

Bosker, E.M.; Marlet, G.A.

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Universiteit Utrecht

**Utrecht School
of Economics**

**Tjalling C. Koopmans Research Institute
Utrecht School of Economics
Utrecht University**

Janskerkhof 12
3512 BL Utrecht
The Netherlands
telephone +31 30 253 9800
website www.koopmansinstitute.uu.nl

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How to reach the authors

Please direct all correspondence to the first author.

Maarten Bosker
Utrecht University
Utrecht School of Economics
Janskerkhof 12
3512 BL Utrecht
The Netherlands
Email: m.bosker@econ.uu.nl

Gerard Marlet
Stichting Atlas voor gemeenten
Postbus 9627
3506 GP Utrecht
The Netherlands
E-mail: Marlet@atlasvoorgemeenten.nl

This paper can be downloaded at: <http://www.koopmansinstitute.uu.nl>

Urban growth and decline in Europe

Maarten Bosker^a
Gerard Marlet^b

^aUtrecht School of Economics
Utrecht University

^bStichting Atlas voor Gemeenten

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Abstract

In this paper we examine growth differences between European cities. We have used the Urban Audit, a rather new dataset from Eurostat. After clarifying the merits of this dataset as well as some of its limitations, we provide some detailed characteristics of city growth in the European Union. This shows that urban growth in the EU is pretty persistent and is still, in spite of further European integration, largely driven by growth of national born population; non-national European born and non-European born migrants contribute only marginally to urban growth differentials. Moreover differences in birth rates explain a substantial part of the variation in (national-born population) growth rates. Controlling for these differences in birth rates, we look for the determinants of migration-driven European city growth relative to average city growth in the EU as a whole as well as to average national city growth, meanwhile distinguishing between national, non-national EU and non-EU population growth. Our results suggest that, by and large, the smaller, less dense, safer, amenity-rich cities with high levels of GDP per capita are growing fastest. When focussing on national, EU and non-EU population growth, we moreover find that nationals are attracted to the less dense, amenity-rich, more productive cities; that EU non-nationals are concentrated in cities with high levels of human capital; and that non-EU population growth is determined by climate and by employment structure

Keywords: European urban growth

JEL classification: R00, R11, O18

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1. INTRODUCTION

In the 1990s Europe experienced a period of rapid political and economic change. It witnessed a further deepening of integration¹ between the EU member countries following the treaty of Maastricht in 1992, along with an increase of its membership in 1995². Also Eastern European countries transformed to open market economies following the fall of communism. This process was fastest in the former GDR, or East Germany, which indeed became a member of the EU immediately after reuniting with West-Germany in 1991.

In this paper we examine growth differences between European cities during this period. All the above-mentioned increases in economic integration are, at least in theory, aimed at stimulating migration between European countries. Did this process especially favour the largest cities in Europe, because higher density results in more diffusion of knowledge and ideas and therefore provides the best economic opportunities for firms and workers (Jacobs 1984)? Or rather because larger and denser cities generally provide more amenities to residents (Glaeser 2001)? Or did the larger and denser cities in fact lose out as a result of greater negative congestion forces like increasing house prices, building restrictions (Glaeser 2003), pollution and social problems (Cheshire 1989)?

To answer these questions, this paper tries to find empirical explanations for the observed variations in growth experience between European cities during this period. Which European cities grew most during the 90s, which cities shrank, and why? Examples of declining cities can be found in e.g. the former GDR and the Baltic states (Berlin, Frankfurt an der Oder, Tallinn and Riga). But surprisingly, some of the most important cities in the middle of the European core regions, such as Milan, Barcelona and Munich, also faced population decline during this period. Fast growers instead are cities like Helsinki and Dublin, which took advantage of the rise of the ICT-sector, but also cities like Athens and southern Italian cities which appear to have large inflows of migrants from outside Europe.

In our search for possible explanations we focus on three subcategories of possible explanations for city growth (decline): density, urban (dis)amenities and economic opportunities (e.g. expected wages).

¹ Removing barriers of trade, migration and streamlining national regulations.

² Austria, Sweden and Finland.

This subdivision largely reflects the results from earlier studies on urban growth in the USA, where it is found that, as Glaeser et al. (2003) puts it, people tend to move towards “better weather and away from higher density and low skill cities”;

the introduction of newer technologies reduced the need to agglomerate (people, at least Americans, like to use their cars), making the high-density cities build around older public transport infrastructure less attractive. Furthermore, dense cities face more congestion, for example increasing house prices and building restrictions (Glaeser et al., 2001), pollution and social problems (Cheshire 1989), which may eventually result in an ongoing process of urban sprawl.

People move towards better weather because they like to live in dry places with mild temperatures. There is rather strong evidence that such a climate is the most important amenity of a city in attracting people (Roback 1982; Rappaport, 2006). With household incomes and mobility rising in the second half of the twentieth century, more and more people were able to choose a desirable place to live in a mild and dry climate, which in the US often meant the South or West coast (Graves, 1980; Rappaport, 2006). Quality-of-life became – beside wages and job opportunities – an important reason for people to migrate (Mueser and Graves, 1995).

Urban amenities are also important factors in quality-of-life. People like to live in cities with a wide variety of consumer goods such as shops, culture and restaurants (Glaeser et al., 2001). In this ‘consumer city view’, cities are no longer centres of production, but centres of consumption. Others emphasize the importance of safety for the amenity value of cities which are successful in attracting urban residents (Cullen and Levitt, 1999). On this view, the most successful cities can be expected to be cities with nice temperatures, low levels of rainfall, high levels of urban amenities, and low crime rates. Having a nice climate and high levels of urban amenities allow people in these cities to consume urban amenities like beer gardens and open-air events more intensively (Kim, 2002).

Finally, people in the US move away from low skill cities, because cities with high levels of human capital are considered to have higher productivity and are as a result of that first expected to attract firms, and then people to the higher wages offered; see e.g. Lucas (1988) and Glaeser and Saiz (2003). Highly educated people are also considered to increase the demand for, and therefore the supply of, urban amenities like opera, theatre and sports events; and might even be an amenity in themselves,

attracting other people because, generally, highly educated people cause less social problems (Glaeser et al., 2001).

What does all this mean for understanding European city growth? All the empirical studies mentioned above explain urban growth differences in the US. But the European Union is not the US. Cheshire and Magrini (2006) mention at least two major differences between the EU and the US which may limit the research possibilities in the European Union.

First, and despite ongoing European integration, the volume of US interregional migration is 15 times higher than that of migration in the EU; this surely has something to do with language and cultural differences and – even now – infrastructural and bureaucratic borders within Europe (Boekema 2000). Secondly, and perhaps even more seriously, there is an absence of sufficient data for empirically establishing the importance of amenities, housing, job opportunities, skills, economic structure, and other indicators, as determinants of urban growth (Gyourko 1999).

We address both these problems explicitly in this paper. To handle the first potential problem, we – like Cheshire and Magrini (2006) – do not just explain population growth compared to the European average, but also to the national average. Also, we not only look at total population growth but distinguish between growth of national-born, EU and non-EU population growth and thus hope to find some evidence on the determinants of border-crossing migration.

The second fundamental problem, lack of data, seems to have been at least partly solved since the recent launch by EUROSTAT, the statistical office of the European Union of a new dataset with the aim “*to compare quality of life in towns and cities within the European Union*”: the Urban Audit (European Commission 2004). The Urban Audit contains information about more than 300 variables for 258 towns and cities in the European Union’s fifteen member states and its twelve Eastern European candidate countries. Because of the above-mentioned aim of this EU project, the dataset has a relatively large number of indicators on quality-of-life in European cities in addition to the more conventional economic variables (such as employment structure, income, etc.), and is thus in principle ideally suited for our purposes³.

Explicitly taking note of the particularities of the European situation, we find that by and large, and with birth rate differences controlled for, the smaller, less dense, safer,

³ The data set also has some substantial disadvantages. See section 2, for a more detailed description of the pro’s and con’s of this dataset.

amenity-rich cities with high levels of GDP per capita are growing fastest. We also find large differences between the various subcategories of population growth we studied. Warm and dry climates, for example, only matter for attracting more non-EU migrants. Urban amenities mostly explain growth differentials of national-born population within the European countries. National-born population is moreover attracted to the less dense, more productive cities. Growth of non-national EU population is hard to explain but seems to be concentrated in cities with high levels of human capital.

Our paper is structured as follows. Section 2 describes in more depth the Urban Audit data set, presenting its merits along with its drawbacks. Section 3 provides some useful descriptive statistics on European city growth in the 1990s. Section 4 presents the results of our estimations, providing possible explanations for the observed variation in growth rates between cities. Section 5 presents our conclusions.

2. DATA

As mentioned above, the Urban Audit dataset contains information about more than 300 variables for 260 towns and cities in 27 European countries, measured at three different points in the 1990s⁴ (see Figure A1 and Table A1 in the Appendix for more detail on the cities included). Cities are defined according to their administrative boundaries.⁵ Although at first this extent of the data set sounds very promising for our research purposes, on a closer look of the data it immediately becomes clear that their coverage is in fact rather poor (see Appendix Table A1). For several countries many indicators are not provided, and there are no cities with all indicators available at any

⁴ One observation in 1991 (or in the period 1989-1993), one in 1996 (or in 1994-1998) and one in 2001 (or in 1999-2003), respectively.

⁵ The Urban Audit dataset also provides data on Larger Urban Zones (LUZ), which aims to capture cities as so-called Functional Urban Regions instead of merely administrative units. Although these LUZs can be argued to capture urban agglomerations more accurately, the data for these LUZs are of a substantially poorer quality. Both in terms of variable-coverage (about 160 variables less) and also in terms of cities covered per available variable; e.g. our main variable of interest, population growth between 1991 and 1996, is reported for 148 LUZs compared to 235 administrative cities. This data unavailability becomes especially problematic when looking for the determinants of the varying growth experiences of European cities (see section 4). Therefore we have chosen to use administrative cities as our main unit of analysis. (Note: Results using LUZ data are available upon request. They show a largely similar picture in terms of the characteristics of city growth (see section 3); the regression results (only possible to look at density and economic opportunity variables given data availability) vary from time to time compared to the results presented in section 4, but given the substantially smaller samples (in the LUZ regressions the number of observations is always about two-thirds of that when looking at administrative cities) they are difficult to compare to the results presented in this paper.)

point in time (even though data coverage does improve over the decade). What is worse, missing values generally don't occur for the same cities across variables (see section 4 for more on this).

In spite of these limitations we were able to extract indicators for all categories of possible determinants of urban growth mentioned above: density, economic conditions & human capital, and amenities.⁶ Below we briefly discuss the variables used in the empirical section of this paper.⁷

Urban Growth – the dependent variable(s)

As we said before, we not only look at total population growth between 1991 and 2001, but also at the growth rate of national, EU and non-EU populations. For each of these categories we are able to extract⁸ a total of 235, 134, 119 and 119 observations⁹ for each growth variable respectively.

Density

Following Glaeser et al. (2003) we use a city's total population size and its population density as proxies for density. We use them both because, as argued by Glaeser et al. (2003), population density may not reflect the true density of a city if for example empty space at the fringes is incorporated in a city's area. In such cases total population size may be a better proxy.

Amenities

As the Urban Audit is initiated to compare cities' quality of life, it promises a large set of amenities; it claims to contain data from air pollution and water quality to the number of doctors and hospital beds, cinemas, parks and theatres. Unfortunately, it is especially these amenity indicators that suffer from large numbers of missing values (most of them being only available for 2001, and just for selected cities). With a view

⁶ Losing an (sometimes substantial) acceptable amount of observations in the process.

⁷ For a complete description of the whole Urban Audit data set, we refer to the *Urban Audit Methodological Handbook* (downloadable from: http://epp.eurostat.cec.eu.int/cache/ITY_OFFPUB/KS-BD-04-002/EN/KS-BD-04-002-EN.PDF).

⁸ Extract, because sometimes when total population figures are missing, we can construct them by adding total male and total female population (which, strangely enough, are available) or by adding national, EU and non-EU population.

⁹ Data on national, EU and non-EU population are mainly missing for the 12 Eastern European candidate countries and the UK.

to these problems with missing values, we selected the ‘best’ variables in terms of data availability from the wide range which the Urban Audit claims to offer.

This has resulted in a set of weather-related amenity indicators: sun hours per day, rainy days per year, average temperatures both in the coldest month and in the warmest month. And in a set of amenities we labelled urban (dis)amenities.

As urban disamenities we chose both total crime rates and amount of murders. We included the subcategory murders explicitly because in other research this category has been found to offer the best explanation for the extent to which people in cities feel safe¹⁰ (see e.g. Marlet and van Woerkens, 2006). In the choice of urban amenities we follow Glaeser et al. (2001) and include two proxies for the amenity value of cities: the number of people working in trade, hotels and restaurants as a proxy for the supply of shops & horeca facilities, and the number of hotel stays per capita as a proxy for tourist attractions. However, direct indicators for amenities are possibly preferable. Therefore we also look at two direct measures for urban amenities, the amounts per capita of museums and of theatres, the two measures with the least missing values.

Economic opportunities & human capital

As measures of economic opportunities we further distinguish between expected wages and employment structure. We measure expected wages by proxies for both wages and job opportunities. These proxies are (regional) GDP per capita for wages and unemployment rate for job opportunities. In addition to these measures we include some indicators measuring the employment structure of the city. Share of industrial employment as an indicator for the lack of high-skilled jobs on the one hand and for pollution on the other, the number of headquarters as an indicator for the presence of high-skilled jobs and a capital city dummy as a proxy for the presence of a large public sector.

Finally, human capital levels are measured by the share of highly educated people in a city and the number of students in a city. We also include this latter variable as it can be a proxy for the presence of highly skilled jobs (the presence of more students is likely to result in more university, i.e. high skilled jobs) and even levels of human

¹⁰ Murder rates (contrary to e.g. petty crime rates) highly correlate with the ‘do you feel save’-question in the Urban Audit Perception Survey, that is available for 32 European countries.

capital itself (especially in Europe, with its low level of labour mobility, many students are likely to start working in city where they study).¹¹

3. CHARACTERISTICS OF EUROPEAN CITY GROWTH

As a preliminary to the empirical results, this section provides detailed descriptives about city growth in the EU. These already reveal several interesting facts, some of which are subsequently taken into account in explanations of the observed differences in growth experiences between cities.

3.1 *Some descriptives*

Table 1 and Table 2 show several descriptives about city growth during the period 1991-2001, as well as information about the size of the cities included in the sample. As can be seen, we do not only show information about total population and total growth but we also distinguish between three different components that together make up total population and total growth respectively, namely national, non-national EU, and non-EU population.

Table 1a. City growth 1991 – 2001

	total	national	EU	non-EU
mean	0.004	-0.005	0.000	0.013
stdev	0.081	0.081	0.010	0.022
min	-0.223	-0.213	-0.048	-0.050
max	0.295	0.238	0.070	0.137
nr obs	235	134	120	119

corr	national	EU	non-EU
total	0.952	0.028	0.150
national	-	-0.099	-0.138
EU	-	-	0.017

Table 1b. City size 2001

	total (x1000)	% national	% EU	% non-EU
mean	427.03	0.943	0.014	0.039
stdev	719.73	0.062	0.035	0.042
min	50.76	0.463	0	0
max	7172.09	1	0.459	0.279
nr obs	256	229	229	228

corr	% national	% EU	% non-EU
total	-0.164	0.036	0.242
% national	-	-0.787	-0.830
% EU	-	-	0.369

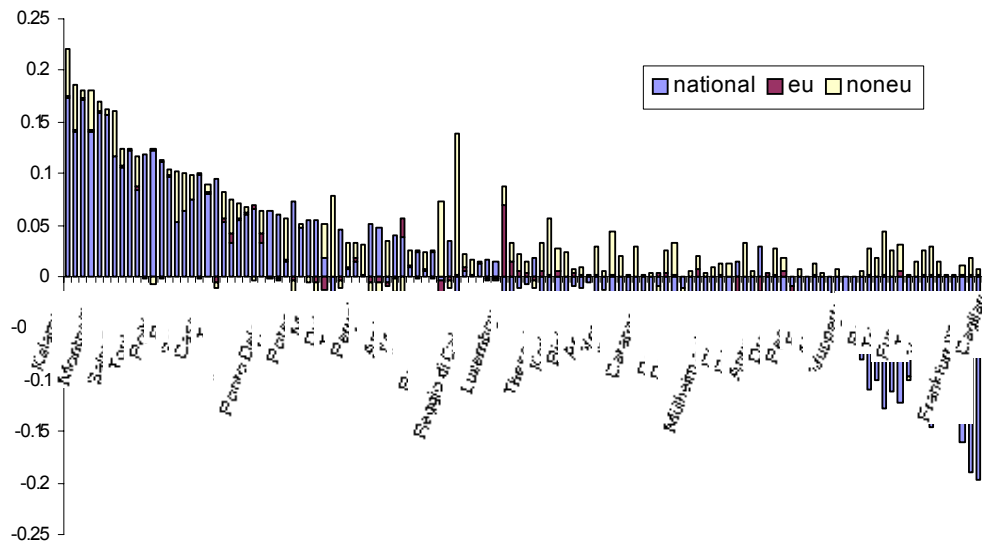
Notes: for each individual city with data available about national, EU and non-EU population in both 1991 and 2001, total growth = growth national + growth EU + growth non-EU.

Table 1a shows that the average EU city grew about 0.4% in population size between 1991 and 2001. This is much lower than the average 10% found during roughly the same period in the USA (see Table 2 in Glaeser and Shapiro, 2003). As in case of the USA, the heterogeneity in growth experiences between cities, shown by the standard

¹¹ Both human capital variables can also be argued to be a proxy for urban amenities, see section 4 for more details.

deviation and the minimum and maximum growth rate, is substantial (fastest growing city Galway saw a 30% increase in its population over the sample period whereas Liepaja's population, the slowest growing city, decreased by more than 20%). The same holds when looking at city size proper in Table 1b, with the largest city London being about 140 times larger than the smallest city Campobasso. Figure 1 provides a more detailed picture of the heterogeneity in growth rates, showing that many of the slowest growing cities are located in Italy and former East-Germany, whereas Greek cities generally show high levels of population growth.

Figure 1. City growth 1991-2001



Note: The figure only includes cities for which national, EU and non-EU population data is available in both 1991 and 2001.

The subdivision of total growth in the growth of national, EU and non-EU population also shows some interesting things. First, a look at Figure 1 and the very high correlation between total growth and national growth of 0.95 in Table 1a shows, together with the fact that 95% of the average city's population consists of national-born people (see Figure 1b), the well-known (see e.g. Cheshire and Magrini, 2006) reluctance with which Europeans move between cities in different member states. Second, non-EU population growth is almost always positive, and if negative (mainly in French cities) only slightly so, hinting at the overall attractiveness of Europe to people from outside the EU. Another interesting finding is that growth in national-

born population is negatively correlated with both EU and non-EU population growth, suggesting that nationals do not move to the same cities as non-nationals. The positive correlation between EU and non-EU population growth instead suggests that non-nationals prefer similar cities regardless of whether they come from within or outside the EU. This is confirmed by the positive correlation between the share of EU and non-EU population in Table 1b and also by a look at Table 2.

Table 2a. Top 5 fastest growing cities 1991-2001

top 5	total	national	EU	non-EU
1	Galway	Galway	Luxembourg	Athina
2	Tilburg	Kalamata	Bruxelles / Brussel	Dublin
3	Kalamata	Oulu	Wiesbaden	Regensburg
4	Oulu	Montpellier	København	Thessaloniki
5	Ioannina	Braga	Freiburg im Breisgau	Patra

Table 2b. Top 5 largest cities 2001

top 5	total	% national	% EU	% non-EU
1	London	Cluj-Napoca	Luxembourg	Tallinn
2	Paris	Timisoara	Bruxelles / Brussel	Athina
3	Berlin	Craiova	Charleroi	Frankfurt am Main
4	Madrid	Torun	Liège	München
5	Roma	Arad	München	Wien

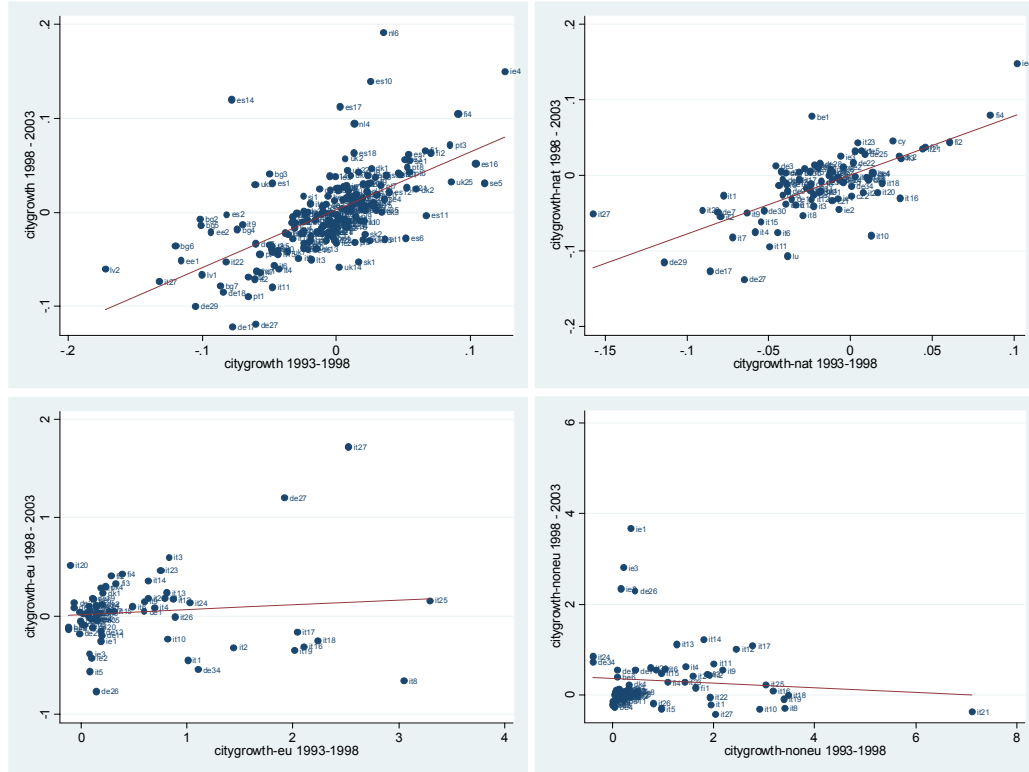
A comparison of the top 5 in terms of national and non-national population growth in Table 2a shows that cities with the fastest growing non-national populations are all relatively large, with Luxembourg and Brussels (not surprisingly) attracting many EU-citizens and Athens (and two other Greek cities) and Dublin attracting many non-EU migrants (the former probably in the form of so-called boat-refugees and the latter in the form of expats). In terms of absolute size, too, the cities with the largest non-national populations are mostly large international cities such as Brussels, Frankfurt and Munich. Cities with a population consisting almost entirely of nationals are mostly (small) cities in the former communist countries which have only recently opened up to the rest of the world.

3.2 Persistence in growth rates

An interesting finding presented in Glaeser and Shapiro (2001) and Rappaport (2004) is that the population growth rate in US cities is remarkably persistent over time. To see whether or not this persistence is also found in European cities' growth rates, Figure 2 shows a scatter plot – one each for total (upper left), for national (upper

right), EU (lower left) and for non-EU (lower right) population growth – of city growth during the period 1996-2001 against growth during the period 1991-1996.

Figure 2. Persistence in growth rates over the decade



Notes: The correlation between growth during the period 1996-2001 and 1991-1996 is, going from the upper left to lower right (with in brackets the corresponding p-value): 0.626 [0.000], 0.697 [0.000], 0.105 [0.395] and -0.093 [0.438] respectively.

Another striking thing is that total city growth in the EU is found to be highly persistent with almost the same correlation (0.63) as that found by Glaeser and Shapiro (2001).¹² When looking at the different subcategories, we see that national-born population growth is even more persistent (correlation 0.70) than total population growth. This finding is totally reversed in the case of both EU and non-EU population growth, where we don't find the least evidence of persistence (both correlations are insignificant). Apparently cities' attractiveness to national born

¹² Note the time period over which we look at persistence is somewhat shorter than in that paper. Our finding of persistence over a period of only 10 years can be argued to be somewhat less convincing than when looking at the issue over a longer period of time as Glaeser and Shapiro (2001) do.

population is very stable over time, whereas foreigners are much more unpredictable in their choice of settlement¹³.

3.3 *Natural growth or migration driven growth?*

Before starting to look for explanation(s) of the observed patterns in European city growth (and its subcategories), we wish to draw attention to the following important issue. The aim of the (empirical) urban growth literature (e.g. Glaeser and Shapiro, 2001; Glaeser et al., 2001; Rappaport, 2006 and Rappaport and Sachs, 2001) is to explain the variation in growth rates between cities by factors explaining the attractiveness of cities (amenities, wages, weather, skill level, etc). All the papers mentioned above assume that city size growth is equivalent to migration-induced population growth, with city growth resulting from people moving to attractive cities and away from unattractive places (see e.g. the title of Rappaport 2006). Using population growth data instead is fine, but we argue that one important issue has not received enough attention.

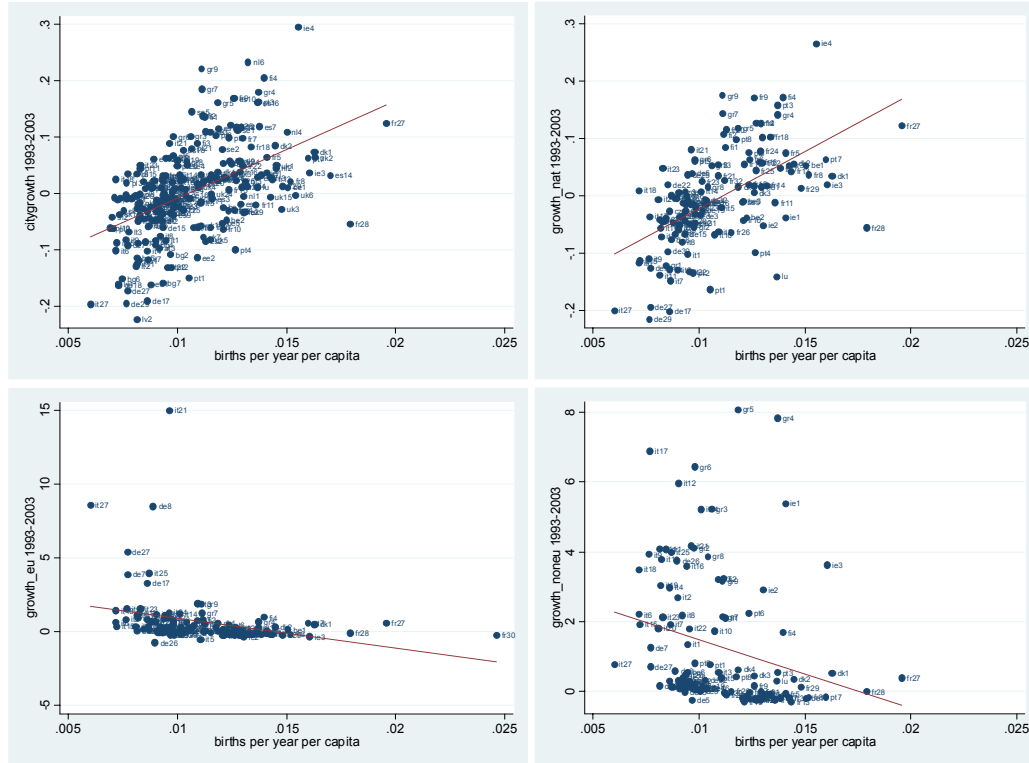
This is the fact that city growth does not consist of migration-driven growth only; natural growth is also important. Differences in birth rates between cities might be an important explanation of the observed differences in population growth rates¹⁴. Figure 3 illustrates this for our sample, showing a simple scatter plot of city growth (and its three subcategories) between 1991 and 2001 against cities' birth rates. As can be seen, the correlation between cities' birth rates and population growth is positive and significant. The scatter plots, plotting national, EU and non-EU population growth against birthrates, provide further evidence in favour of our case. National-born population growth is significantly positively correlated with birth rates, whereas these are not significantly and negatively correlated with both EU and non-EU population growth. Moreover, the variation in birth rates already explains about 26% of the variation in total population growth and as much as 32% of the variation in national-

¹³ Possible explanations for this are the active role governments play in the allocation of (economic) refugees and also the more often-changing settlement preferences of foreign firms and governmental institutions.

¹⁴ The mentioned papers all (implicitly) assume that natural population growth does not vary between cities or that natural growth rates of cities are uncorrelated with the city characteristics of interest so that estimates of these characteristics' effects are not affected (see the next section for more on this).

born population growth if we apply a simple regression of growth rates on birth rates.¹⁵

Figure 3. Birth rates and city growth



Notes: The correlation between birth rates and city growth during the period 1991–2001 is, going from the upper left to lower right (with the corresponding p-value in square brackets): 0.510 [0.000], 0.568 [0.000], -0.290 [0.001] and -0.248 [0.007] respectively. Similarly the R^2 of a simple regression of city growth on birth rates is: 0.26, 0.32, 0.08 and 0.06 respectively.

By a large (and perhaps not surprisingly), national-born population growth depends far more on natural increases in the population than EU and non-EU population growth, which are far more likely to represent migration-induced city growth. Of course using actual net migration data, like e.g. Mueser and Graves (1995) in case of the USA, would solve this issue; but this is (to our knowledge) not available for European cities.¹⁶ We therefore argue that taking explicit account of differences in natural growth rates between cities is quite important when using (national) population growth as a proxy for migration-induced population changes. Cheshire and

¹⁵ In case of EU and non-EU population growth birth rates only explain 8% and 6% of the variation respectively.

¹⁶ The Urban Audit data set does provide data on migration (for a small number of cities), but only the number of people moving to a city. Data on migration out of a city is not provided; as a results net migration is not known.

Magrini (2006) is the only other paper we know of that explicitly takes note of this issue.¹⁷ This is what we do in the next section, where we start our search for possible explanations of migration-induced population growth in our sample of European cities by including birth rates as a control variable in our regressions.

4. CORRELATES OF CITY GROWTH

In searching possible explanations for the observed variation in city size growth in the European Union, we distinguish between several subcategories (see the introduction). Our estimation strategy is to add each subcategory separately and run a simple OLS regression to get estimates of the partial correlation of each individual variable within a certain subcategory. The reason why we don't add all variables at once to the regression is data availability. As mentioned in the data description, missing values do generally not occur for the same cities in the same variables. This results in an increasing loss of data points as more and more variables are added simultaneously to the regression (except for initial population size, initial population density and birth rates). As a result the number of observations decreases while the number of parameters to be estimated increases, so that small sample problems are growing in two ways. When looking at subcategories separately, we have to admit that this is still a problem, but joining subcategories would not improve matters as this entails a much bigger loss of degrees of freedom. For example, if the subcategories 'economic opportunities' and 'employment structure' (having 71 and 111 observations respectively when added separately) were added together, this would reduce the sample size to only 39 cities.

We also show results when adding country dummies to the regressions.¹⁸ What these dummies effectively do is change the interpretation of the regression results. When not included, the regression results offer an explanation for the observed variation in city growth rates within Europe as a whole, whereas when country dummies are included we effectively focus on explaining the variation within individual countries (the dummies capture all the variation between countries within Europe). A variable

¹⁷ They however lack data on natural growth (birth) rates at the individual city level and address the issue by constructing a variable that takes the same value for each city within the same country, i.e. national growth minus growth in a countries' cities (i.e. those cities included in their dataset). Consequently their variable is not only a proxy but also unable to capture birth rate differences between cities within the same country.

¹⁸ We also experienced with including only a dummy for Eastern European cities; this did not add any additional insights (results available upon request).

that is only significant after country dummies have been excluded can therefore be interpreted as being, if not downright insignificant, at best an important variable in explaining the variance in city growth rates between European countries. A variable which is significant only when country dummies are included could hardly explain the (apparently large) variation between European countries, but turns out to be significant once this variation is removed by the inclusion of country dummies. Finally we note that we only control for birth rates when looking at total or national-born population growth. The reason for this is that the results regarding the variables of interest only change while we look at these growth figures. When looking at EU and non-EU population growth, in- or excluding birth rates does not make any difference. This confirms the finding, mentioned before, that EU and non-EU population growth are hardly explained by birth rates. Especially in case of total or national-born population growth, the results regarding the variables in the subcategory economic conditions are sensitive to the in- or exclusion of birth rates.¹⁹ Note also that the estimated effect of the birth rate is always positive (as expected) and very significant.

4.1 Growth and density

Table 3 shows our baseline results when including only the proxies for density to the regression.

Table 3. Growth and density

Growth 1991-2001:	total	total	nationals	nationals	EU	EU	non-EU	non-EU
birth rate	18.76 [0.000]	16.68 [0.000]	22.28 [0.000]	24.49 [0.000]				
population 1991	-0.019 [0.001]	-0.013 [0.012]	-0.010 [0.296]	-0.006 [0.478]	-0.458 [0.131]	-0.524 [0.269]	-1.016 [0.000]	-0.087 [0.648]
population density 1991	-0.008 [0.066]	-0.012 [0.006]	-0.022 [0.034]	-0.031 [0.001]	0.141 [0.415]	0.161 [0.647]	0.726 [0.003]	-0.221 [0.285]
country dummies	no	yes	no	yes	no	yes	no	yes
R2	0.354	0.627	0.454	0.613	0.035	0.154	0.170	0.692
nr. obs	217	217	122	122	110	110	110	110

Notes: p-values in brackets. Bold faced coefficient are significant at at least the 10% level.

In case of total and national-born population growth, both proxies are always negatively affecting population growth. Moreover the negative effect of population

¹⁹ Which does make sense as variables such as income level, unemployment, and level of education can be expected to influence the decision to have children.

density seems more robust than that of total population size, both when adding country dummies and other variables (see also Tables 4-8). National-born population seems to prefer the smaller and less dense cities, something that is also found by Glaeser and Shapiro (2003) in their sample of US cities. This is not the case when looking at EU population, where we (never) find a significant effect of density on growth. In case of non-EU population the evidence is somewhat mixed, as they seem to prefer the smaller, dense cities in Europe. This latter effect is however not so robust to the inclusion of country dummies (which possibly suggests that these small but dense cities are sort of a country-wide phenomenon, e.g. the Netherlands), and/or other variables, which is why we do not want to emphasize this result too much. How can we understand the negative relation between national-born population growth and density? Glaeser's US-interpretation of this phenomenon is mainly the preference for car use: "cities built around the automobile replaced cities that rely on public transportation" (Glaeser 2001). He also refers to the European case, saying that he expects that: "in Europe where the infrastructure predates cars and where gas taxes are high, high density areas will also succeed" (Glaeser 2001).

Our results show that they don't appear to do so, or at least they don't if population growth is used as the indicator for success. Cities could however combine attractiveness and population decline and be 'successful' in the sense that they attract people with higher incomes. High demand for, combined with inflexible supply of, space drives up housing prices and rents so that only the wealthy can afford to live in attractive cities, so that in course of time these people will be replacing other (less wealthy) as city residents. This leaves total population size unchanged or may even lead to population decline. As Sassen (2003) puts it: "Apartments that once held families now hold one single investment banker. And the space required by that single banker for offices, restaurants and shops can be two, three, four times more than that required by the family he or she replaces."²⁰

Glaeser hints on this in his later work stating that heterogeneity in housing supply is an important determinant of urban growth differentials (Glaeser 2005). To test for this, future research will have to look at the increase of housing prices and changing composition of the urban population. Some studies in the US (Clark 2001), and separate European countries (Marlet, Van Woerkens, 2005) already did so. But for the

²⁰ Saskia Sassen, How population lies, in: Newsweek, 3-7-2006.

European Union as a whole, we – despite the new Urban Audit – still lack appropriate data to conduct such an analysis.

4.2 *Growth and economic conditions & human capital*

As mentioned before we further distinguish between economic opportunities on the one hand and employment structure on the other hand when looking at cities' economic conditions. Table 4 shows the results when including our measures for economic opportunities GDP per capita and the unemployment rate.

Table 4. Growth and economic opportunities

Growth 1991-2001:	total	total	nationals	nationals	EU	EU	non-EU	non-EU
birth rate	20.86 [0.000]	14.10 [0.021]	19.95 [0.003]	17.45 [0.051]				
population 1991	-0.011 [0.260]	-0.010 [0.344]	0.023 [0.090]	0.012 [0.343]	0.437 [0.229]	0.149 [0.646]	-0.162 [0.370]	-0.200 [0.406]
population density 1991	-0.026 [0.033]	-0.033 [0.023]	-0.065 [0.001]	-0.063 [0.003]	-0.381 [0.237]	0.182 [0.465]	-0.027 [0.837]	-0.068 [0.706]
GDP per capita 1991	0.028 [0.065]	0.058 [0.039]	0.026 [0.082]	0.078 [0.019]	-0.626 [0.063]	-3.241 [0.004]	0.015 [0.945]	0.298 [0.561]
unemployment 1991	-0.317 [0.057]	-0.384 [0.147]	0.041 [0.853]	0.282 [0.397]	-0.275 [0.922]	-7.257 [0.234]	-0.941 [0.611]	4.458 [0.394]
country dummies	no	yes	no	yes	no	yes	no	yes
R2	0.418	0.486	0.456	0.561	0.099	0.464	0.005	0.136
nr. obs	71	71	52	52	47	47	47	47

Notes: p-values in brackets. Bold faced coefficients are significant at the 10% level at least. Population, population density and GDP per capita are in logs.

In case of both total and national growth we find a significant positive effect of GDP levels on subsequent city growth. Note also that adding country dummies does not much increase the explained variation, which suggests that this result is not driven by differences in GDP levels. Apparently nationals tend to show behavior consistent with e.g. the new economic geography literature, where people are reckoned to move in response to higher wage levels. Again Glaeser and Shapiro (2003) find a similar result in their sample of US cities. Their positive effect disappears, however, when a human capital measure is also added to the regression, which suggests that GDP levels could simply be a proxy of human capital. This could also be the case in our sample, although we have to be aware that our results regarding human capital levels (see below) do not provide compelling evidence in favor of this. When shifting the focus to non-national population we, as in the case of density, find completely different results. That is, no evidence of a positive effect (in case of EU population even a

somewhat puzzling²¹ negative effect) of GDP levels on growth of both EU and non-EU population.

The unemployment rate is almost always insignificantly correlated with population growth. Only when looking at total population growth relative to the European average do we find a significant negative correlation. The fact that this finding is not robust to the inclusion of country dummies seems to suggest that unemployment differences at best offer an explanation for the observed city growth rate difference between countries.

Table 5 shows the results when focusing on the impact of a city's employment structure. Like Cheshire and Magrini (2006), we find a negative correlation of a high employment share in industrial activity with total (and also national) growth. In our case, however, this correlation is never significant, while on the other hand we find a significantly positive correlation for non-EU population growth, which suggests that non-EU population is drawn towards cities with a relatively large industrial sector (again note that the result is robust to the inclusion of country dummies, which again does not much increase the explained variation). This could be reconciled with relatively low-skilled migrants from outside the EU finding jobs in the more industrial cities.

Table 5. Growth and employment structure

Growth 1991-2001:	total	total	nationals	nationals	EU	EU	non-EU	non-EU
birth rate	14.61 [0.000]	17.94 [0.000]	21.13 [0.000]	22.51 [0.000]				
population 1991	-0.008 [0.321]	-0.037 [0.000]	0.003 [0.776]	-0.031 [0.034]	-0.672 [0.147]	-0.425 [0.509]	-0.804 [0.007]	-0.512 [0.132]
population density 1991	-0.030 [0.000]	-0.017 [0.019]	-0.041 [0.000]	-0.024 [0.028]	0.312 [0.341]	0.277 [0.587]	-0.086 [0.651]	-0.126 [0.595]
headquarters 2001	0.002 [0.675]	0.011 [0.018]	-0.001 [0.891]	0.010 [0.125]	0.121 [0.614]	-0.150 [0.575]	0.527 [0.007]	0.264 [0.154]
capital city	-0.021 [0.454]	0.026 [0.161]	-0.104 [0.001]	-0.016 [0.556]	-0.468 [0.577]	0.088 [0.941]	-0.048 [0.930]	0.190 [0.797]
% industry 2001	-0.078 [0.415]	-0.005 [0.959]	-0.077 [0.614]	-0.018 [0.904]	5.420 [0.357]	-0.031 [0.996]	12.15 [0.000]	6.708 [0.060]
country dummies	no	yes	no	yes	no	yes	no	yes
R2	0.435	0.651	0.646	0.720	0.084	0.139	0.533	0.619
nr. obs	111	111	71	71	69	69	69	69

Notes: p-values in brackets. Bold faced coefficient are significant at at least the 10% level. Population, population density and headquarters are in logs.

²¹ Maybe the EU-support to cities in relatively poor regions could be an explanation.

Our capital city dummy does not significantly correlate with city growth. Only when looking at national-born population growth differences with reference to the European average it shows a significant negative effect. The results regarding the correlation between the number of headquarters in a city and its growth performance are somewhat more convincing. In the largest sample for total population growth, this variable has a significant positive correlation with a city's growth performance relative to other cities in the same country. This could be an indication that firms find it attractive to locate their headquarter close to other headquarters and usually decide where to locate their headquarter on the individual country level. The fact that the number of headquarters also positively correlates with growth of the non-EU population, but only significantly so relative to the European average, suggests furthermore that non-EU firms are instead much more inclined to choose their headquarter locations on a European scale. Again EU population growth does not significantly correlate with any of the included variables. This last conclusion changes quite substantially when we look at human capital as a possible determinant of population growth levels in Table 6.

Table 6. Growth and human capital

	Growth 1991-2001:							
	total	total	nationals	nationals	EU	EU	non-EU	non-EU
birth rate	18.20 [0.000]	17.98 [0.000]	17.54 [0.000]	20.93 [0.001]				
population 1991	-0.005 [0.463]	-0.010 [0.128]	0.039 [0.000]	0.034 [0.008]	-0.384 [0.141]	-0.219 [0.440]	-0.310 [0.059]	-0.176 [0.431]
population density 1991	-0.010 [0.077]	-0.009 [0.003]	-0.061 [0.000]	-0.062 [0.000]	0.031 [0.893]	-0.108 [0.586]	0.237 [0.058]	0.037 [0.808]
% highly educated 2001	-0.077 [0.530]	0.115 [0.401]	-0.080 [0.633]	-0.285 [0.149]	15.16 [0.043]	27.80 [0.007]	2.630 [0.245]	3.191 [0.026]
students per capita 2001	0.246 [0.004]	0.070 [0.486]	0.385 [0.013]	0.500 [0.005]	-8.008 [0.052]	-14.24 [0.005]	-0.384 [0.752]	-0.627 [0.736]
country dummies	no	yes	no	yes	no	yes	no	yes
R2	0.359	0.601	0.586	0.645	0.252	0.504	0.110	0.358
nr. obs	136	136	70	70	60	60	60	60

Notes: p-values in brackets. Bold faced coefficient are significant at the 10% level at least. Population, population density, and students per capita are in logs.

A highly educated population is positively correlated with both EU and non-EU population growth. This confirms the notion that international migration within Europe mainly concerns the higher educated. Cities' national-born population growth, on the other hand, is not correlated with a highly educated population, so that (national-born population growth having by far the biggest share in total population

growth) total population growth is uncorrelated with this proxy of human capital. This is notably different from the results in the US, where human capital levels are one of the most robust explanations of cities' total population growth; see e.g. Glaeser et al. (2001) and Black and Henderson (1999). The other proxy we use for human capital, a city's number of students, is positively (and significantly) correlated with national-born population growth and negatively correlated with non-national population growth (also significantly so in case of EU population). We do not pay much attention to this however, since its validity as a proxy for human capital is questionable and, as put forward by e.g. Marlet and van Woerkens (2005), students per capita is probably a better proxy for a city's level of amenities since students are a conspicuous population category demanding and supplying high amenity levels. Also, students not significantly correlated with total population growth once we look at the variation within one country, suggesting that this variable could also capture differences in education level between European countries.

4.3 Growth and amenities

As announced in section 2, this category of variable possibly explaining population growth will now be refined a little further into subcategories of climate-related variables and of urban (dis)amenities.

Table 7. Growth and the weather

	Growth 1991-2001:							
	total	total	nationals	nationals	EU	EU	non-EU	non-EU
birth rate	16.57 [0.000]	16.53 [0.000]	27.68 [0.000]	29.04 [0.000]				
population 1991	-0.022 [0.002]	-0.012 [0.049]	-0.005 [0.781]	-0.004 [0.738]	0.055 [0.817]	0.361 [0.485]	-0.377 [0.161]	0.552 [0.149]
population density 1991	-0.005 [0.031]	-0.007 [0.001]	-0.025 [0.288]	-0.009 [0.634]	-0.541 [0.111]	-0.971 [0.208]	-0.328 [0.330]	-1.226 [0.006]
sun hours per day	-0.037 [0.451]	0.049 [0.380]	0.073 [0.358]	0.060 [0.372]	1.286 [0.328]	-0.208 [0.871]	4.640 [0.013]	0.967 [0.485]
rainy days per year	-0.016 [0.467]	-0.003 [0.892]	0.074 [0.214]	0.176 [0.712]	0.574 [0.451]	1.182 [0.461]	0.137 [0.866]	3.013 [0.006]
avg temp. coldest month	0.002 [0.178]	0.001 [0.568]	-0.002 [0.627]	0.002 [0.402]	-0.107 [0.211]	-0.160 [0.278]	-0.124 [0.332]	-0.165 [0.163]
avg temp. warmest month	0.002 [0.515]	-0.002 [0.632]	0.008 [0.172]	-0.210 [0.517]	0.066 [0.231]	0.254 [0.435]	0.224 [0.001]	0.523 [0.009]
country dummies	no	Yes	no	yes	no	yes	no	yes
R2	0.296	0.687	0.357	0.688	0.079	0.126	0.645	0.832
nr. obs	137	137	63	63	53	53	53	53

Notes: p-values in brackets. Bold faced coefficient are significant at the 10% level at least. Population, population density, sun hours per day and rainy days per year are in logs.

Table 7 shows the results when focusing on the climate related variables. Contrary to the US findings, where people move towards cities with many sun hours, few rainy days per year, relatively high temperatures in winter and modest temperatures in summer (Mueser 1995 and Rappaport 2006), we find no significant correlations between total, national or EU population growth and any of these climate-related variables. Nor do we find evidence, as provided in Cheshire and Magrini (2006), that weather matters only nationally; and when country dummies are included, the weather still remains insignificant. In our view, this insignificance of weather variables is for at least a substantial part due to the fact that climate conditions do not greatly vary between cities in the same country (especially when compared to e.g. the USA). They do vary between cities in different countries, but, given the reluctance of Europeans to move across borders (see Boekema et al. 2000), these do not have a big impact on city's growth rates.

Strikingly we do find significant correlations when looking at non-EU population growth. We are, however, not convinced that this finding has anything to do with a preference for cities with warmer climates. Instead we think it probably reflects, to a high extent, the fact that many cities in the southern part of Europe are dealing with large numbers of non-EU migrants entering the European Union territories (partly due to the fact that southern Europe is located very close to North-Africa).

The results for urban (dis)amenities in Table 8 show more significant correlations. As in Glaeser et al. (2001), we do find a positive correlation between our two proxies for urban amenities and total, national as well as non-EU population. EU population growth, again, does not significantly correlate with any of the variables included.

When using museums and theaters per capita instead of the proxies, the results are less significant. Only when controlling for the differences in total population growth rate between countries, we find a positive correlation with musea per capita (not found in Glaeser et al. (2001)). When looking at the correlation with our measures of urban disamenities, we find that differences in murder rates between cities in different European countries are negatively correlated with total population growth. Total crime rates are (perhaps predictably – see the remarks in section 2) not significantly correlated with population growth rates. Overall, one can say that the evidence in favor of a large effect of urban (dis)amenities on population growth is only marginally present.

Table 8. Growth and urban (dis)amenities

	Growth 1991-2001:							
	total	total	total	total	nationals	nationals	nationals	nationals
birth rate	18.25 [0.000]	13.90 [0.000]	18.67 [0.000]	15.37 [0.002]	22.25 [0.000]	20.61 [0.001]	18.11 [0.001]	29.69 [0.001]
population 1991	-0.006 [0.363]	-0.005 [0.449]	-0.009 [0.206]	-0.005 [0.545]	0.013 [0.274]	0.008 [0.511]	0.019 [0.248]	0.0002 [0.989]
population density 1991	-0.008 [0.006]	-0.008 [0.004]	-0.007 [0.004]	-0.008 [0.000]	-0.036 [0.042]	-0.029 [0.090]	-0.029 [0.269]	0.0001 [0.997]
hotel stays per capita 2001	0.009 [0.020]	0.011 [0.007]			0.012 [0.013]	0.012 [0.015]		
% horeca + retail 2001	0.469 [0.002]	0.818 [0.000]			0.273 [0.152]	0.721 [0.007]		
murder rate 2001	-881.4 [0.000]	-172.9 [0.587]	-589.9 [0.000]	278.6 [0.308]	-445.0 [0.348]	-310.3 [0.511]	275.8 [0.175]	452.5 [0.258]
crime rate 2001	0.114 [0.533]	-0.187 [0.501]	0.125 [0.386]	-0.375 [0.133]	-0.311 [0.225]	-0.197 [0.511]	-0.181 [0.397]	-0.262 [0.468]
musea per capita 2001			145.9 [0.380]	345.6 [0.031]			238.1 [0.326]	383.2 [0.088]
theaters per capita 2001			-156.1 [0.614]	-435.3 [0.183]			-456.3 [0.309]	-496.9 [0.232]
country dummies	no	yes	no	yes	no	yes	no	yes
R2	0.633	0.729	0.435	0.649	0.653	0.700	0.314	0.558
nr. obs	82	82	93	93	60	60	50	50
	growth:	EU	EU	EU	EU	non-EU	non-EU	non-EU
population 1991	0.066 [0.848]	0.520 [0.347]	0.468 [0.210]	0.520 [0.407]	-0.338 [0.133]	-0.170 [0.410]	-0.176 [0.346]	-0.250 [0.330]
population density 1991	0.088 [0.794]	-0.844 [0.212]	-0.711 [0.214]	-0.738 [0.429]	0.001 [0.997]	-0.419 [0.170]	-0.291 [0.616]	0.412 [0.328]
hotel stays per capita 2001	0.098 [0.686]	0.064 [0.785]			0.205 [0.029]	0.134 [0.093]		
% horeca + retail 2001	0.247 [0.956]	-13.57 [0.111]			8.973 [0.093]	-5.046 [0.206]		
murder rate 2001	-18506 [0.383]	-28918 [0.214]	-8344 [0.153]	-11266 [0.256]	38042 [0.104]	23996 [0.193]	110.9 [0.978]	5805 [0.436]
crime rate 2001	4.352 [0.606]	-0.894 [0.937]	1.233 [0.752]	2.580 [0.756]	-3.093 [0.466]	-1.924 [0.548]	-2.625 [0.724]	1.652 [0.575]
musea per capita 2001			745.1 [0.872]	-184.3 [0.977]			4396 [0.562]	11443 [0.153]
theaters per capita 2001			5553 [0.425]	5511 [0.599]			-4812 [0.639]	-9398 [0.233]
country dummies	no	yes	no	yes	no	yes	no	yes
R2	0.039	0.199	0.081	0.090	0.465	0.665	0.162	0.750
nr. obs	49	49	41	41	49	49	41	41

Notes: p-values in brackets. Bold-faced coefficients are significant at the 10% level at least. Population, population density and hotel stays per capita are in logs.

5. CONCLUSIONS

In this paper we examine growth differences between European cities using a recent dataset from Eurostat, the Urban Audit. Our results show that urban growth in the EU is pretty persistent and is still, in spite of further European integration, largely driven by growth of national born population; non-national European born and non-European born migrants contribute only marginally to urban growth differences. Moreover differences in birth rates explain a substantial part of the variation in (national-born

population) growth rates. Controlling for these differences in birth rates, we find that, overall, the smaller, less dense, safer, amenity-rich cities with high levels of GDP per capita are growing fastest. When a distinction is made between national, EU and non-EU population growth, we moreover find that nationals are attracted to the less dense, amenity-rich, more productive cities, that EU non-nationals are concentrated in cities with high levels of human capital, and that non-EU population growth is determined by climate and employment structure.

Like in the US, people in Europe tend to leave the larger and denser cities, despite the higher amenity values and economic opportunities they generally offer. This could have something to do with crime, or other disamenities in cities. But we think it is more likely that highly valued cities continue to attract highly educated people with higher incomes, who, since they demand more space and can afford it, are not in the short run necessarily increasing total population in these cities but tend to be replacing other people. The effect of increasing house prices on urban population growth and, more importantly, its composition, would in our view thus be an interesting direction for future research. Some studies in the US (Clark 2001) and individual European countries (Marlet, Van Woerkens, 2005) already look at the issue, but for the European Union as a whole, we – despite the new Urban Audit – still lack appropriate data to conduct such an analysis.

Figure A1. Cities included in the Urban Audit dataset.

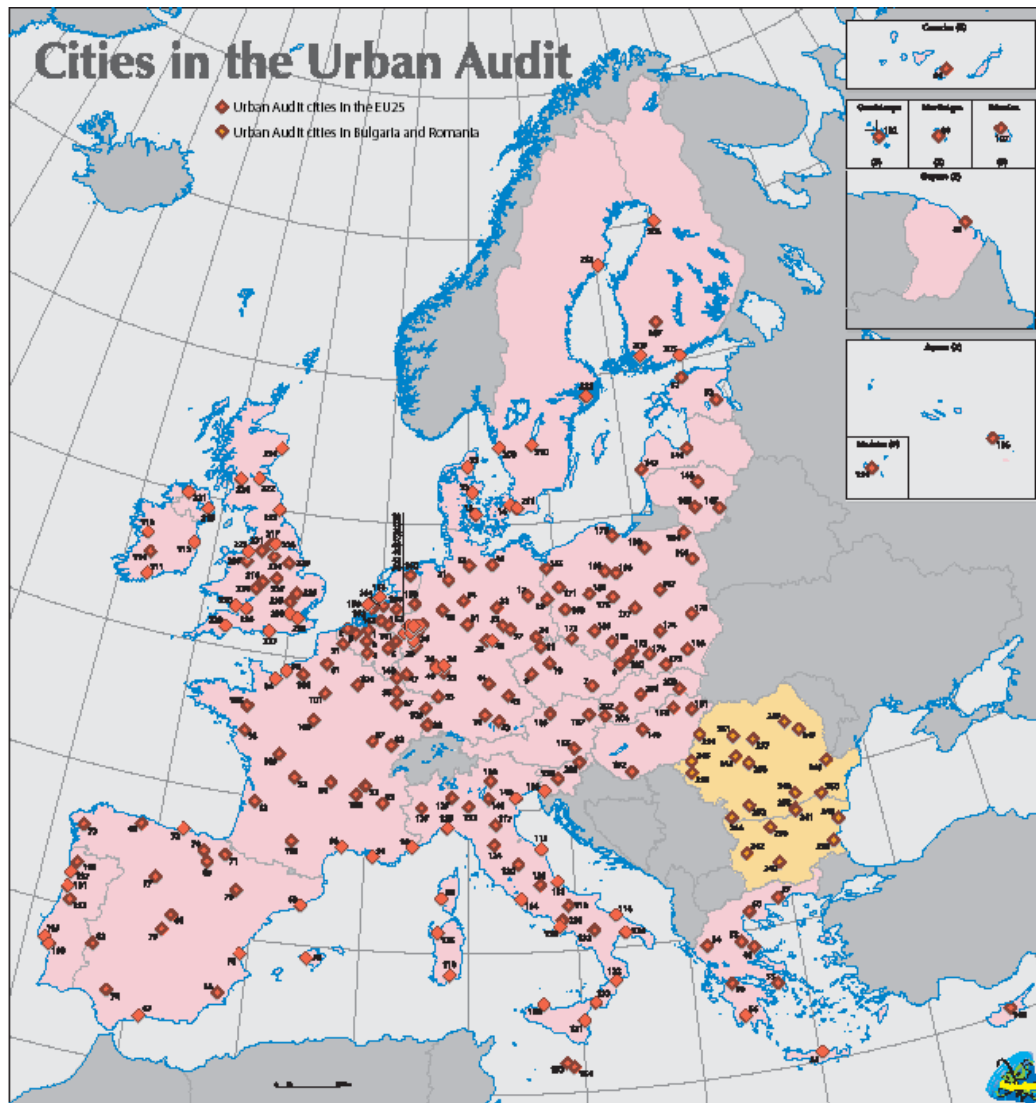


Table A1 Cities in the Urban Audit – data availability (x = observation available)

city	total growth	growth nationals	growth EU	growth non-EU	population	population	population density	birth rates	musea	theaters	hotel stays	% horeca + retail	sun hours per day	rainy days per year	avg temp. coldest month	avg temp. warmest month	% highly educated	students	% industry	crime rate	murder rate	unemployment	GDP per capita	headquarters	capital?
Wien	X	X	X	X	X	X	X	X	X	X	X						X			X	X			X	X
Graz	X				X	X	X	X	X	X	X		X	X	X	X				X				X	
Linz	X				X	X	X	X	X	X	X		X	X	X	X				X	X			X	
Bruxelles / Brussel	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X		X	X	X		X	X
Antwerpen	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X		X	X	X	X	X	
Gent	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X		X	X	X	X	X	
Charleroi	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X		X	X	X	X	X	
Liège	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X		X	X	X	X	X	
Brugge	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		X		X	X	X	X	X	
Sofia	X				X	X	X	X	X	X	X		X	X	X	X	X	X		X	X			X	X
Plovdiv	X				X	X	X	X	X	X	X		X	X	X	X	X	X		X	X			X	
Varna	X				X	X	X	X	X	X	X		X	X	X	X	X	X		X	X			X	
Burgas	X				X	X	X	X	X	X	X		X	X	X	X	X	X		X	X			X	
Pleven	X				X	X	X	X			X		X	X	X	X	X	X		X	X			X	
Ruse	X				X	X	X	X	X	X	X		X	X	X	X	X	X		X	X			X	
Vidin	X				X	X	X	X			X		X	X	X	X	X	X		X	X			X	
Lefkosia		X				X	X				X	X	X	X	X				X			X			X
Praha	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X
Brno	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Ostrava	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Plzen	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Usti nad Labem	X	X			X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X			
Berlin	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X
Hamburg	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
München	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Köln	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Frankfurt am Main	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Essen	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Leipzig	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Dresden	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Dortmund	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	
Düsseldorf	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Bremen	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Hannover	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Nürnberg	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Bochum	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Wuppertal	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Bielefeld	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Halle an der Saale	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Magdeburg	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Wiesbaden	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Göttingen	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

city	total growth	growth nationals	growth EU	growth non-EU	population	population	population density	birth rates	musea	theaters	hotel stays	% horeca + retail	sun hours per day	rainy days per year	avg temp. coldest month	avg temp. warmest month	% highly educated	students	% industry	crime rate	murder rate	unemployment	GDP per capita	headquarters	capital?
Mülheim a.d.Ruhr	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	
Moers	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		
Darmstadt	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Trier	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		
Freiburg im Breisgau	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Regensburg	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Frankfurt (Oder)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	
Weimar	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Schwerin	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	
Erfurt	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Augsburg	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		
Bonn	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		
Karlsruhe	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		
Mönchengladbach	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Mainz	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		
København	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X		X
Aarhus	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	
Odense	X	X	X	X	X	X	X	X	X	X							X	X		X	X	X	X		
Aalborg	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X		X	X	X	X	X	
Tallinn	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
Tartu	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		
Madrid	X				X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X			X
Barcelona	X				X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X			
Valencia	X				X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X			
Sevilla	X				X	X	X	X	X		X	X	X	X	X	X			X	X	X	X			
Zaragoza	X				X	X	X	X			X	X	X	X	X	X			X	X	X	X			
Málaga	X				X	X	X	X			X	X	X		X	X			X	X	X	X			
Murcia	X				X	X	X	X	X	X	X		X		X	X				X	X	X			
Las Palmas	X				X	X	X	X			X	X	X		X	X			X	X	X	X			
Valladolid	X				X	X	X	X			X	X	X		X	X			X	X	X	X			
Palma di Mallorca	X				X	X	X	X					X		X	X				X	X	X			
Santiago de Compostela	X				X	X	X	X	X	X		X	X	X	X	X			X	X	X	X			
Vitoria/Gasteiz	X				X	X	X	X	X	X			X	X	X	X				X	X	X			
Oviedo	X				X	X	X	X			X	X	X		X	X			X	X	X	X			
Pamplona/Iruña	X				X	X	X	X			X	X	X		X	X			X	X	X	X			
Santander	X				X	X		X	X	X	X		X	X	X	X				X	X	X			
Toledo	X				X	X	X	X					X		X	X				X	X	X			
Badajoz	X				X	X	X	X					X		X	X				X	X	X			
Logroño	X				X	X	X	X				X	X	X	X	X			X	X	X	X			
Helsinki	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X
Tampere	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X		X	X			X	
Turku	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X		X	X			X	
Oulu	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X			X	X	X		X	

city	total growth	growth nationals	growth EU	growth non-EU	population	population	population density	birth rates	musea	theaters	hotel stays	% horeca + retail	sun hours per day	rainy days per year	avg temp. coldest month	avg temp. warmest month	% highly educated	students	% industry	crime rate	murder rate	unemployment	GDP per capita	headquarters	capital?
Paris	X				X								X		X	X		X						X	X
Paris avec petite couronne					X		X			X	X	X	X		X	X		X	X	X	X			X	X
Lyon	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Toulouse	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Strasbourg	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Bordeaux	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Nantes	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Lille	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Montpellier	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Saint-Etienne	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Le Havre	X	X	X	X	X	X	X	X			X		X		X	X	X	X		X	X			X	
Rennes	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Amiens	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Rouen	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Nancy	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Metz	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Reims	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Orléans	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Dijon	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Poitiers	X	X	X	X	X	X	X	X				X	X		X	X	X	X	X	X	X			X	
Clermont-Ferrand	X	X			X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Caen	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Limoges	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Besançon	X	X	X	X	X	X	X	X			X		X		X	X	X	X		X	X			X	
Grenoble	X	X			X	X	X	X			X		X		X	X	X	X		X	X			X	
Ajaccio	X	X	X	X	X	X	X	X					X		X	X	X	X		X					
Saint Denis	X	X	X	X	X	X		X			X		X		X	X	X	X		X	X			X	
Pointe-a-Pitre	X	X	X	X	X	X		X					X		X	X	X	X		X					
Fort-de-France	X	X	X	X	X	X		X					X		X	X	X	X		X	X				
Cayenne			X		X			X					X		X	X	X	X		X				X	
Marseille	X	X	X	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X			X	
Nice	X	X	X	X	X	X	X	X					X		X	X	X	X		X	X			X	
Athina	X	X	X	X	X	X	X	X	X				X		X		X					X		X	X
Thessaloniki	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X					X		X	
Patra	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X					X		X	
Irakleio	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X					X		X	
Larisa	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X					X		X	
Volos	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X					X		X	
Ioannina	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X					X		X	
Kavala	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X					X		X	
Kalamata	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X					X		X	
Budapest	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
Miskolc	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	
Nyiregyhaza	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			

city	total growth	growth nationals	growth EU	growth non-EU	population	population	population density	birth rates	musea	theaters	hotel stays	% horeca + retail	sun hours per day	rainy days per year	avg temp. coldest month	avg temp. warmest month	% highly educated	students	% industry	crime rate	murder rate	unemployment	GDP per capita	headquarters	capital?
Pecs	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	
Dublin	X	X	X	X	X	X		X					X	X	X	X		X				X			X
Cork	X	X	X	X	X	X		X					X	X	X	X		X				X			
Limerick	X	X	X	X	X	X		X					X	X	X	X		X							
Galway	X	X			X	X		X					X	X	X	X	X	X				X			
Roma	X	X	X	X	X	X	X	X	X		X	X		X		X			X		X	X		X	X
Milano	X	X	X	X	X	X	X	X	X		X	X		X		X		X	X			X		X	
Napoli	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Torino	X	X	X	X	X	X	X	X	X		X	X		X	X	X			X			X		X	
Palermo	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X			X	X	X	X		X	
Genova	X	X	X	X	X	X	X	X	X		X	X		X	X	X		X	X			X		X	
Firenze	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Bari	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Bologna	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X			X	X	X	X		X	
Catania	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Venezia	X	X	X	X	X	X	X	X			X	X	X	X	X	X			X			X		X	
Verona	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Cremona	X	X	X	X	X	X	X	X			X	X							X			X		X	
Trento	X	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X		X	
Trieste	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Perugia	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Ancona	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X	X		X		X	
I'Aquila	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Pescara	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Campobasso	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Caserta	X	X	X	X	X	X	X	X			X	X							X			X		X	
Taranto	X	X	X	X	X	X	X	X			X	X							X			X		X	
Potenza	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Catanzaro	X	X	X	X	X	X	X	X			X	X							X			X		X	
Reggio di Calabria	X	X	X	X	X	X	X	X			X	X			X				X			X		X	
Sassari	X	X	X	X	X	X	X	X			X	X							X			X		X	
Cagliari	X	X	X	X	X	X	X	X			X	X		X	X	X			X			X		X	
Vilnius	X				X	X	X	X	X	X	X	X	X		X	X	X	X		X	X				X
Kaunas	X				X	X	X	X	X	X	X	X	X		X	X	X	X		X	X				
Panevezys	X				X	X	X	X	X	X	X	X			X	X	X	X		X	X				
Luxembourg	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
Riga	X				X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X				X
Liepaja	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
Valletta																									X
Gozo																									
s' Gravenhage	X				X	X	X	X	X	X	X		X	X	X	X	X				X		X		
Amsterdam	X				X	X	X	X	X	X	X		X	X	X	X	X				X		X		X
Rotterdam	X				X	X	X	X	X	X	X		X	X	X	X	X				X		X		
Utrecht	X				X	X	X	X	X	X	X		X	X	X	X	X			X	X		X		

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Eindhoven	X				X	X	X	X		X			X	X	X	X	X			X	X			X		
Tilburg	X				X	X		X	X	X			X	X	X	X				X	X			X		
Groningen	X				X	X		X	X	X	X		X	X	X	X	X				X			X		
Enschede	X				X	X		X	X	X			X	X	X	X				X	X			X		
Arnhem	X				X	X	X	X	X	X	X		X	X	X	X	X				X			X		
Heerlen	X				X	X	X	X	X	X	X		X	X	X	X	X			X	X			X		
Warszawa					X			X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X
Lodz	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Krakow	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Wroclaw	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Poznan	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Gdansk					X			X	X	X	X	X		X	X	X	X	X	X	X			X	X		
Szczecin	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Bydgoszcz	X				X	X	X	X	X	X	X	X					X	X	X	X			X	X		
Lublin	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Katowice	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Bialystok	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X			
Kielce	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Torun					X			X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Olsztyn					X			X	X	X	X	X		X	X	X	X	X	X	X			X	X		
Rzeszow	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X			
Opole	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Gorzow Wielkopolski					X			X	X	X	X	X	X	X	X	X	X	X	X	X			X			
Zielona Gora	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Jelenia Gora	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Nowy Sacz	X				X	X	X	X	X		X	X	X	X	X	X	X	X	X	X			X			
Suwalki	X				X	X	X	X	X		X	X	X	X	X	X	X	X	X	X			X			
Konin	X				X	X	X	X	X		X	X					X	X	X	X			X			
Zory	X				X	X	X	X	X		X	X					X		X	X			X			
Lisboa	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Oporto	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	X		
Braga	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X		X	X	X		
Funchal	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X		X	X	X		
Coimbra	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X		X	X	X		
Setubal	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X		X	X	X		
Ponto Delgada	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X		X	X	X		
Aveiro	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X		X	X	X		
Bucuresti					X			X	X	X	X				X	X	X	X	X						X	
Cluj-Napoca					X			X	X	X	X				X	X	X	X	X							
Timisoara					X			X	X	X	X				X	X	X	X	X							
Craiova					X			X	X	X	X						X	X	X							
Braila					X			X	X	X	X						X	X	X							
Oradea					X			X	X	X	X				X	X	X	X	X							
Bacau					X			X	X	X	X				X	X	X	X	X							

city	total growth	growth nationals	growth EU	growth non-EU	population	population	population density	birth rates	musea	theaters	hotel stays	% horeca + retail	sun hours per day	rainy days per year	avg temp. coldest month	avg temp. warmest month	% highly educated	students	% industry	crime rate	murder rate	unemployment	GDP per capita	headquarters	capital?
Arad				X				X	X	X	X	X					X	X	X						
Sibiu				X				X	X	X	X	X			X	X	X	X	X						
Targu Mures				X				X	X	X	X	X			X	X	X	X	X						
Piatra Neamt				X				X	X	X	X	X					X	X	X						
Calarasi				X				X	X	X	X	X					X	X	X						
Giurgiu				X				X	X	X	X	X					X	X	X						
Alba Iulia				X				X	X	X	X	X					X	X	X						
Stockholm	X			X	X	X	X	X	X	X	X	X					X	X	X	X				X	X
Göteborg	X			X	X	X	X	X	X	X	X	X					X	X	X	X				X	
Malmö	X			X	X	X	X				X	X					X	X	X	X				X	
Jönköping	X			X	X	X	X	X	X	X	X	X					X	X	X	X				X	
Umeå	X			X	X	X	X	X	X	X	X	X					X	X	X	X				X	
Ljubljana	X			X	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X				X
Maribor	X			X	X	X	X			X	X		X	X	X	X	X	X		X	X				
Bratislava	X			X	X			X	X	X	X		X	X	X	X	X	X		X	X				X
Kosice	X			X	X	X	X	X	X	X			X	X	X	X	X				X				
Banska Bystrica	X			X	X	X	X	X	X		X		X	X	X	X	X	X		X	X				
Nitra	X			X	X	X	X	X	X		X		X	X	X	X	X	X		X	X				
London	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X			X	X	X	X
Inner London	X			X	X	X	X	X	X	X		X					X	X	X	X				X	X
Birmingham	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Leeds	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Glasgow	X			X	X	X	X	X	X	X			X	X	X	X	X	X		X			X	X	
Bradford	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Liverpool	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Edinburgh	X			X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Manchester	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Cardiff	X			X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Sheffield	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Bristol	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Belfast	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Newcastle upon Tyne	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Leicester	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Derry	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Aberdeen	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	
Cambridge	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Exeter	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Lincoln	X			X	X	X	X	X	X	X			X	X	X	X	X	X		X	X	X	X	X	
Gravesham	X			X	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	
Stevenage	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Wrexham	X			X	X	X	X			X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Portsmouth	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Worcester	X			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
nr. observations	235	134	120	119	256	237	221	253	183	167	203	186	201	180	231	230	196	181	184	198	161	146	99	178	260

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