	Greenberg index *100	Greenberg index *100	Greenberg index*100
	Alternative aggregation	δ=0.05	δ=0. 5	δ=1
	(1)	(2)	(3)	(4)
Year 2004	1.156***	0.312***	0.780***	0.981***
	[0.345]	[0.119]	[0.188]	[0.243]
Year 2007	2.779***	0.623**	1.718***	2.234***
	[0.876]	[0.262]	[0.443]	[0.575]
Population	-0.004**	-0.001	-0.002	-0.002
	[0.001]	[0.001]	[0.002]	[0.003]
Less 14	2.267***	0.695***	1.442***	1.811***
	[0.389]	[0.105]	[0.189]	[0.245]
15_64	1.012***	0.167*	0.530***	0.728***
	[0.298]	[0.090]	[0.152]	[0.196]
Secondary Educat.	0.046	0.040**	0.037	0.036
	[0.052]	[0.017]	[0.027]	[0.033]
Tertiary Education	0.213**	0.045**	0.112***	0.150***
	[0.077]	[0.018]	[0.033]	[0.043]
Activity Rate	0.040	-0.027	0.0011	0.018
	[0.095]	[0.026]	[0.046]	[0.060]
GDP growth	0.018	0.013**	0.015	0.017
	[0.016]	[0.005]	[0.009]	[0.012]
Domain	0.015***	0.004**	0.008***	0.010***
	[0.005]	[0.002]	[0.003]	[0.003]
Albania	0.0001	-0.0001*	0.00004	0.0001
	[0.000107]	[0.00004]	[0.0001]	[0.0001]
Serbia and	-0.001**	-0.0005***	-0.001***	-0.001***
Montenegro	[0.0004]	[0.0001]	[0.0002]	[0.0003]
Bosnia and	0.001	0.001**	0.001**	0.001*
Herzegovina	[0.001]	[0.0004]	[0.001]	[0.001]
Macedonia, FYR	0.0004	-0.0001	0.0001	0.0003
	[0.0003]	[0.0001]	[0.0002]	[0.0002]
Croatia	0.0005	-0.0003	-0.00004	0.0001
	[0.001]	[0.001]	[0.001]	[0.001]
Bulgaria	0.001**	0.0002	0.001***	0.001***
	[0.0005]	[0.0002]	[0.0003]	[0.0004]
Romania	0.00001	-0.00003***	-0.00002*	-0.00001
	[0.00002]	[0.00001]	[0.00001]	[0.00002]
Poland	-0.0003	0.00005	-0.00004	-0.0001
	[0.0005]	[0.0001]	[0.0002]	[0.0003]
Ukraine	-0.00004	-0.0001*	-0.00003	-0.00002
	[0.0001]	[0.00004]	[0.0001]	[0.0001]
Moldova	-0.0001	-0.0001*	-0.0002	-0.0002
	[0.0002]	[0.0001]	[0.0001]	[0.0002]
Russia	0.002	-0.0003	0.001	0.001
	[0.001]	[0.0005]	[0.001]	[0.001]
France	-0.002	-0.0001	-0.001	-0.002
	[0.001]	[0.001]	[0.001]	[0.001]
Germany	-0.00003	0.0001	0.0002	0.0001
	[0.00053]	[0.0002]	[0.0003]	[0.0004]
UK	0.004***	0.001	0.00222**	0.003***
	[0.001]	[0.0005]	[0.001]	[0.001]

Cont.

Cont.

	(1)	(2)	(3)	(4)
Philippines	-0.001	0.00004	-0.0002	-0.0003
	[0.0004]	[0.00014]	[0.0002]	[0.0002]
China	0.0004*	0.0006***	0.0005***	0.0005***
	[0.0002]	[0.0001]	[0.0001]	[0.0001]
Bangladesh	-0.0001	-0.0001	-0.0001	-0.0001
	[0.0003]	[0.0001]	[0.0001]	[0.0002]
Sri Lanka	-0.001	-0.0003**	-0.001***	-0.001***
	[0.0005]	[0.0002]	[0.0003]	[0.0003]
India	0.0004**	0.0001	0.0002*	0.0003*
	[0.0002]	[0.0001]	[0.0001]	[0.0002]
Pakistan	-0.0005*	-0.0001	-0.0002	-0.0003
	[0.0002]	[0.0001]	[0.0002]	[0.0002]
Algeria	-0.001	0.001	-0.0003	-0.001
	[0.001]	[0.0005]	[0.001]	[0.001]
Egypt, Arab Rep.	0.001*	0.0001	0.0003**	0.0004**
	[0.0003]	[0.0001]	[0.0001]	[0.0002]
Morocco	-0.0001	0.0001***	0.00002	-0.00003
	[0.0001]	[0.00005]	[0.0001]	[0.0001]
Tunisia	0.001	0.0005***	0.001**	0.001**
	[0.0004]	[0.0001]	[0.0002]	[0.0003]
Ghana	0.0001	-0.0003**	-0.0001	-0.00002
	[0.001]	[0.0002]	[0.0004]	[0.0005]
Nigeria	0.002**	0.0006*	0.001**	0.001**
	[0.001]	[0.0003]	[0.0005]	[0.001]
Senegal	-0.001**	0.00003	-0.0003	-0.0005**
	[0.0003]	[0.0001]	[0.0002]	[0.0002]
Brazil	0.0004	-0.0001	0.0004	0.0005
	[0.001]	[0.0004]	[0.001]	[0.001]
Ecuador	-0.00003	-0.00003	-0.0001*	-0.0001
	[0.00004]	[0.00003]	[0.00003]	[0.00004]
Peru	-0.0004	-0.0003**	-0.0003	-0.0004
	[0.0003]	[0.0001]	[0.0002]	[0.0003]
Other	0.0002			
	[0.0002]			
Constant	-101.1***	-20.22***	-55.77***	-74.76***
	[25.66]	[7.614]	[13.14]	[17.00]
Observations	309	309	309	309
Number of codes	103	103	103	103
R-squared	0.979	0.966	0.979	0.979

Notes: robust standard errors in parenthesis. Standard Errors adjusted for 103 clusters. * significant at 10%; ** significant at 5%; *** significant at 1%. The least recent year dummy is always the one removed from regression. The other excluded variables are the percentage of people over 65 years of age and the percentage of people with primary education.

Table 11: Error Component Model. Register Office. Province-specific trends

Dependent Variable: Delta fragmentation Index	
Delta Population	-0.011***
	[0.003]
Delta Less 14	-0.332
	[0.304]
Delta 15_64	-0.333
	[0.205]
Delta Secondary Education	-0.029*
	[0.017]
Delta Tertiary Education	-0.042
	[0.027]
Delta Activity Rate	0.079
	[0.055]
Delta GDP growth	0.013*
	[0.007]
Delta Domain	0.008**
	[0.003]
Delta EU	0.213
	[0.378]
Delta Central-Eastern Europe	0.132***
	[0.031]
Delta Other Europe	4.920
	[3.327]
Delta Northern Africa	0.690***
	[0.104]
Delta Other Africa	0.083
	[0.171]
Delta North America	0.033
	[1.005]
Delta Latin America	0.097
	[0.083]
Delta Asia	-0.231*
	[0.120]
Delta Oceania	7.4760*
	[3.865]
Constant	0.917***
	[0.234]
Observations	206
Number of code	103
R-squared	0.769

Notes: robust standard errors in parenthesis. Standard Errors adjusted for 103 clusters. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 12: Two-way error Component Model on Balassa Index. Census data

Dependent Variable: Balassa Index			
	(1)	(2)	(3)
Year 2001	0.018	0.036	0.042
	[0.051]	[0.053]	[0.052]
Foreigners' Number	0.073***	0.074***	0.068**
	[0.027]	[0.028]	[0.027]
Less 14	0.003	0.003	0.002
	[0.006]	[0.006]	[0.006]
15_64	-0.001	-0.001	-0.003
	[0.005]	[0.005]	[0.006]
Male	0.008***	0.008***	0.008***
	[0.002]	[0.002]	[0.003]
Occupied	0.002	0.002	0.002
	[0.003]	[0.003]	[0.003]
Rail		-0.004***	-0.004***
		[0.001]	[0.001]
Airports Number		-0.0002	-0.010*
		[0.001]	[0.006]
Distance (to airports)		0.001	0.002
		[0.001]	[0.002]
Central-Eastern Europe	-0.575***	-0.585***	-0.582
	[0.203]	[0.205]	[0.403]
Other Europe	-0.331*	-0.334*	-0.163
	[0.186]	[0.186]	[0.438]
Northern Africa	-0.689***	-0.698***	-1.332***
	[0.224]	[0.225]	[0.454]
Other Africa	-0.840***	-0.841***	-1.023**
	[0.212]	[0.213]	[0.419]
North America	-0.192	-0.202	-0.053
	[0.161]	[0.161]	[0.358]
Latin America	-0.432**	-0.435**	-0.563
	[0.185]	[0.186]	[0.396]
Asia	-0.955***	-0.962***	-1.207***
	[0.196]	[0.197]	[0.397]
Rail*Central-Eastern Europe			0.00005
			[0.0003]
Rail*Other Europe			-0.0001
			[0.0003]
Rail*Northern Africa			0.0005
			[0.0004]
Rail*Other Africa			0.0004
			[0.0003]
Rail*North America			-0.0001
			[0.0003]
Rail*Latin America			0.00005
			[0.0003]
Rail*Asia			0.0004
			[0.0003]

Cont.

	Cont.		
	(1)	(2)	(3)
Distance*Central-Eastern Europe			-0.001
			[0.003]
Distance*Other Europe			-0.002
			[0.003]
Distance*Northern Africa			0.002
			[0.003]
Distance*Other Africa			-0.005*
			[0.003]
Distance*North America			-0.001
			[0.003]
Distance*Latin America			0.001
			[0.003]
Distance*Asia			-0.003
			[0.003]
Airport*Central-Eastern Europe			0.011
			[0.007]
Airport*Other Europe			0.021***
			[0.001]
Airport*Northern Africa			0.012*
			[0.007]
Airport*Other Africa			0.010
			[0.008]
Airport*North America			0.001
			[0.003]
Airport*Latin America			0.011
			[0.007]
Airport*Asia			0.013
			[0.008]
Constant	0.614		8.097***
	[0.479]		[2.278]
Observations	1517		1517
R-squared	0.205		0.24

Notes: robust standard errors in parenthesis. Standard Errors adjusted for 95 clusters. * significant at 10%; ** significant at 5%; *** significant at 1%. The excluded variables are the 1991 year dummy, the ethnic group dummy for Oceania, the percentage of people over 65 years of age and the percentage of female.

Table 13: Alternative estimation. Logit Transformattion

	Fragmentation -CENSUS	Fragmentation -Register	Greenberg-Register
	(1)	(2)	(3)
Year 2001	0.387		
	[0.443]		
Year 2004		0.379***	0.291***
		[0.045]	[0.048]
Year 2007		0.679***	0.502***
		[0.093]	[0.106]
Activity Rate	0.052***	-0.003	0.034***
	[0.010]	[0.010]	[0.011]
GDP Growth		-0.002	-0.002
		[0.002]	[0.002]
Population	0.001	-0.002***	-0.002***
	[0.002]	[0.0005]	[0.0004]
Less 14	0.0163	-0.033	-0.081*
	[0.051]	[0.030]	[0.047]
15_64	-0.067	0.048	-0.030
	[0.050]	[0.034]	[0.038]
Primary Education	0.008		
	[0.021]		
Secondary Education	0.120***	-0.003	-0.002
	[0.040]	[0.001]	[0.005]
Tertiary Education	-0.003	0.022**	-0.002
	[0.076]	[0.011]	[0.010]
Rail	0.0035***		
	[0.001]		
Airports Number	0.038		
	[0.036]		
Airport Distance	-0.0013**		
	[0.0006]		
Domain		0.001	0.001
		[0.001]	[0.001]
Constant	-10.180**	-5.106*	-1.873
	[4.440]	[2.757]	[3.071]
Observations	190	309	309
Number of code	95	103	103
R-squared	0.976	0.962	0.957

Notes: robust standard errors in parenthesis. Standard Errors adjusted for 95 clusters in column (1) and 103 in columns (2) and (3). * significant at 10%; ** significant at 5%; *** significant at 1%.

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