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Regional quality of living in Europe

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Abstract. This article sets out the conceptual framework and results of Regional Quality of Living indicators that were developed in order to benchmark European NUTS2 regions. Nine non-business-related indicators are constructed to support the goal of policy makers to improve the attractiveness of regions and cities for people or companies to settle in, and by doing so create economic growth. Each of the constructed indicators represents a pillar of the Quality of Living. The highest indicator scores are found for regions within Switzerland, Sweden, Norway and the Netherlands. Some countries show a wide divergence between regional scores. The southern regions of Italy and Spain, for example, have significantly lower scores than those in the north. In addition, capital city regions have better *RQI* scores. A positive correlation was found between the average *RQI* scores and both GDP per capita and weighted population density. Compared to GDP per capita, weighted population density has a modest influence on the *RQI* score. The European regions are divided into 11 clusters, based upon GDP per capita and weighted population density in order to benchmark a region with its peers.

1 Introduction

An ambition shared by all European countries is to create economic growth. In his book "Triumph of the city: How our greatest invention makes us richer, smarter, greener, healthier and happier" Glaeser (2011) focused on cities as important sources for economic growth and hot-spots of innovation. The Brookings Institution (Katz, Bradley 2013) and McKinsey's Global Institute (Dobbs et al. 2011) emphasized that cities and metropolitan regions are attractive places for people to settle and businesses to operate and are thus the engines for economic growth.

In order to create economic growth, the strengthening of competitiveness is essential; an important aspect of this competitiveness is the "quality of living". The Dutch government (IenM 2012) emphasizes the importance of strong regions with a good "quality of living" as well as good connections to the rest of Europe and the world.

Results from several studies have been published about the attractiveness of the Dutch regions for companies in terms of the economic environment (Raspe et al. 2010, Weterings et al. 2011). The Regional Competitiveness Index (Dijkstra et al. 2011, Annoni, Dijkstra 2013) shows the competitiveness of European regions. These studies mainly took economic

factors into account, without including the "quality of living" factors for residents and employees. Although economic factors are important in determining the attractiveness of regions for companies, the quality of the (social, political, natural, etc.) environment for employees also plays an important role and therefore deserves attention. Currently, "quality of living" is not being monitored systematically.

A set of nine indicators characterizing the Regional Quality of Living Index (*RQI*) aims to fill this gap. These indicators provides a European-wide benchmark of non-business-related indicators that are important to living standards and the quality of the human environment. This set of indicators offers the first comprehensive picture of the "quality of living" in almost all NUTS2 regions of the European continent, including all EU-countries and the non-EU-countries Norway and Switzerland.

Improvement of *RQI* scores may also contribute to achieving the objectives formulated in the Europe 2020 10-year strategy proposed by the European Commission on March 2010 (European Commission 2010) for the economic advancement of the European Union. The results can be used for other purposes as well: to improve the attractiveness of specific regions for students, or in the context of population decline.

A study of the "quality of living" in The Netherlands (Lagas et al. 2014) shows that Dutch regions are doing very well, and are comparable to the highest ranking European regions.

2 Methods

2.1 Theory

A review of the scientific literature on "quality of living" leads to the conclusion that, at present, there is no consensus on either the definition of the concept or specification of the underlying dimensions (Morais, Camanho 2011, van Kamp et al. 2003). Several terms and definitions are presented in the literature for concepts such as "quality of living", "quality of life", "liveability", and "standards of living". "Quality of living", as a concept, is attracting growing interest in the scientific literature. The subject has been picked up from different points of view by various institutes and researchers.

Regional Quality of Living (life) in the European Commission

In the European Union this topic gained more attention as it has become an essential element in the development of cities and regions. A European Parliament resolution (2005) on regional expansion indicates that these places are not only locations where problems are concentrated, but also where the future lies.
In 2008 the Commission on the Measurement of Economic Performance and Social Progress (CMEPSP) was created at the instigation of President Sarkozy of France because he was dissatisfied with the current level of statistical information about the state of the economy and society. The Commission's aim was to identify the limits of GDP as an indicator of economic performance and social progress. It was suggested that more attention should be given to "quality of life" as well as to Sustainable Development and the Environment (Stiglitz et al. 2009). Eurostat recently published new Quality of Life indicators for various countries in Europe (Eurostat 2015a).

Internationally, there are several indices that reflect "quality of living" or "liveability". Several research institutes or business consultants have considered this concept from various angles and at different levels of aggregation.

The Mercer Quality of Living index (Mercer 2010) and the Liveability index (EIU 2015) are used for determining the amount of compensation awarded to workers who temporarily have had to accept a lower standard of living. These indices and underlying indicators are intended for people working for companies in foreign countries. Other indices like International Living (2010) and NUMBEO (2012) focus on holiday and retirement situations. Another difference between several indices found in the literature is the level of analysis. Some international indices were published with a benchmark for countries (International Living 2010, OECD 2012a, EIU 2015). Country data, however,

are not generally representative of regions because of the heterogeneity of countries. City indices are published by institutions, such as in the Quality of Living Index (Mercer 2010), the Economist Intelligence Unit's Liveability Index (EIU 2012) and Monocle's Most Liveable Cities index (Monocle 2011) for a limited number of cities.

Most of the indices mentioned and underlying data are commercially developed and not publicly available. At the moment there is no benchmark for European regions as concerns "quality of living" indices compiled from public data that are freely available.

2.1.1 Quality of living characterized by 9 indicators

Indicators and sub-indicators were chosen that are important for individuals, including their families, working at multinationals, as they may consider settling in a foreign region either for some time or permanently. After reviewing several indicators applied in the Quality of Living Index (Mercer 2010), Liveability Index (EIU 2012) and OECD Better Life Index (OECD 2012a), data was selected for 25 sub-indicators and nine indicators representing our *RQI* (Figure 1).

2.1.2 NUTS 2 regions as level of analysis

Using the Nomenclature of Territorial Units for Statistics (NUTS) for the journal European Regions, developed and regulated by the EU, the choice for the level of analysis was between NUTS0 regions (countries), NUTS1 regions (certain parts of countries), NUTS2 regions (provinces), and NUTS3 regions (city regions) or metropolitan regions (individual cities including smaller cities). The disadvantage of data at the national level is that these data are not representative of important regions within a country, as some countries are very heterogeneous. Italy, for example, where there is a wide divergence between the less developed south and the more developed north. The same applies to Turkey, Flemish and Walloon Belgium, former East and West Germany, and the southern and northern parts of Sweden, Finland and Norway.

Glaeser (2011) focuses on cities as important sources for economic growth, but for "quality of living" the surrounding area is important as well. For people living in cities, elements like Outdoor Recreation, Public Services (e.g. infrastructure around cities) and the Natural Environment are important factors for the Quality of Living. According to Hyslop (2013), metropolitan regions would be the preferred choice. This spatial level however isn't officially regulated by the EU and, consequently, available data are scarce.

Considering the relevance of the spatial level and data availability, data were collected for the European NUTS2 regions (NUTS2 codes 2010). This is in line with former research carried out by the PBL on Dutch top sectors and their European competitors (Raspe et al. 2012). NUTS2 is adopted as the spatial level of analysis by several other researchers, like the EU Regional Competitiveness Index (Dijkstra et al. 2011, Morais, Camanho 2011). In our study the non-EU member countries Norway and Switzerland were also taken into account because they are an integral part of the European economic system as members of the European Free Trade Association (EFTA).

2.2 Methods of data handling

The methods of data handling for creating the *RQI* were performed according to the OECD handbook on constructing composite indicators (Nardo, Saisana 2008). Data from reliable public sources like Eurostat, ESPON, Worldbank, OECD and several other sources (Lagas et al. 2014) are used in this study. Most of the data were available for the NUTS2 level. In other cases data available for NUTS0, NUTS1 or NUTS3 and City level were used to calculate regional indicator scores (Appendix A.2). Depending on the nature and availability of the data, imputations are carried out.

City data from several databases (e.g. Eurostat: Urban Audit - 418 'key cites') were used for the calculation of the regional sub-indicators. We made the assumption that the living conditions of the inhabitants of the largest cities are representative of the majority of the population of the region. When a region contained two or more cities a population weighted average value was calculated and considered as representative for the region.

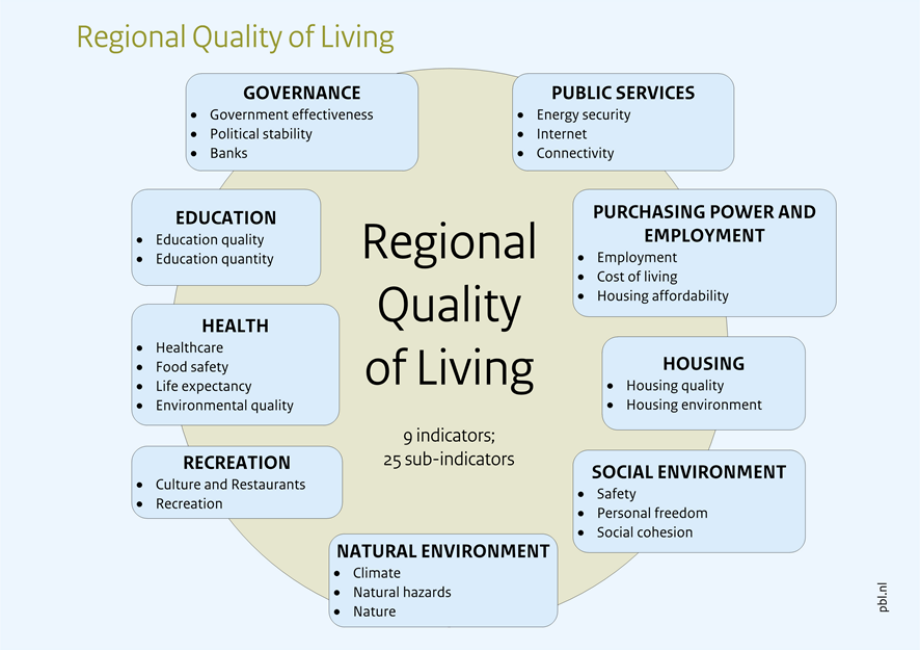


Figure 1: Indicators and sub-indicators to characterize the Quality of Living

Measurements of the indicators in the *RQI* were based preferably upon objective data, however we also used subjective data when objective regional data was unavailable.

2.2.1 Calculation of indicators and sub-indicators

Most of the indicators were calculated with at least two and up to seven underlying data sources (Appendix A.2). All sub-indicators and underlying data sources were scored using the Max–Min method: The score was normalized/scaled on the basis of the minimum and maximum score, resulting in a scoring between 1 and 10. For all indicators, a score of 10 represents the best and 1 the worst. Consequently, a low score does not automatically mean that the situation is bad or unacceptable, because only relative scores were calculated. Similarly, a high score does not necessarily mean a good or acceptable situation.

In some situations, outliers led to very high or very low average values of the data set or to a skewed distribution. When the average of the scaled data was lower than 4 or higher than 7, Winsorisation of the data was applied by taking the 95 percentile value as the maximum and/or the 5 percentile value as the minimum (Nardo, Saisana 2008).

When data were unreliable or unexplainable 'no data' (nd) were used. Expert judgement was applied to decide whether data were acceptable or not. For example, 'nd' was entered for the Spanish, Portuguese and French islands off the European continent and for some data sets for Iceland and non-EU countries, such as Turkey, Switzerland, Norway, Croatia, Liechtenstein and Macedonia. Most of the analyses were therefore performed for 305 NUTS2 regions.

Some regions are merged with surrounding ones to correct the bias resultant from commuting patterns. This was done for Wien (AT12+AT13), Greater London (UKl1+UKl2+UKH2+UKH3), Berlin (DE30 +DE40), Greater Amsterdam (NL23+NL32), Praha (CZ01+CZ02) and Brussels (BE10+BE24+BE31). The adopted merge criteria are based on the new harmonized EC-OECD definition of cities and commuting zones (OECD 2013). If a city and its commuting zone covers multiple regions, and more than forty percent of the population of a region lives inside that city and commuting zone, then these regions were combined (Annoni, Dijkstra 2013).

2.2.2 Merging national data and regional perception data

When only objective data were available at the national scale and perception data available at the regional scale, we used these perception data for regional differentiation. The national average of the perception data for different regions inside a country was calculated. The deviation of this national average for a region was then used to calculate a regional value (Charron et al. 2012).

For example, the country sub-indicator A tells that Italy scored 7, while the regional sub-indicator B tells that the South Italian region scored 5 and the North Italian region scored 8, and the country average for all regions is 7.4. Thus the results after considering two sub-indicators are that the North Italian region scored 7*(8/7.4)=7,57 and the South Italian region scored 7*(5/7.4)= 4.72.

2.2.3 Distance decay method

The potential value scores were calculated for some sub-indicators by distance decay modeling and regional imputation (Equation 1). The values for a and b are estimated from empirical data. A matrix was developed for this purpose, containing the distances between all NUTS2 regions (316x316 matrix). For instance, we assumed that having a university within a distance of fifty kilometers gave a benefit of 60% and within a distance of one hundred kilometers a benefit of 10%.

$$P_i = \sum_{j=1}^{N} \frac{x_j}{1 + \exp(a + b \ln(d_{ij}))} \tag{1}$$

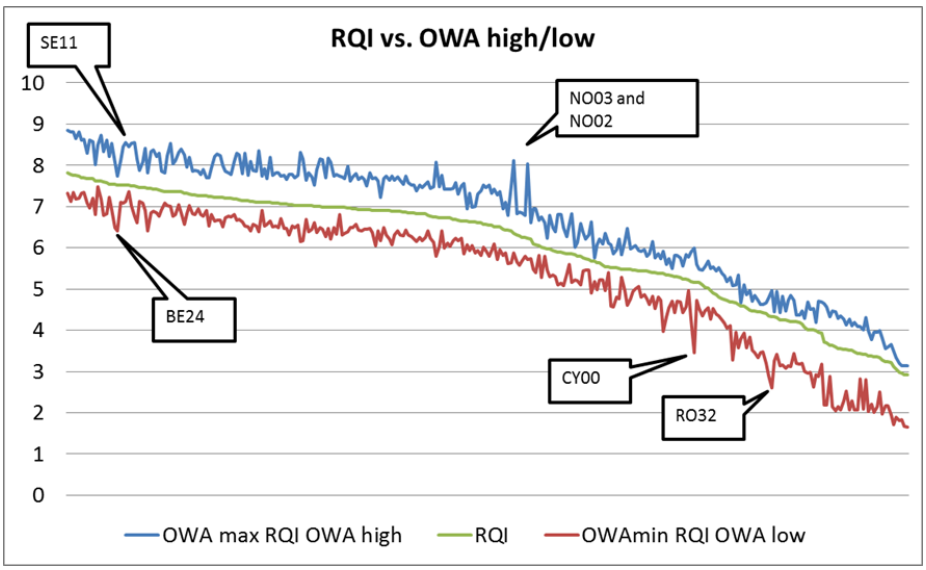
where P_i is the potential score of region i, x_j is the number of universities in region j, and d_{ij} is the distance between region i and region j. The parameter a controls the decay of the curve, b the steepness of the curve.

2.2.4 Weighting and sensitivity

Although the primary aim of this study is to construct a set of indicators to monitor the "quality of living", we constructed the *RQI* to compare the overall performance of regions. The *RQI* value is calculated as the average of the nine quality of living indicators, using an equal weighting method. We deliberately chose not to apply a specific weighting scheme, because we consider all nine categories of the *RQI* as important pillars in the "quality of living". The process of assigning weights is subjective by nature, it generally depends on the objective of the index in question. Equal weighting schemes are often used in the literature for composite indicators. After testing several weighting methods equal weights were chosen in a recent study (Sharpe, Andrews 2012). The study concluded that all methods have advantages and shortcomings and that weighting can be influenced by personal valuations.

Furthermore, we do not expect that there is a causality between the indicators other than that they are possibly influenced by common underlying factors like the regional GDP per capita. An advantage of equal weights is that weights do not change when data are updated, which is a disadvantage of weighting methods using the Data Envelop Analysis such as in Benefit of the Doubt (Cherchye et al. 2006). Therefore for the determination of the *RQI* the average score of the nine quality of living indicators was calculated.

The Ordered Weighted Averaging method (Yager 1996) was used to check for compensability effects. The *RQIOWA-max* and a *RQIOWA-min* were calculated (Figure 2). *RQIOWA-max* is the result of a calculation when the best characteristics of a region are focused on by applying higher weighting factors to these indicators (Equation 2). A weighting of 9 for best scoring category; 8 for the second best and 1 for the worst scoring category. *RQIOWA-min*, in parallel fashion, uses the same calculation method where the worst indicator scores for a region are given the highest weights. This weighting scheme is based upon our decision that no indicator should weigh more than 20% and no less than 2% for the total Index.



Note: Next to the *RQI* curve for 316 regions the corresponding *RQIOWA-max* and *RQIOWA-min* score curve are shown (see Equation 2).

Figure 2: Analysis of compensability effects by determination of Regional Quality of Living applying the equal weighting method and the Ordered weighted Averaging method

$$RQIOWA(c_1, c_2, \ldots, c_9) = \frac{\sum_{i=1}^{9} c_{(i)} w_i}{\sum_{i=1}^{9} w_i} \tag{2}$$

In this equation c_i indicates the score for category i, $c_{(i)}$ the scores in the respective order. The w_i are weighting factors, ranked from high to low. *RQIOWA* symbolizes the Ordered Weighted Averageing value for *RQI*.

Figure 2 shows that the scores of NUTS2 regions will change when either the best characteristics of a region or its worst characteristics are made the focus.

The results show that for some regions a higher ranking will be realized with *RQIOWA-max*, but will realize a lower ranking with *RQIOWA-min*, especially for some regions that have one extremely low score for one indicator (e.g. some Norwegion regions, shown in Figure 2). The opposite can be seen for regions with only one very good score (e.g. the Cyprus and Romanian region Bucaresti-Ilfov). For example, results for the regions of Bucuresti and Stockholm are thus:

RO32 Bucuresti-Ilfov: *RQIOWA-max*, *RQI*, *RQIOWA-min* respectively: 4.9, 4.3, 2.6 with rankings: 227; 246; 256.

SE01 Stockholm: *RQIOWA-max*, *RQI*, *RQIOWA-min* respectively: 8.6, 7.5, 7.1 rankings 12, 13 , 12.

3 Results

3.1 Map of European regions

On a map of the European regions (Figure 3) the highest values for the *RQI* can be seen in western Europe. A gradient from south to north and from east to west can be observed.

3.2 Capital regions in European countries

For most countries, the capital city region scored relatively higher than other regions in that country (Figure 4). Countries where their capital city region has extremely high

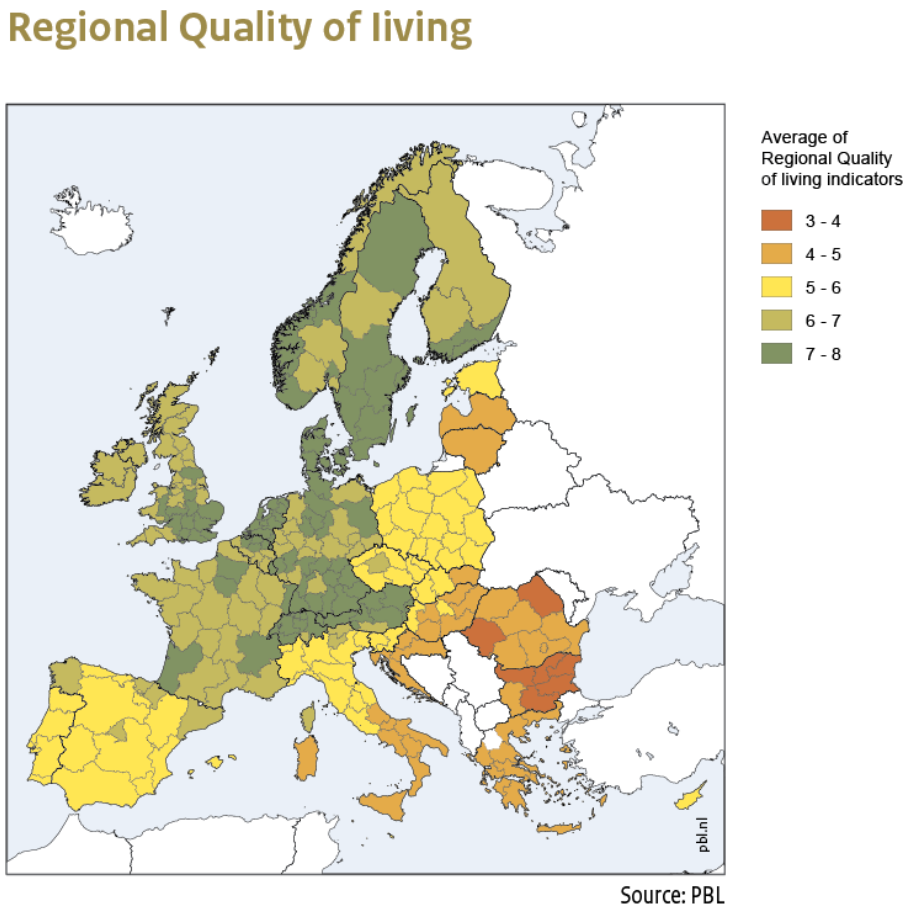


Figure 3: The Regional Quality of Living Index for European regions. Calculated as the average score of nine *RQI* indicators, each scaled 1 to 10

RQI scores are Norway (Oslo region), France (Paris, Iles de France region), Ireland (Dublin region), Czech (Prague region), Slovakia (Bratislava region) and Bulgaria (Sofia region, Yugozapaden region). This is in line with the statement of Glaeser (2011) that metropolitan city regions are important sources for economic growth and should therefore hold a better "quality of living". The regions that include the capital city are mostly large with relatively high GDP and high population densities with consequently relatively high values for *RQI* categories Education, Public Services and Recreation. Large variation within countries is found for Italy (IT), Belgium (BE) and Spain (ES). The northern regions of both these countries score better in terms of the *RQI* than their southern counterparts. Also, large variations are found in France (FR), Germany (DE) and Norway (NO). Figure 5 shows a large gap between average scores for northwestern European countries (average *RQI* >6.8) and south-eastern countries of Europe (average *RQI* <5.8).

3.3 RQI *vs GDP per capita and weighted population density*

3.3.1 Regional GDP per capita vs Regional Quality of Living

Higher GDP per capita mostly relates with a better *RQI*. Below a GDP per capita of about 18.000 euros no *RQI* scores higher than 6 were found (Figure 5). Probably there is some kind of threshold value that should be reached, after which the *RQI* score improves remarkably. An explanation could be that regions with a less developed economy primarily focus on the development of the basic needs, like infrastructure (Public services), basic Education and Health care services and after that the focus is on other categories of *RQI*

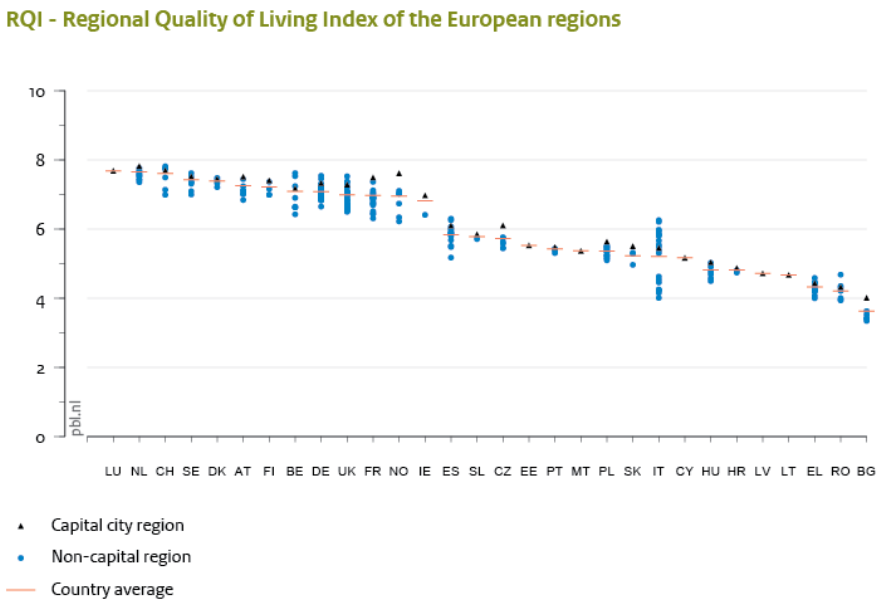


Figure 4: *RQI* values for the European NUTS2 regions, showing the average *RQI* value per country and its capital city

like Housing, Recreation, Social Environment and (higher) Education.

Between GDP and *RQI* a strong correlation of 0.78 was found. The scores for Governance, Social Environment, Education, Public Services and Recreation are strongly related to GDP (see also Table 1). However, a negative relation is found for Natural Environment.

3.3.2 Population density vs Regional Quality of Living

The influence of population density on the *RQI* score is analyzed because it is suspected to have a positive correlation with amenity-based *RQI* categories like Education and Public Services resulting in higher scores on the *RQI*. The conventional definition of population density is population/area for NUTS2 regions This definition is problematic because the ratio between the urban and rural environment shows large variations. This results in a very low population density for regions with a million-person city situated in a very large rural area. In comparison with the relevant part of a NUTS2 region, where the people live, the population density is much higher. Therefore a weighted population density (*wPD*) will be more useful to analyze the relations between densities and the *RQI*. The *wPD* was calculated as the average of two overlapping 10x10 km2 grids with grid population as a weighting factor.

A relatively weak but significant correlation of 0.10 is found between *log wPD* and *RQI*. A closer look (Figure 6) shows that a higher *wPD* indeed relates with a higher score on the *RQI* in general but that no increase is seen above *log wPD* values of 3.0 – 3.2 (1000 – 1600 Inhabitants/km2). High weighted population density may lead to better scores for Education, Public Services and Recreation but it seems that above a certain population density no further improvement will be realized.

3.3.3 Clustering regions with GDP per capita and weighted population density

To identify the peers for the European regions, a cluster analysis was conducted based on GDP per capita and *wPD*. As a result, clusters regions can be compared with other regions with comparable GDP per capita and *wPD*. Figure 7 shows the European regions with their logarithmic values of GDP per capita and *wPD* and the eleven clusters that were chosen. For both GDP per capita and *wPD* four classes were concerned: high,

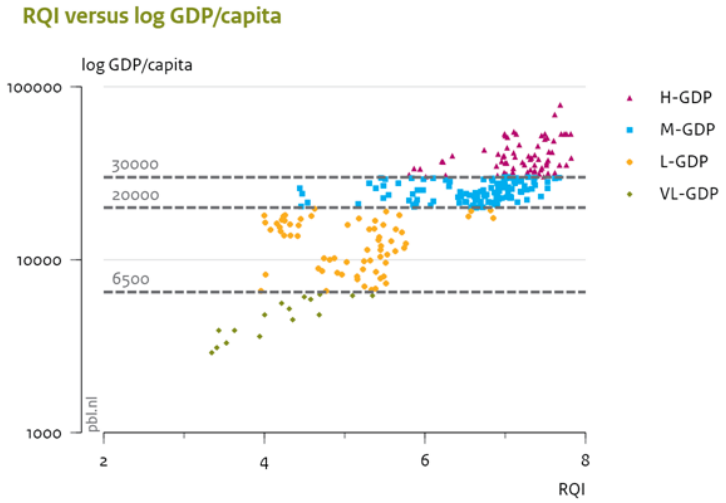


Figure 5: Average score of Regional Quality of Living Indicators vs several classes of regional GDP per capita

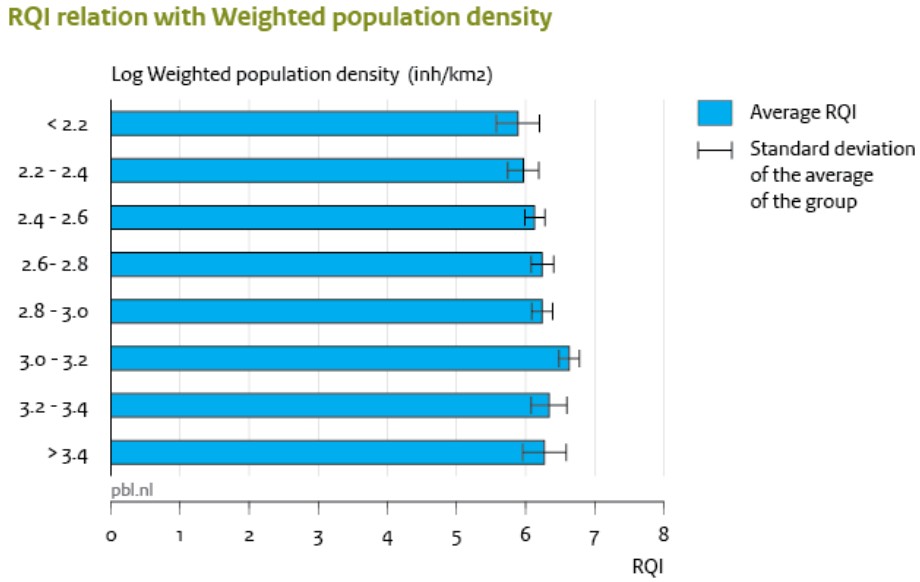


Figure 6: Average scores for Regional Quality of Living indicators for different levels of weighted population density

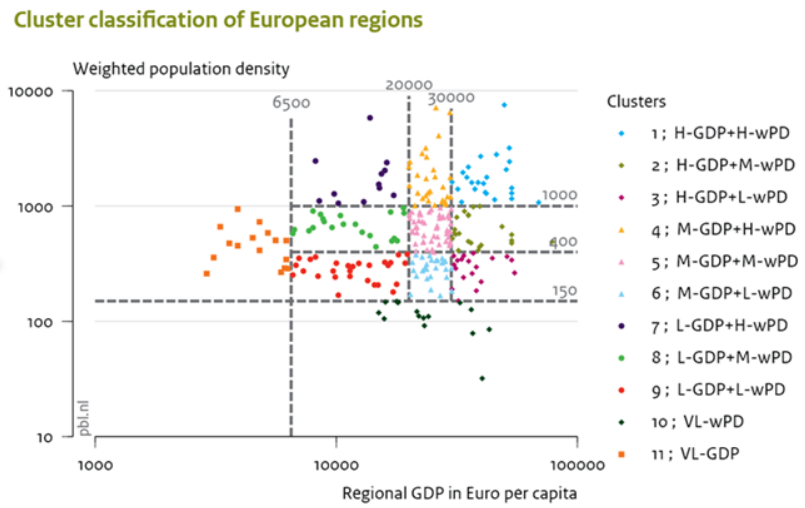


Figure 7: The 11 clusters of regions of Europe classified with their GDP per capita and population density

moderate, low and very low (See also for European maps in Appendix Figure A.1a and A.1b). The highest values for *RQI* are found for Cluster 1 High GDP per capita and high *wPD* (H-GDP+H-wPD). The highest average *RQI* values are found for the clusters with high GDP (Figure 8). The influence of *wPD* is different for different GDP per capita ranges.

3.4 Clustering of the European regions

Table 1 shows the average scores for the nine *RQI* indicators for the eleven clusters. These data make it is possible to compare a region with the average scores of all regions in the same cluster in order to identify strong and weak indicators. In Appendix A.3 the regions of the different clusters are presented with their *RQI* scores and the lowest and highest indicator scores per region.

3.4.1 Regions with high GDP per capita

The highest *RQI* scores are found for Swiss and Dutch regions in the clusters with high or moderate *wPD*. In the cluster with low *wPD* Swedish and Danish regions are scoring high.

Italian regions show the lowest scores. In all three clusters regions in the southern parts of Europe like Italy and Spain show relatively low *RQI* scores. Table A.2 shows that the differences between the three clusters with regard to *wPD* can be found in Education and Recreation and in the other direction for Natural Environment and Social Environment. The regions with the highest *wPD* (Hamburg 3200 inhabitants/ km2), Ile de France (7500 inh/ km2) and Greater London (2700 inh/ km2) have relative lower *RQI* values. These results are in line with the findings by the OECD (2006). They concluded that moderate sized cities showed higher productivity than the largest metropoles worldwide. Though most of the largest metropoles have higher economic growth, foreign investment and labour productivity than the rest of the country, they are also more polluted, crime-ridden and socially disparate (OECD 2006).

3.4.2 Regions with moderate GDP per capita

English and Dutch regions score relatively high in comparison to their peers in the clusters with moderate GDP per capita (see Table A.3). High scores are also found for several French, German and Belgian regions. The biggest cluster with moderate *wPD*

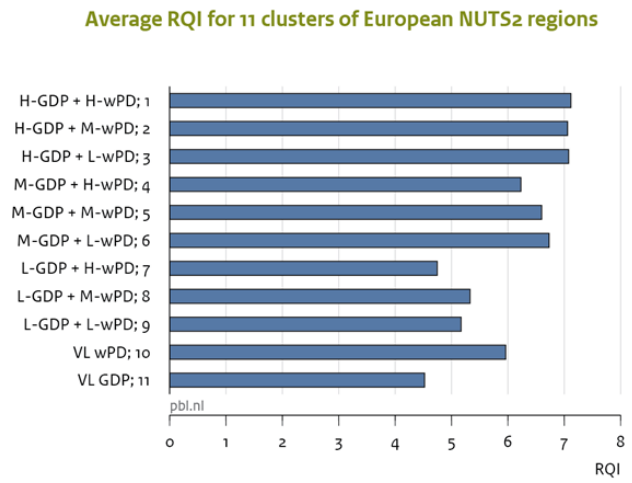


Figure 8: Average *RQI* values for the European Nuts2 regions for 11 clusters

involves several western European regions of The Netherlands, France, Germany and the United Kingdom which have scores higher than 7. In the cluster with low *wPD*, Austrian, French and English regions, have the highest scores of 6.7 to 7.5. The regions with the highest *wPD*, West Midlands (3200 inh/ km2), Merseyside, (2200 inh/ km2) and Greater Manchester (2700 inh/ km2), have relatively low *RQI* values. Table 1 shows that the differences between the three clusters with regard to *wPD* can be found in Education and in the other direction for Natural Environment and Purchasing Power and Jobs.

3.4.3 Regions with low GDP per capita

English, Czech and Polish regions have the highest rankings in the clusters with low GDP per capita (see Table A.4). Differences as a consequence from different *wPD* are significant. In the cluster with high *wPD* the Mazowieckie region has the highest score of 5.64 while in the clusters with moderate and low *wPD* the best score is 6.8. In the cluster with moderate and low *wPD* the English regions score best. Only for Health can a pattern be recognized that shows that lower population density leads to better scores.

3.4.4 Regions with very low GDP per capita or population density

The cluster with low *wPD* shows high scores for the Austrian region, Burgenland, and some Scandinavian regions. Relatively few people are living in these regions (see Table A.5).

In the cluster with very low GDP East European regions are found. From these regions Polish regions have the highest rankings (see Table A.5).

3.4.5 Regional benchmarking with peers

Figure 9 shows for the Dutch region of Utrecht a comparison with the characteristics of Cluster 1 (high-GDP per capita and high-*wPD*) and the average score of all European regions. Utrecht scores high on Education, Governance, Social Environment and Recreation, even better than the average of Cluster 1 regions, but low on Natural Environment compared to the average of all regions as well as the average of the Cluster 1 regions. In comparison to its peers the Bucaresti-Ilfov region shows high scores on Purchasing Power and Employment and Natural Environment but low on Governance, Social Environment, Health, and Recreation.

Table 1: Characteristics of the 11 clusters of European NUTS2-regions

Cluster	Gover-nance	PP&E	Social environ-ment	Health	Educa-tion	Public services	Recrea-tion	Natural environ-ment	Housing	Average of RQI
H-GDP H-wPD	7.9	6.5	8.4	7.5	7.8	7.6	7.3	5.0	6.1	7.1
H-GDP M-wPD	8.0	6.6	8.5	7.5	7.3	7.5	6.8	5.5	5.9	7.1
H-GDP L-wPD	8.7	6.6	8.9	7.8	6.3	7.2	6.7	6.0	5.7	7.1
M-GDP H-wPD	6.7	5.4	7.4	6.9	6.4	6.4	6.5	5.0	5.3	6.2
M-GDP M-wPD	7.3	5.9	8.0	7.5	6.1	6.9	6.6	5.5	5.6	6.6
M-GDP L-wPD	7.6	6.3	8.0	7.6	5.4	7.1	6.8	6.3	5.6	6.7
L-GDP H-wPD	4.4	6.4	4.6	4.5	3.5	4.9	3.7	6.3	4.3	4.7
L-GDP M-wPD	5.7	5.6	6.3	5.4	4.2	5.2	4.7	6.4	4.4	5.3
L-GDP L-wPD	5.4	5.4	5.9	5.8	3.6	5.2	4.4	6.3	4.6	5.2
VL wPD	6.9	5.7	7.5	7.3	3.9	5.6	5.2	6.4	5.2	6.0
VL GDP	4.3	6.2	5.0	3.5	2.6	4.7	3.7	7.1	3.5	4.5

Note: PP&E ... Purchasing Power and Employment

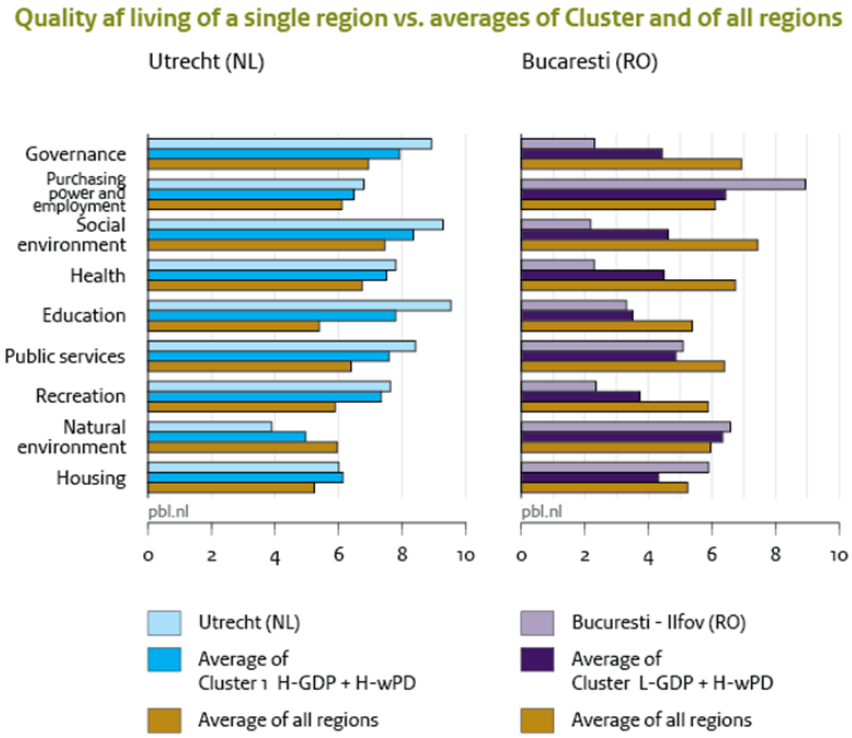


Figure 9: Examples of benchmarking European regions with their peers

4 Conclusions

The Regional Quality of Living Indicators, using non-business-related indicators, can help to improve the attractiveness of regions, thereby encouraging people and companies to settle and invest in these regions. A set of nine indicators is presented. The highest scores for *RQI* indicators are found for regions in Switzerland, Sweden, Norway and the Netherlands.

Some countries show a wide divergence between regional scores. The southern regions of Italy and Spain, for example, have significantly lower scores than those in the north. In addition, most of the capital city regions have a high *RQI* value in comparison to the rest of their country.

Results show a relation between *RQI* scores and the GDP per capita and population density. Significant correlation is found between *RQI* and GDP per capita. Between population density and *RQI* scores a relatively weak but also significant positive correlation is found. In order to benchmark a European region with its peers, a cluster analysis was conducted based on GDP per capita and weighted population density. Eleven different clusters are distinguished, which makes benchmarking between comparable regions possible to identify strong or weak *RQI* characteristics of a region.

Improving the "quality of living" can help to make the regions and their cities more attractive for local residents and businesses, but also to attract foreign knowledge workers and multinationals. It may help countries and regions in Europe to realize their ambitions to create economic growth and to achieve the objectives formulated in the Europe 2020 10-year strategy presented by the European Commission on March 2010 (European Commission 2010) for advancement of the economy of the European Union.

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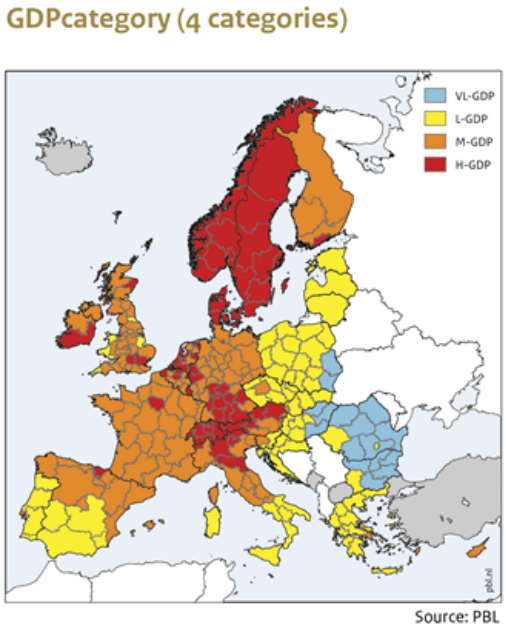
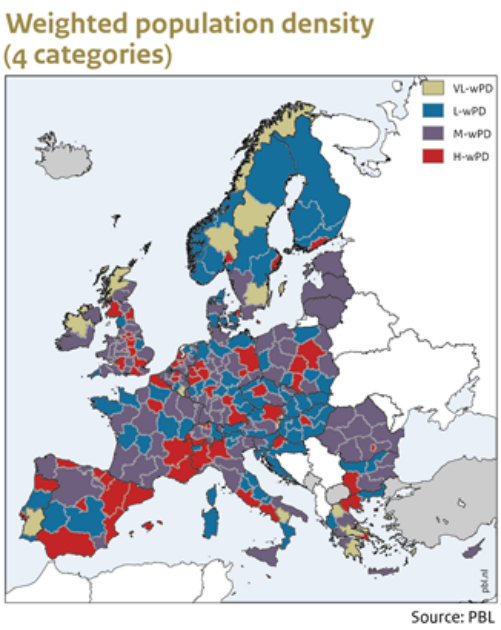
A Appendix

A.1 Maps of Europe for different clusters

Figure A.1a and A.1b shows the different classes for GDP/cap and population density. European regions are classified: high, moderate, low and very low. Figure A.2 shows the map of Europe for 11 clusters. All the 11 clusters are given with their NUTS 2 regions in different tables with regard to their GDP per capita in Table A.2 to A.5.



(a) Overview of categories with respect to GDP per capita in the European region. (euro/inhabitant); 1=High >30000; 2=Moderate (20000-30000); 3=Low (6500-20000); 4=very low (<6500)



(b) Overview of categories with respect to weighted population density (inh/km^2)in the European regions 1=High >1000; 2=Moderate (400-1000); 3=Low (150-400); 4=very low (<150)

Figure A.1: Categories of regions

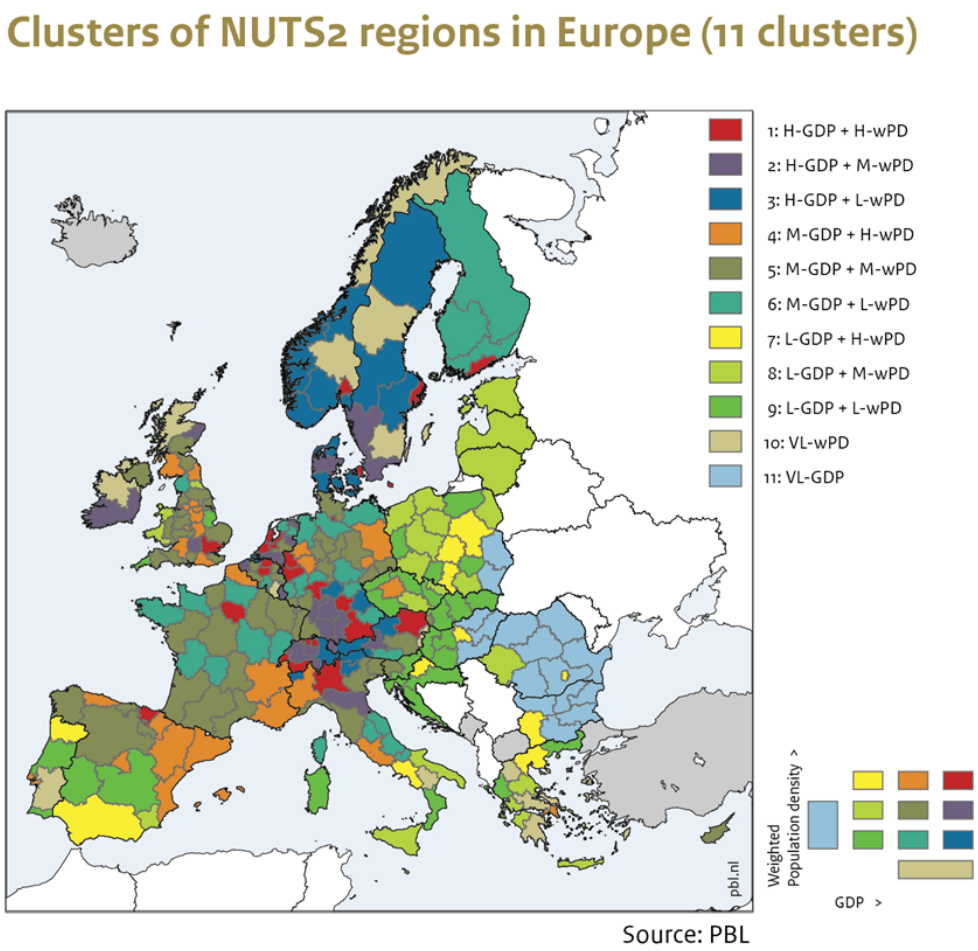


Figure A.2: Overview of the 11 different clusters in Europe

A.2 Description of the indicators and sub-indicators for Regional Quality of Living

Indicators and sub-indicators were chosen which are important for people, individually or with their families, related to foreign companies that want to settle in a specific region, either for some time or permanently. After concerning several indicators applied in the Quality of Living Index (Mercer 2010), Liveability Index (EIU 2012) and OECD Better Life index data we selected for 25 sub-indicators aggregated to 9 indicators representing the Quality of Living.

***RQI* 1. Governance** Governance is an important factor for people when deciding to settle in a region. This was taken into account in all "quality of living" indices. The indicator Governance was calculated with the sub-indicators *RQI* 1.1 Government Effectiveness, *RQI* 1.2 Political Stability and Terror and *RQI* 1.3 Banks. Governance data were derived from the World Governance Indicators (Worldbank 2012), a recent study on regional variation in quality of government within the EU (Charron et al. 2012). Data on corruption were also taken into account, as well as EU regional statistics and perception data from the EU Urban Audit, Perception Survey (Eurostat 2015a). Data from the Global Peace Index were used (VoH 2012) for Political Stability and Terror. The scores for Banks resulted from a benchmark using OECD data on the soundness of banks taken from Sustainable Governance Indicators (OECD 2011) and the Standard and Poor's credit rating per country.

***RQI* 2. Purchasing Power and Employment** The indicator *RQI* 2 Purchasing Power and Employment is the result of the average of three sub-indicators: *RQI* 2.1 Housing Affordability, *RQI* 2.2 Employment and *RQI* 2.3 Cost of Living. For the *RQI* 2.2 Employment data for unemployment of people aged from 15 to 24, and 20 to 65, were derived from Eurostat's regional labour market statistics. Price level indices with a correction for income per capita were used for the *RQI* 2.3 Cost of Living. The sub-indicator 2.1 Housing Affordability refers to the property price per square meter, divided by income per capita.

***RQI* 3. Social Environment** When people decide whether or not they intend to settle in a certain region, Freedom, Safety in the personal environment and Social Cohesion are important factors, representing the Social Environment. *RQI* 3.1 Safety was calculated with the indicators *RQI* 3.1 Safety, *RQI* 3.2 Personal Freedom and *RQI* 3.3 Social Cohesion. Data for Safety were obtained from DG Regional Policy research (Charron et al. 2012) and the EU perception survey. The sub-indicator 3.2 Personal Freedom was constructed with country data from Sustainable Governance Indicators with a regional correction. Regional data on Voice and Accountability were derived from a recent study on regional variation in the quality of government in EU member states (DG Regional Policy 2010). The data for Social Cohesion were derived from the European Social Survey (ESS 2014) and Eurofound (2014).

***RQI* 4. Health** The indicator Health was calculated with four sub-indicators. *RQI* 4.1 Healthcare represents the average of 7 datasets representing qualitative and quantitative aspects of healthcare. *RQI* 4.3 Life Expectancy includes life expectancy at birth and at the age of 65, and healthy years at the age of 50. *RQI* 4.4 Environmental Quality was focussed on health effects as a consequence of environmental pollution. Objective data on air quality (particulate matter and ozone) and noise, as well as perception data were used for calculation of the score for Environmental Quality. Most of these data were derived from the Urban Audit data 'Key Cities', a database of 416 cities, and the European Environmental Agency. *RQI* 4.2 Food Quality and Safety is a country sub-indicator and was derived from the Global Food Security Index (EIU 2012).

***RQI* 5. Education** Education is an important settlement factor for both companies and potential residents. The qualitative aspects (*RQI* 5.1) as well as the quantitative aspects (*RQI* 5.2) were considered. Quality standards and education opportunities (including higher education) are among the factors that people take into account when choosing to settle in a specific region. The data used for the sub-indicator 5.1

Education Quality were derived from PISA (2012), university rankings and the EU Urban Audit (perception surveys). The 'Distance decay method' was applied for the sub-indicator 5.2 Education Quantity. Regions near to those with universities benefit from this.

***RQI* 6. Public Services** Public Services are important to potential residents when deciding where to settle. This indicator includes information from the sub-indicators 6.1 Energy Security, *RQI* 6.2 Internet and *RQI* 6.3 Connectivity. Data for Energy Security were derived from the World Economic Forum where the use of renewable energy sources produces high scores. The data used for the *RQI* 6.2 Internet (availability and quality) were derived from the EU Urban Audit. The sub-indicator 6.3 Connectivity refers to potential accessibility of the region by road, rail, and air. In terms of connectivity inside the region, only data from the EU perception surveys were available.

***RQI* 7. Recreation** The presence of restaurants or cultural possibilities and recreational opportunities are factors that also determine the quality of the living environment. This indicator was calculated with data from the sub-indicators *RQI* 7.1 Culture and Restaurants and *RQI* 7.2 Recreation Possibilities. Regions near those with high ranking restaurants (e.g. with Michelin stars) benefit from this factor based on the Distance decay method. *RQI* 7.2 Recreation Possibilities was calculated with data from Urban Audit – Key cities, LUCAS and the Perception survey.

***RQI* 8. Natural Environment** Although the Natural Environment and in particular climate cannot directly be influenced by policy measures, it is a factor that is taken into account when people choose to settle in a certain region. Three sub-indicators were used for this: *RQI* 8.1 Climate, *RQI* 8.2 Natural Hazards and *RQI* 8.3 Nature. Climate data on temperature and precipitation were taken from the EU Urban Audit. Regions with medium temperatures and precipitation levels generally scored best, as high and low levels are not comfortable to most people. The sub-indicator *RQI* 8.2 Natural Hazards refers to the aggregated exposure potential for 11 natural hazards, including floods, forest fires, droughts, earthquakes and tropical storms. The regions' integrated sensitivity and response capacity (ESPON 2013) were also taken into account for this indicator. *RQI* 8.3 included land use and biodiversity data.

***RQI* 9. Housing** Housing covers *RQI* 9.1 Housing Quality which refers to the quality of both privately owned and rented housing and *RQI* 9.2 Housing Environment which is made up of several datasets, including the amount of green space and green/blue urban areas, as well as data from the EU perception survey with respect to satisfaction with the housing environment, such as public spaces and green.

Table A.1: Additional information with respect to the data applied for the calculation of the Regional Quality of Life Index

Indicator/ Sub-indicators/datasets of Regional Quality of Living	Geographical level	Source	Reference year
RQI 1 Governance			
RQI 1.1 Governance Effectiveness (regional correction for national data applied)			
Government Effectiveness	Country	Worldbank 2012	2011
Regulatory Quality	Country	Worldbank 2012	2011
Rule of Law:	NUTS2/NUTS1	Charron et al. 2012	2009
Control of Corruption	NUTS2/NUTS1	Charron et al. 2012	2009
Corruption	Country	TI 2012	2012
RQI 1.2 Political Stability and terror			
Political Terror Scale	Country Country	VoH 2012	2011
Political Stability and Absence of Violence/Terrorism	Country	Worldbank 2012	2011
Physical Integrity Rights Index	Country	VoH 2012	2011
Political stability	Country	CIRI 2012	2011
RQI 1.3 Banks (Country indicator)			
Standard & Poor Country ratings	Country	S&P 2014	2013
Soundness of banks	Country	OECD 2011	2011
RQI 2 Purchasing power and jobs			
RQI 2.1 Housing Affordability			
Price owner-occupied housing (relative to Disposable income)	NUTS2 (both)	Eurostat 2015a Eurostat 2015a	2009
Price rented housing (relative to Disposable income)	NUTS2 (both)	Eurostat 2015a Eurostat 2015a	2009
RQI 2.2 Employment			
Unemployment (15–24 year age group)	NUTS2	Eurostat 2015a	2012
Unemployment (20–65 year age group)	NUTS2	Eurostat 2015a	2012
RQI 2.3 Cost of living			
Price goods (relative to Disposable income)	Country (Goods) NUTS2 (income)	Eurostat 2015a Eurostat 2015a	2010
Price fuel/alcohol (relative to Disposable income)	Country (Goods) NUTS2 (income)	Eurostat 2015a Eurostat 2015a	2010
RQI 3 Social environment			
RQI 3.1 Safety (regional correction for national data applied)			
Feel safe in this city?	Cities	Eurostat 2015a	2009
Most people can be trusted?	Cities	Eurostat 2015a	2009
Feel safe in this neighbourhood?	Cities	Eurostat 2015a	2009
Business costs of crime and violence (Country data)	Country	Eurostat 2015a	2011
Reliability of police services (Country data)	Country	Eurostat 2015a	2011
Organised crime (Country data)	Country	Eurostat 2015a	2011
RQI 3.2 Freedom (Country Indicator)			
Civil Rights	Country	OECD 2011	2011
Access to Information	Country	OECD 2011	2011
Voice and accountability	Country	Worldbank 2012	2011
RQI 3.3 Social cohesion (Country indicator)			
Most of the time: people helpful or mostly looking out for themselves	NUTS2	ESS 2014	2011
Important to help people and care for others well-being	NUTS2	ESS 2014	2011
Important to be loyal to friends and devote to people close	NUTS2	ESS 2014	2011

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Indicator/ Sub-indicators/datasets of Regional Quality of Living	Geographical level	Source	Reference year
Participating in social activities of a club, society or association	NUTS2	Eurofound 2014	2011
How often did you do unpaid voluntary work in the last 12 months?	NUTS2	Eurofound 2014	2011
RQI 4 Health			
RQI 4.1 Healthcare			
Infant mortality rate	Country	Eurostat 2015a	2009
Satisfied with hospitals?	Cities	Eurostat 2015a	2009
Cancer death rate	NUTS2	Eurostat 2015a	2010
Per capita government expenditure on health	Country	WHO 2011	2011
Satisfied with healthcare?	Cities	Eurostat 2015a	2009
Satisfied with doctors?	Cities	Eurostat 2015a	2009
Heart disease death rate	NUTS2	Eurostat 2015a	2010
Per capita total expenditure on health at average exchange rate (USD)	Country	WHO 2011	2011
RQI 4.2 Food quality and safety			
Food quality and safety	Country	EIU 2012	2012
RQI 4.3 Life expectancy			
(double weight of NUTS2 data)			
Life expectancy at given exact age	NUTS2	Eurostat 2015a	2010
Life expectancy at birth	Country	OECD 2012b	2012
Life expectancy, Females at age 65	Country	OECD 2012b	2012
Life expectancy, Males at age 65	Country	OECD 2012b	2012
Number of years of healthy life expected	NUTS2	Eurostat 2015a	2010
RQI 4.4 Environmental quality			
Air pollution is a big problem here?	Cities	Eurostat 2015a	2009
Noise is a big problem here?	Cities	Eurostat 2015a	2009
This is a clean city?	Cities	Eurostat 2015a	2009
Number of days ozone concentration exceeds 120 $\mu g/m^3$	NUTS2	Eurostat 2015a	2011
Number of days particulate matter conc. (PM_10) exceeds 50 $\mu g/m^3$	NUTS2	Eurostat 2015a	2011
Accumulated ozone concentration in excess 70 $\mu g/m^3$	NUTS2	Eurostat 2015a	2011
Annual average concentration of PM_10	NUTS2	Eurostat 2015a	2011
RQI 5 Education			
RQI 5.1 Education quality			
(double weight of PISA)			
Satisfied with schools?	Cities	Eurostat 2015a	2009
Quality of University – best 20% in world = 5 etc.	Cities	QS 2013	2012
PISA score	Country	NCIS 2012	2012
Aged 15 to 64 qualified at tertiary level (ISCED 5–6)	NUTS2	Eurostat 2015a	2008 2008
Number of foreign languages	Country	Eurostat 2015a	2009
RQI 5.2 Education Availability			
(3x weight Universities)			
Number of universities per region (Distance decay calculation)	Cities	QS 2013	2012
N-international schools per region (Distance decay calculation)	Cities	Wikipedia 2014	2014
RQI 6 Public services			
RQI 6.1 Energy security			
Energy security and access	Country	WEF 2013	2012
RQI 6.2 Internet			
Satisfied with public internet access?	Cities	Eurostat 2015a	2012
Households with access to the Internet	NUTS2	Eurostat 2015a	2012
Households with broadband access	NUTS2	Eurostat 2015a	2012
Individuals who ordered goods or services over the Internet	NUTS2	Eurostat 2015a	2012

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Indicator/ Sub-indicators/datasets of Regional Quality of Living	Geographical level	Source	Reference year
RQI 6.3 Connectivity			
Satisfied with public transport?	Cities	Eurostat 2015a	2009
Rail accessibility	NUTS3	ESPON 2011	2011
Road accessibility	NUTS3	ESPON 2011	2011
Air accessibility	NUTS3	ESPON 2011	2011
RQI 7 Recreation			
RQI 7.1 Culture and Restaurants			
Michelin star restaurants (Distance decay calculation)	Cities	Michelin 2013	2012
Satisfied with cultural facilities?	Cities	Eurostat 2015a	2009
Satisfied with cinemas?	Cities	Eurostat 2015a	2009
RQI 7.2 Recreation possibilities			
Satisfied with sports facilities?	Cities	Eurostat 2015a	2009
Area for recreational sports and leisure use	Cities	Eurostat 2015a	2011
Land area for recreational sports and leisure (use/cap)	Cities	Eurostat 2015a	2011
Length of bicycle network	Cities	Eurostat 2015a	2011
Satisfied with outdoor recreation?	Cities	Eurostat 2015a	2009
Recreation, leisure and sport	NUTS2	Eurostat 2015a	2009
RQI 8 Natural environment			
RQI 8.1 Climate			
Number of days of rain per year	NUTS2	Eurostat 2015a	2011
Average number of hours of sunshine per day	NUTS2	Eurostat 2015a	2011
Average temperature of warmest month	NUTS2	Eurostat 2015a	2011
Average temperature of coldest month	NUTS2	Eurostat 2015a	2011
Rainfall	NUTS2	Eurostat 2015a	2011
RQI 8.2 Natural hazards			
Aggregated hazard exposure potential	NUTS2	ESPON 2013	2010
Sensitivity and response	NUTS2	ESPON 2013	2010
RQI 8.3 Nature			
Recreation, leisure and sport	NUTS2	Eurostat 2015a	2009
Nature reserves	NUTS2	Eurostat 2015a	2009
Forestry	NUTS2	Eurostat 2015a	2009
Landscape Shannon Evenness Index	Country	Eurostat 2015b	2009
RQI 9 Housing			
RQI 9.1 Housing quality			
Average price per m^2 – apartment	NUTS2	Eurostat 2015a	2009
Average price per m^2 – house	NUTS2	Eurostat 2015a	2009
Rooms per person	Country	OECD 2012b	2009
Dwellings with basic facilities	Country	OECD 2012b	2009
RQI 9.2 Housing environment			
Satisfied with green space?	Cities	Eurostat 2015a	2009
Satisfied to live in this city?	Cities	Eurostat 2015a	2009
In 5 years, it will be more pleasant to live here?	Cities	Eurostat 2015a	2009
Satisfied with public spaces?	Cities	Eurostat 2015a	2009
Green space (in m^2) to which the public has access, per capita	Cities	Eurostat 2015a	2009
Proportion of the area in green space	Cities	Eurostat 2015a	2009

Note: Indicator scores were calculated from average of sub-indicators unless otherwise mentioned. Sub-indicators were calculated from average of underlyingdata unless otherwise mentioned.

A.3 Tables with RQI *values of the European regions divided in 11 clusters*

Table A.2: Regions with High GDP per capita

Cluster 1 H-GDP + H-wPD			
NUTS2 code	NUTS2 name	RQI score	RQI Indicator range
CH04	Zürich	7.82	5,6 - 9,7
NL00	Amsterdam Great	7.82	5,0 - 9,6
CH03	Nordwestschweiz	7.76	5,9 - 9,6
CH01	Région lémanique	7.74	5,0 - 9,9
NL33	Zuid-Holland	7.68	4,7 - 9,7
NO01	Oslo og Akershus	7.62	5,8 - 9,9
NL31	Utrecht	7.58	3,8 - 9,5
DE21	Oberbayern	7.54	5,2 - 8,9
BE21	Prov. Antwerpen	7.53	4,0 - 9,4
SE11	Stockholm	7.52	5,8 - 9,6
AT00	Wien Great	7.52	6,3 - 8,8
FR10	Île de France	7.49	5,5 - 9,8
DK01	Hovedstaden	7.45	5,3 - 9,5
FI1B	Helsinki-Uusimaa	7.41	5,4 - 9,6
DE25	Mittelfranken	7.31	5,5 - 8,9
UK00	London Great	7.29	4,4 - 8,7
BE00	Bruxelles great	7.17	4,8 - 9,1
DE71	Darmstadt	7.10	4,8 - 8,7
DE60	Hamburg	7.00	4,0 - 8,7
DEA2	Köln	6.99	4,4 - 8,6
DE50	Bremen	6.91	3,9 - 8,6
DEA1	Dusseldorf	6.89	3,6 - 8,6
ES21	País Vasco	6.01	4,0 - 8,3
ITC4	Lombardia	5.94	4,5 - 7,1

Cluster 2 H-GDP + M-wPD			
NUTS2 code	NUTS2 name	RQI score	RQI Indicator range
NL41	Noord-Brabant	7.76	5,1 - 9,5
CH02	Espace Mittelland	7.70	5,9 - 9,4
LU00	Luxembourg	7.68	5,0 - 9,5
NL11	Groningen	7.60	4,5 - 9,7
NL42	Limburg (NL)	7.53	4,9 - 9,1
SE23	Västsverige	7.51	5,2 - 9,5
CH06	Zentralschweiz	7.49	5,2 - 9,4
DE12	Karlsruhe	7.46	5,4 - 8,7
NL21	Overijssel	7.42	4,9 - 9,4
UKJ1	Berkshire, Buckingh	7.37	4,7 - 9,3
SE22	Sydsverige	7.36	4,9 - 9,5
DK04	Midtjylland	7.33	5,3 - 9,7
DE14	Tübingen	7.28	5,6 - 8,6
AT32	Salzburg	7.12	4,9 - 9,0
DE27	Schwaben	7.09	5,3 - 8,9
AT34	Vorarlberg	7.02	4,7 - 8,6
CH07	Ticino	6.99	4,8 - 9,4
UKM5	North Eastern Scotl	6.98	5,8 - 8,5
IE02	Southern and Easter	6.97	4,8 - 9,0
DE11	Stuttgart	6.95	5,1 - 8,6
BE25	Prov. West-Vlaande	6.90	5,2 - 8,1
ITH5	Emilia-RomagNA	5.80	4,7 - 7,1

Cluster 3 H-GDP + L- wPD			
NUTS2 code	NUTS2 name	RQI score	RQI Indicator range
SE12	Östra Mellansverige	7.62	5,1 - 9,6
DK02	Sjælland	7.48	5,0 - 9,6
NL34	Zeeland	7.44	5,0 - 9,2
DK03	Syddanmark	7.41	5,8 - 9,6
SE33	Övre Norrland	7.31	5,3 - 9,4
DE26	Unterfranken	7.26	5,6 - 8,9
AT33	Tirol	7.24	5,4 - 8,7
DK05	Nordjylland	7.21	5,7 - 9,5
CH05	Ostschweiz	7.14	4,9 - 9,4
NO04	Agder og Rogaland	7.11	4,8 - 9,9
AT31	Oberösterreich	7.10	5,7 - 8,6
SE31	Norra Mellansverige	7.09	3,8 - 9,4
NO05	Vestlandet	7.03	3,8 - 9,9
NO06	Trøndelag	7.02	4,3 - 9,9
DE23	Oberpfalz	7.01	5,2 - 8,9
NO03	Sør-Østlandet	6.34	1,9 - 9,9
ITH2	Provincia Autonoma	6.26	5,0 - 7,5
ITH1	Provincia Autonoma	6.21	4,9 - 7,3
ITC2	Valle d'Aosta/Vallée	5.86	5,0 - 6,8

Table A.3: Regions with Moderate GDP

Cluster 4 M-GDP + H-wPD			
NUTS2 code	NUTS2 name	RQI score	RQI Indicator range
UKJ2	Surrey, East and We	7.53	5,9 - 9,1
FR71	Rhône-Alpes	7.37	5,3 - 9,0
DE00	Berlin Great	7.33	6,0 - 8,6
UKK1	Gloucestershire, Wil	7.11	4,6 - 8,5
UKF2	Leicestershire, Rutla	7.08	4,5 - 8,6
UKF1	Derbyshire and Nott	7.07	4,5 - 8,6
DEA3	Münster	6.99	4,6 - 8,6
DEA5	Arnsberg	6.90	4,5 - 8,6
UKM3	South Western Scotl	6.87	4,8 - 8,5
UKD3	Greater Manchester	6.74	3,4 - 8,2
UKC2	Northumberland and	6.70	4,8 - 8,3
DED5	Chemnitz	6.65	4,8 - 8,7
UKG3	West Midlands	6.65	3,9 - 8,3
UKD7	Merseyside (NUTS 2	6.64	4,5 - 8,2
UKE3	South Yorkshire	6.57	3,8 - 8,2
UKE4	West Yorkshire	6.55	2,2 - 8,2
FR30	Nord - Pas-de-Calais	6.51	4,8 - 7,9
FR82	Provence-Alpes-Côte	6.31	4,7 - 7,5
ES51	Cataluña	6.30	4,3 - 8,5
ES22	Comunidad Foral de	6.26	4,1 - 7,9
CZ00	Praha Great	6.10	5,0 - 7,3
ES30	Comunidad de Madr	6.10	4,2 - 7,5
ES24	Aragón	5.91	4,1 - 7,7
ES12	Principado de Asturi	5.89	4,1 - 8,3
ES52	Comunidad Valencia	5.87	3,4 - 7,4
ES53	Illes Balears	5.85	3,7 - 7,4
ITC1	Piemonte	5.67	4,8 - 6,7
PT17	Lisboa	5.48	3,8 - 7,0
ITI4	Lazio	5.45	4,4 - 6,8
EL30	Attiki	4.44	3,3 - 6,4

Cluster 5 M-GDP + M-wPD			
NUTS2 code	NUTS2 name	RQI score	RQI Indicator range
NL22	Gelderland	7.67	4,8 - 9,4
BE23	Prov. Oost-Vlaander	7.62	5,3 - 8,8
UKJ3	Hampshire and Isle	7.37	5,8 - 8,7
DE92	Hannover	7.29	5,8 - 8,7
UKJ4	Kent	7.27	5,8 - 8,7
DEF0	Schleswig-Holstein	7.27	6,2 - 8,8
BE22	Prov. Limburg (BE)	7.24	5,2 - 8,2
DE13	Freiburg	7.20	5,2 - 8,6
UKH1	East Anglia	7.19	5,4 - 8,6
DEA4	Detmold	7.13	5,5 - 8,6
FR42	Alsace	7.12	5,5 - 8,0
DE91	Braunschweig	7.07	5,5 - 8,7
UKG1	Herefordshire, Worc	7.07	5,1 - 8,8
UKL2	East Wales	7.03	4,7 - 8,4
FR61	Aquitaine	7.03	5,1 - 8,4
UKE2	North Yorkshire	7.02	5,1 - 8,2
AT22	Steiermark	7.01	5,8 - 8,4
FR62	Midi-Pyrénées	6.99	5,4 - 8,5
DEB3	Rheinhessen-Pfalz	6.98	5,0 - 8,8
UKK2	Dorset and Somerse	6.96	5,0 - 8,1
UKM2	Eastern Scotland	6.94	4,9 - 8,5
FR24	Centre (FR)	6.92	5,1 - 8,0
DED2	Dresden	6.92	5,9 - 8,7
FR51	Pays de la Loire	6.91	4,6 - 8,5
FR41	Lorraine	6.89	5,6 - 8,0
DED4	Leipzig	6.89	4,4 - 8,7
DECo	Saarland	6.84	4,6 - 8,6
DEE0	Sachsen-Anhalt	6.83	4,4 - 8,5
DE73	Kassel	6.83	4,7 - 8,7
FR23	Haute-Normandie	6.82	5,2 - 8,2
FR72	Auvergne	6.77	4,8 - 8,0
UKD6	Cheshire	6.73	3,7 - 8,2
FR21	Champagne-Ardenn	6.73	4,9 - 7,9
UKG2	Shropshire and Staff	6.72	4,1 - 8,3
UKE1	East Yorkshire and N	6.66	5,3 - 8,2
BE33	Prov. Liège	6.63	5,3 - 7,6
UKD4	Lancashire	6.60	3,6 - 8,2
UKN0	Northern Ireland (UI	6.52	5,1 - 8,0
UKK4	Devon	6.50	5,0 - 8,1
FR81	Languedoc-Roussillc	6.45	5,1 - 7,6
BE32	Prov. HaiNAut	6.43	4,9 - 7,6
ES11	Galicia	6.07	4,4 - 8,4
ITH4	Friuli-Venezia Giulia	5.98	5,0 - 7,4
ES23	La Rioja	5.98	3,9 - 7,8
ES13	Cantabria	5.90	4,1 - 8,6
SL02	ZahodNA Slovenija	5.85	3,7 - 6,9
ITH3	Veneto	5.83	4,7 - 7,2
ES41	Castilla y León	5.80	3,9 - 7,8
SK01	Bratislavský kraj	5.51	3,4 - 7,4
ITC3	Liguria	5.48	3,8 - 7,3
ITI1	ToscaNA	5.31	3,4 - 6,8
CY00	Kypros	5.17	2,1 - 7,2

Cluster 6 M-GDP + L- wPD			
NUTS2 code	NUTS2 name	RQI score	RQI Indicator range
NL13	Drenthe	7.53	5,3 - 9,7
NL12	Friesland (NL)	7.36	4,8 - 9,7
DEB2	Trier	7.20	5,2 - 8,8
DE24	Oberfranken	7.20	5,5 - 8,9
FI1C	Etala Suomi	7.16	4,3 - 9,6
DE93	Lüneburg	7.15	5,0 - 8,7
FR22	Picardie	7.06	5,5 - 8,1
DEB1	Koblenz	7.04	4,9 - 8,8
DE22	Niederbayern	7.03	5,1 - 8,9
FI1D	Pohjois-JA Ita	6.99	4,6 - 9,6
FI19	Länsi-Suomi	6.99	4,5 - 9,6
DE72	Gießen	6.97	5,0 - 8,7
DE94	Weser-Ems	6.93	4,9 - 8,7
FR63	Limousin	6.92	4,6 - 8,4
FR43	Franche-Comté	6.90	5,4 - 8,1
DEG0	Thüringen	6.90	4,7 - 8,8
FR53	Poitou-Charentes	6.90	4,4 - 8,5
FR52	Bretagne	6.88	4,7 - 8,4
DE80	Mecklenburg-Vorpon	6.87	4,1 - 8,8
AT21	Kärnten	6.84	4,5 - 8,7
FR25	Basse-Normandie	6.75	4,7 - 8,2
FR26	Bourgogne	6.70	4,7 - 8,0
BE35	Prov. NAmur	6.65	5,1 - 7,6
UKD1	Cumbria	6.62	4,8 - 8,2
FR83	Corse	6.44	4,1 - 7,7
ITI2	Umbria	5.55	3,7 - 7,1
ITI3	Marche	5.39	3,6 - 7,1
ITF1	Abruzzo	4.54	2,2 - 6,3
ITF2	Molise	4.46	2,2 - 6,5

Table A.4: Regions with Low GDP

Cluster 7 L-GDP + H-wPD			
NUTS2 code	NUTS2 name	RQI score	RQI Indicator range
PL12	Mazowieckie	5.64	4,0 - 7,4
PT11	Norte	5.42	3,6 - 7,3
PL11	Lódzkie	5.39	3,3 - 7,0
MT00	Malta	5.37	2,7 - 7,6
PL22	Slaskie	5.24	3,3 - 7,2
ES61	Andalucía	5.18	2,7 - 6,9
HU10	Közép-Magyarország	5.04	3,4 - 6,5
HR01	SjeverozapadNA Hrv	4.87	3,4 - 7,4
RO32	Bucuresti - Ilfov	4.33	2,1 - 8,9
EL12	Kentriki Makedonia	4.19	2,2 - 6,4
ITF3	Campania	4.16	2,0 - 6,2
BG41	Yugozapaden	4.01	1,9 - 7,1

Cluster 8 L-GDP + M-wPD			
NUTS2 code	NUTS2 name	RQI score	RQI Indicator range
UKL1	West Wales and The	6.85	5,0 - 8,3
UKC1	Tees Valley and Durl	6.58	4,1 - 8,3
CZ06	Jihovýchod	5.58	4,3 - 7,0
EE00	Eesti	5.53	2,9 - 7,0
ES62	Región de Murcia	5.52	3,6 - 7,9
PL41	Wielkopolskie	5.51	3,9 - 7,3
PL42	Zachodniopomorski	5.49	3,8 - 7,2
CZ08	Moravskoslezsko	5.45	4,0 - 7,1
PL51	Dolnoslaskie	5.44	3,4 - 7,3
PL34	Podlaskie	5.33	3,2 - 7,5
PL63	Pomorskie	5.23	3,1 - 7,0
PL61	Kujawsko-Pomorski	5.16	3,0 - 6,9
PL21	Malopolskie	5.16	3,8 - 6,1
LV00	Latvija	4.72	3,3 - 7,6
LT00	Lithuania	4.67	2,7 - 6,9
EL43	Kriti	4.59	3,4 - 6,8
ITG1	Sicilia	4.25	2,1 - 6,4
EL23	Dytiki Ellada	4.25	1,9 - 6,5
ITF4	Puglia	4.22	1,7 - 6,6
EL14	Thessalia	4.20	2,1 - 6,4
RO42	Vest	3.96	2,0 - 7,1

Cluster 9 L-GDP + L- wPD			
NUTS2 code	NUTS2 name	RQI score	RQI Indicator range
UKF3	Lincolnshire	6.82	4,7 - 8,6
UKK3	Cornwall and Isles of	6.54	4,6 - 8,1
CZ03	Jihozápad	5.76	4,2 - 7,2
CZ05	Severovýchod	5.74	4,3 - 7,1
SL01	VzhodNA Slovenija	5.71	3,5 - 6,9
ES42	Castilla-la Mancha	5.68	3,7 - 7,7
CZ04	Severozápad	5.63	4,0 - 7,2
PL52	Opolskie	5.52	3,1 - 7,2
ES43	Extremadura	5.48	3,3 - 7,9
CZ07	Strední Morava	5.45	3,8 - 7,0
PL43	Lubuskie	5.45	3,5 - 7,6
PT16	Centro (PT)	5.43	3,8 - 7,0
PL62	Warminsko-Mazurski	5.38	2,9 - 7,6
PT15	Algarve	5.38	3,7 - 6,9
SK03	Stredné Slovensko	5.32	3,3 - 6,7
SK02	Západné Slovensko	5.28	3,3 - 6,5
PL33	Swietokrzyskie	5.25	3,3 - 7,5
HU22	Nyugat-Dunántúl	5.02	3,3 - 7,2
SK04	Východné Slovensko	4.97	3,4 - 6,7
HU21	Közép-Dunántúl	4.91	2,9 - 6,6
HR03	Jadranska Hrvatska	4.81	2,6 - 7,6
HU23	Dél-Dunántúl	4.77	2,7 - 7,0
HR02	Sredisnja i IstocNA (P	4.74	2,5 - 7,2
ITG2	SardegNA	4.63	2,2 - 7,0
EL22	Ionia Nisia	4.45	1,7 - 6,9
EL21	Ipeiros	4.41	2,0 - 6,9
EL11	ANAtoliki Makedonia	4.08	1,9 - 6,2
ITF6	Calabria	4.01	1,9 - 6,3

Table A.5: Regions with very low GDP or Population density

Cluster 10 VL-wPD			
NUTS2 code	NUTS2 name	RQI score	RQI Indicator range
AT11	Burgenland (AT)	7.45	5,4 - 9,2
SE21	Småland med öarNA	7.37	5,1 - 9,5
FI20	Åland	7.37	4,6 - 9,6
SE32	Mellersta Norrland	7.00	3,6 - 9,4
UKM6	Highlands and Island	6.79	4,7 - 8,5
NO07	Nord-Norge	6.74	3,4 - 9,9
BE34	Prov. Luxembourg (E	6.63	5,0 - 7,6
IE01	Border, Midland and	6.41	4,4 - 9,0
NO02	Hedmark og Opplan	6.23	1,6 - 9,9
PT18	Alentejo	5.31	2,8 - 7,8
EL42	Notio Aigaio	4.47	2,2 - 6,9
EL41	Voreio Aigaio	4.43	2,3 - 6,9
EL25	Peloponnisos	4.32	2,0 - 6,6
EL24	Sterea Ellada	4.26	2,0 - 6,5
ITF5	Basilicata	4.24	1,8 - 6,4
EL13	Dytiki Makedonia	4.00	1,8 - 6,5

Cluster 11 VL-GDP			
NUTS2 code	NUTS2 name	RQI score	RQI Indicator range
PL32	Podkarpackie	5.35	3,0 - 7,8
PL31	Lubelskie	5.10	3,1 - 7,3
HU33	Dél-Alföld	4.69	2,8 - 7,3
RO22	Sud-Est	4.68	2,0 - 8,3
HU31	Észak-Magyarország	4.58	2,7 - 6,9
HU32	Észak-Alföld	4.50	2,6 - 6,7
RO41	Sud-Vest Oltenia	4.35	1,9 - 7,9
RO11	Nord-Vest	4.31	2,1 - 7,1
RO12	Centru	4.21	2,1 - 6,8
RO31	Sud - Muntenia	4.00	2,0 - 7,4
RO21	Nord-Est	3.94	1,7 - 7,2
BG33	Severoiztochen	3.63	1,8 - 7,3
BG42	Yuzhen tsentralen	3.53	1,5 - 6,7
BG34	Yugoiztochen	3.43	1,8 - 6,2
BG32	Severen tsentralen	3.41	1,4 - 7,2
BG31	Severozapaden	3.34	1,3 - 7,0

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Do we follow the money? The drivers of migration across regions in the EU

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Abstract. Most immigration theories tend to highlight that migration follows wealth and economic dynamism, but is this also the case across regions in Europe? The aim of the paper is to investigate whether migrants in Europe indeed follow the money, and to contrast this with a variety of potential alternative explanations, including the presence of migrants from a similar origin. The analysis is based on panel data estimations including 133 European regions over a time period of 17 years. Different lag structures have been employed in order to distinguish between short- and longrun effects. The results cast some doubt about the prominence of pecuniary factors as determinants of cross-regional migration in Europe, with little evidence to support the idea that migration follows economic dynamism. Network effects, human capital related-, and territorially embedded innovation enhancing regional characteristics, by contrast, seem to play a much stronger role than hitherto considered.

Key words: Inter-regional migration, mobility, regional economic growth, social networks, regions, Europe

1 Introduction

How important are pecuniary incentives for migration? According to most migration theories, they are crucial. Early theories relied heavily on regional differences in income and living standards as the main motivation for migration, in general, and for rural-to-urban migration, in particular (Hicks 1932, Harris, Todaro 1970). Since then, money and jobs have remained the magnets for migrants in migration theory (e.g. Fields 1979, Lundborg 1991, Schmidt et al. 1994). Most traditional empirical studies on migration have thus tended to focus on differences in living standards and economic dynamism as the key factors behind geographical mobility (Greenwood 1997, Puhani 2001).

Interregional migration patterns within Europe in the last decades however, fly in the face of these theories. Despite substantial and persistent regional disparities in wealth, unemployment rates and economic performance (Puga 2002) – notwithstanding freedom of mobility across much of the EU – migration rates within the EU have remained

*This paper reflects the views of the author only and should not be attributed to the European Commission.

relatively subdued (Décressin, Fatàs 1995, Fatàs 2000). According to (Huber 2004, 619), "it takes several years or decades before regional unemployment disparities are evened by migration." So, if differences in wealth, wages, and employment levels are critical for migration, why has interregional mobility in the EU remained low for so long? Do migrants really follow the money as predicted by traditional theory? Or are there other factors that significantly influence migration at the regional level? In particular, are there potential roles for social networks and other place-based regional externalities as important determinants of migration decisions at the European regional level?

This paper aims to address these questions. Using migration data for 133 European regions during the period in-between 1990-2006, we examine the relevance of pecuniary factors in determining migration trends, by estimating dynamic panel data models. The objective is to first determine the relevance of pecuniary motivations and secondly, to evaluate whether regional wealth, economic dynamism, and job availability are more important than the presence of other migrants, social networks, or other additional regional characteristics, in shaping migration flows across Europe's regions.

In order to achieve this aim, the paper first briefly reviews the theoretical literature on the relationship between pecuniary rewards and migration, before contrasting the potential strength of this relationship with that of other possible migration drivers (Section 2). Section 3 presents a discussion of the data, introduces the variables used in the model and finally provides the empirical specification and justification of the econometric approach. The empirical results are presented and interpreted in Section 4. Section 5 concludes that EU cross-regional migration in recent years is to a greater extent the result of past migration trends, human capital related and territorially-embedded externalities, than simply the differences in wealth across territories.

2 Theoretical considerations: money and other migration drivers

Since the early work of Hicks (1932), financial rewards to individual mobility have been regarded as the fundamental magnet for migrants. According to Hicks (1932, 76), "differences in net economic advantages, chiefly differences in wages, are the main causes of migration." Migrants would regard differences in wages and expected incomes across territories as an opportunity to improve personal wealth, welfare, and living standards (Sjaastad 1962). According to these theories, migrants move in expectation of a higher utility in their destination (Sjaastad 1962, Greenwood 1997), making differences in wages or other forms of incomes across territories the driving force of regional migration. Consequently, the higher the differential of region-specific earning opportunities and the higher the probability of finding a job in the region of destination, the higher the migration flows between home- and host-territory (Harris, Todaro 1970).

The source of unequal earning opportunities across regions has traditionally been rooted in differences in input factor endowment levels (Ranis, Fei 1961, Öberg 1997). In this neoclassical framework, geographical differences in demand and supply of labour trigger migration. Territories with abundant labour supply relative to capital have low marginal returns on labour, whereas territories with relative scarce labour endowments are characterized by higher labour returns. The resulting differences in marginal products lead to different wage levels across territories and are therefore considered the main stimulus behind labour mobility. Under conditions of perfect competition, perfect labour- and capital mobility, classical migration theory predicts people to move from low- to high- labour-productivity regions, leading to an increase of migrants' utility due to higher expected net income levels in high-productivity areas (Borjas 1989, Bauer, Zimmermann 1997, Öberg 1997).[2]

However, when assessing the potential maximization of their lifetime earnings, would-be-migrants have also been found to weight their future career benefits against the financial and psychological costs of leaving their place of origin (Lee 1972, Tassinopoulos,

[2]Further assumptions of the neoclassical model are full employment, homogenous supply of labour, perfect information and transparency, and the absence of transportation costs (Sjaastad 1962). Moreover, traditional migration theories also predict wage convergence between host and source regions, which result in an equalization of real wages across all regions (Todaro 1969).

Kristensen 1998). This cost-benefit calculation involves aspects of investments in human capital. Given certain skill-related attributes, potential migrants choose to move to areas where they believe they can be most productive. Nevertheless, before reaping the expected benefits – mostly in the form of higher wages – migrants have to make certain efforts. These efforts may include learning a new culture and language, the costs of adapting to new working systems, the psychological costs of leaving old social ties behind and forging new ones, but also a number of material costs in the form of travelling and maintenance costs when looking for a new job (Massey et al. 1993). Theory predicts that potential migrants are likely to factor in possible short- or medium-term losses, due to a lack of complete information, or due to the assimilation into a new environment and labour market, in expectation of greater returns in the future (Borjas et al. 1992). When considering moving would-be migrants will estimate the benefits of earnings and employment opportunities in both the home and the potential destination markets, "deduct the costs of making the move, and choose whichever option maximises the net present value of lifetime earnings" (Tassinopoulos, Kristensen 1998, 8). This implies that regions offering the highest pecuniary and financial returns on migration remain to be more attractive for potential migrants (Lee 1972, Pekkala 2002, 2003). Traditional migration theory thus "typically leads to the conclusion that people migrate [...] from regions experiencing a downward economic trend to regions experiencing an economic expansion" (Hooghe et al. 2008, 478). These views have frequently been corroborated by empirical studies. By linking expected future earnings to economic dynamism, Haapanen (2000) for instance, shows that internal migrants in Finland are more like to move to economically prospering regions, and that the elasticity of migration propensity for dynamic regions is over twice as large as that of peripheral regions.

Wage-based migration motives are complemented by financial incentives based on other forms of income, such as state transfers or other public amenities. High re-distributional transfers, on one hand may provide an insurance against the risk of income losses (e.g., due to unemployment) and on the other, increase the overall availability of public goods. Both aspects will increase the utility of (risk-averse) individuals. The consequences on aggregated migration flows are twofold. Whilst potential migrants may be attracted by higher social welfare spending in the host territories, individuals already benefiting from relatively high public social spending may be less willing to leave their places of origin (Haapanen, Ritsilä 2007). Day (1992) for example, shows that inter-provincial migration flows in Canada are significantly influenced by provincial government expenditure policies regarding unemployment insurance benefits and direct transfer payments to individuals. The magnitude and variability of future lifetime earnings is however also subject to a certain degree of uncertainty regarding institutional aspects in the new host area (Ghatak et al. 1996). Informational asymmetries regarding the disposability of public goods, health care, schooling, or the quality of life, as well as uncertainties about employment opportunities and unobservable wages in more advanced regions, may prevent people from leaving economically less attractive regions. Informational asymmetries may also be strongly conditioned by distance (Greenwood 1975, 1997, Zimmermann 2005); the larger the distance between home and host area, the greater the risks and costs of movement. Conversely, information about labour market conditions and social amenities is expected to increase the closer the potential destination is (Zimmermann 2005).

Motives to migrate by an individual are further influenced by a number of other factors. The probability for example, of finding a job in the host region plays a crucial role. High unemployment rates, as well as high ratios of long-term unemployment, may both discourage migration in-flows and simultaneously act as an important 'push-factor' for potential migrants (Todaro 1969, Pissarides, McMaster 1990). Migration therefore, can be considered an intrinsic part of the search process for jobs (Décressin 1994, Huber 2004). The likelihood of migrating and finding a job are highly conditioned by the level of education of the individual (Fields 1975, Zimmermann 2005). Regions possessing industries employing predominantly highly educated people should thus, attract more migrants relative to regions with prevailingly low-skilled labour. Burda, Wyplosz (1992) for instance, show, in the context of East-West European migration, that the most likely movers are the young and the highly educated. Rodríguez-Pose, Vilalta-Bufí (2005, 559)

also find that economically more dynamic regions and "those with a stronger foothold in the knowledge economy" tend to have the greatest capacity to attract highly educated people. As a result, the decision to migrate seems to be affected by a combination of individual and regional characteristics stretching beyond the usual scope of traditional economic migration drivers.

Place-based regional conditions are other factors behind migration, which are attracting increasing interest. Favourable socio-economic features for example, are likely to allow migrants a fast transition into jobs that best suit their abilities, as well as accelerate assimilation in a new structural and administrative system. Favourable human capital endowments and high regional development levels also increase the probability of individuals boosting their own productivity and wages through interaction with others in the region (Rudd 2000, Rodríguez-Pose, Tselios 2012). Individuals moving to highly skilled and well-off regions will therefore benefit from knowledge-spillovers. The presence of large groups of poor and educationally disadvantaged individuals in a region by contrast, will lower overall productivity and thus the region's attractiveness towards potential migrants (Di Addario, Patacchini 2008). Other socio-economic features shaping regional migration flows relate to the structure and the demographic composition of the population. Age has a significant influence on migration decisions (Massey et al. 1993, Tassinopoulos, Kristensen 1998). The propensity to migrate considerably decreases with age (Zimmermann 2005). Hence, regions with a relatively young population structure will have a higher out-flow of (young) people. In addition, tight conditions on local labour markets – especially for young people – could enhance migration (Cairns, Menz 2007).

More recently, urban and natural amenities, as well as aspects related to the quality of life have been prominent features of migration analyses (e.g. Florida 2002, Ferguson et al. 2007, Partridge 2010, Rodríguez-Pose, Ketterer 2012). The beauty and accessibility of the natural environment or the vibrancy of a region's cultural life has been highlighted as potentially a key component in the attraction of talent and skills (Partridge 2010), although this role may be waning (Partridge et al. 2012).[3]

Past migration trends also play a central role in determining the appeal of any given territory for new migrants. The presence of migrants of a similar origin will not only determine the direction of migration flows, but also their persistence. Social network linkages stretching from home to host regions will considerably reduce the costs and risks of migrating for certain groups (Massey et al. 1998). The presence of groups from the same geographical origin in any given region will allow future members of those communities to gain easier access to jobs and reduce the costs of assimilation in new cultural or administrative structures (Massey et al. 1993). This may trigger path dependence, whereby current migration flows may be substantially influenced by the magnitude and direction of past migration movements, reflecting potential chain migration effects on the ethnic group, village, or even family level (Massey, Gracia 1987, Bauer, Zimmermann 1997, Shah, Menon 1999). Group, family, and household ties may also make migration a collective decision. Collective decision-making by larger units of related people, rather than by isolated individuals, may serve as a mean to pool resources and to ensure a higher overall expected income, lower risk, while contributing to loosen several (capital) constraints due to various market failures, albeit often at the expense of individual freedom of choice (Katz, Stark 1988, Stark 1991). As a result, individual earning opportunities may be affected by household externalities (Mincer 1978, Rodríguez-Pose, Tselios 2010).

Finally, structural features of the local economy may also affect specific types of skill-related labour demand and therefore migration patterns across regions. The dual labour market theory (Piore 1979) highlights that migration is driven by a constant demand of migrant labour related to the economic structure of a geographical area. Different territorial characteristics are therefore likely to shape a region's economic structure and

[3] Amenities may play a lower role in the case of Europe than in the US. In a densely urbanised environment, easy access to natural beauty is confined to a more limited number of areas. Average temperatures across the continent are also less extreme than in North America and given its long history, the availability of cultural amenities are more homogenous and often directly related to city size and agglomeration. Hence, regional migration analyses considering amenities in Europe often reach contradictory results (see for instance Rodríguez-Pose, Ketterer 2012, Cheshire, Magrini 2006). Consequently, amenities are not included as an independent variable in our analysis.

thereby its intrinsic labour demands (Massey et al. 1998). The structure and absolute size of the local economy are important elements in attracting certain types of migrants and determining the composition of migration flows. The pattern and size of regional economies are also strongly linked to aspects of market potential. Workers tend to be attracted by regions where the market potential is high and price levels are low, whereas firms tend to cluster in areas with a beneficial access to labour demand. These forces underline that migrants are likely to be attracted by economic agglomeration areas with smaller price indexes and consequently higher real wages (Ottaviano, Puga 1998). Different degrees of industry agglomeration and market potential may therefore influence consumers' and workers' decisions to move. Higher expected real wages in agglomerated areas due to competition among firms, as well as greater diversity, will enhance the pull of agglomerated regions for migrants (Surico 2003, Pekkala 2003). However, different views coexist regarding the effects of industry agglomeration on wages and on the spatial concentration of workers.

In light of the reviewed literature, we contribute in this paper to the empirical evidence on regional migration, by assessing how important net income advantages or pecuniary incentives are when contrasted to other factors leading to migration. In particular, we focus on the potential role of social networks and other place-based regional externalities, as important determinants in migration decisions at the European regional level. Thus, we aim to assess whether the dominant theories of migration, focused on pecuniary factors, are more important than alternative explanations behind migration trends across regions in the EU.

3 Data, variables and econometric specification

3.1 Data and variables

In order to test the importance of pecuniary returns in migration across the EU's regions and to contrast these findings with a number of additional factors influencing migration, we follow the work of Pissarides, McMaster (1990). This approach, which mostly addresses features of traditional migration drivers, is complemented by the use of methods introducing regional and place-based socio-economic externalities (Rodríguez-Pose, Crescenzi 2008, Rodríguez-Pose, Tselios 2010). In order to measure migration, we introduce the net migration rate, defined as the difference between annual immigration and emigration relative to total regional population size (Puhani 2001, Crescenzi, Rodríguez-Pose 2008) as the dependent variable. We consider total migration (considering migration from other EU regions, as well as migration from third-party regions).[4] In-line with traditional migration theories we proxy pecuniary migration returns using differences in relative regional growth rates[5] (Haapanen 2000) and living standards, the latter in the form of GDP per capita levels (Puhani 2001, Jennissen 2003, Greenwood 1997). It is expected that regions with limited economic dynamism (i.e., low economic growth rates) and relatively low standards of living, or a low quality of life (Assadian 1995) will have a negative net migration rate, whereas rich and economically prospering regions will attract migrants.

Traditional migration models further highlight the importance of high unemployment rates as a push-factor for migration (Harris, Todaro 1970). The likelihood of finding a job depending on a region's job opportunities (vacancies) is proxied by the regional unemployment rate. We expect regions with low unemployment rates to experience migration in-flows, whereas high unemployment regions will have a negative net migration

[4] Because of the limited inter-regional migration data provided by Eurostat (especially for Greece and Spain) this analysis follows the approach used by Crescenzi, Rodríguez-Pose (2008) and Puhani (2001) in order to calculate the net migration rate. The data on net migration is calculated as the population change plus deaths minus births. "The net migration data retrieved in this way also includes external migration" (Puhani 2001, 132). Moreover, we standardize the net migration by the average regional population. "Consequently, it is impossible to distinguish between national, intra-EU and extra-EU migration flows" (Crescenzi, Rodríguez-Pose 2008, 72).

[5] Regional economic growth rates are standardized by the respective annual mean value of all the other regions, as migration is likely to be influenced by the level of income in the region of origin relative to the expected level of income that can be obtained somewhere else (cf. Pissarides, McMaster 1990).

rate (Pissarides, McMaster 1990, Puhani 2001). Given that migration decisions are shaped by a comparison of various sources of expected earnings between the home and destination regions, we also include social welfare payments in the model (see for instance Day 1992, Haapanen, Ritsilä 2007). Because of the national character of most social welfare payments, we construct a re-distributional variable combining national and regional data. The aim is to connect social welfare payments determined on a national scale with a region's economic well-being. The resulting variable is calculated as the ratio of total annual national welfare payments over national GDP levels multiplied by regional GDP levels.

Following Rodríguez-Pose, Tselios (2010), we consider place-based regional externalities. These include the regional concentration of industries, which may influence migration flows by increasing the availability and remuneration of jobs in a region. However, regional agglomeration can also lead to intensified competition among workers (Rodríguez-Pose, Crescenzi 2008). As a result, real wages can either increase or suffer from a certain downward pressure (Ottaviano, Puga 1998). To proxy a region's degree of agglomeration we consider population density. Demographic factors and the important role of age in influencing migration decisions (Massey et al. 1993, Zimmermann 2005) are represented by the percentage of total regional population aged between 15 and 24 years. A region's share in this age group is standardised by the value for all other regions. Social migration networks are proxied by introducing the lagged dependent variable as a regressor in our model.

We construct a social filter index (Rodríguez-Pose, Crescenzi 2008, 56) in order to capture other important regional externalities, which may influence migration decisions. This composite index accounts for the territorially embedded innovation enhancing features of a region. The social filter therefore stands for "the unique combination of innovative and conservative [...] elements that favour or deter the development of successful regional innovation systems" (Rodríguez-Pose 1999, 82). Our social filter index is built upon two main pillars: regional educational attainments and the composition of regional productive resources. Regarding the former, education is believed to be one of the most important sources in determining the innovation creating capacity of a region (Lundvall 1992, Malecki 1997). We introduce regional education in the model, as the number of persons with completed tertiary education relative to both, the total population of the region, and relative to the total number of employed people in the region. For the composition of a region's productive resources, we use the percentage of the labour force employed in agriculture as an indicator of low productivity. Agricultural employment may even be an indicator of some form of hidden unemployment, as agricultural workers show very little mobility and in a European context, tend to be aged (Caselli, Coleman 2001).

As educational attainments and the structure of productive resources are believed to be highly dependent on one-another (Rodríguez-Pose, Crescenzi 2008), problems of multicollinearity arise. We therefore use principal component analysis (PCA) in order to construct our social filter index with the objective "to preserve as much as possible of the variability of the initial information" (Rodríguez-Pose, Crescenzi 2008, 57). The first principal component accounts for 44.2% of total variance, whilst the second component represents 35.6%. The coefficients of education variables are, as expected, positive, while that of the share of employment in agriculture is negative.

The model is run for the EU-15 and covers the time period between 1990 and 2006 (time intervals are measured in years).[6] The analysis is based on a mixture of NUTS-1 and NUTS-2 regions. NUTS-1 are used for Belgium, Germany, and the United Kingdom, while NUTS-2 for Austria, Finland, France, Greece, Italy, the Netherlands, Portugal, Spain, and Sweden. Countries without a regional structure were excluded from the analysis.[7]

[6] In part due to data availability our analysis focuses on the period before the crisis, when there was some catching-up between regions. An interesting extension of our paper would be an examination of a regional migration response to the most-recent crisis. One important impact of the crisis for instance, has been a mean increase in the levels of inequality within regions, but with wide dispersion across regions – with some of them actually experiencing decreases in inequality (see Castells-Quintana et al. 2015). Analysing the role for migration decisions of this differential impact of the crisis in terms of inequality could prove to be of high relevance.

[7] This was the case for Denmark, Ireland, and Luxemburg. The exclusion of these countries is caused

In addition, some individual regions had also to be excluded due to inadequate data availability.[8] In total, the analysis was conducted for 133 regions in 12 countries.

The majority of the data used for this analysis was obtained from the Eurostat Regio database. The variables on educational achievement in contrast, were retrieved from the Labour Force Survey Data also provided by Eurostat. In order to calculate national growth rates, data from the OECD database was used. The exact sources and definition of the variables included in the analyses are summarized in Table A.1 in the appendix. All variables report regional data, with the exception of the national growth-rate, which is used as an explicit control for national unobserved effects and thus minimise spatial autocorrelation (i.e., the missing independence of the residuals of neighbouring observations – Crescenzi, Rodríguez-Pose 2008).[9]

3.2 Econometric specification

As net migration flows seem to be a quite persistent over time, we consider a dynamic model. The model's dynamic form allows us to account for potential endogeneity concerns, and to consider the influence of past migration flows or migratory network linkages on current migration decisions. Given the relatively small number of time periods considered and the fact that the only available instruments are internal ones, we use a heteroscedasticity robust System Generalised Method of Moments (System-GMM) estimator for the dynamic model estimations (Roodman 2006). The specific estimator chosen is the Arellano-Bover/Blundell-Bond panel data estimator in its one-step estimation version. We begin by considering a model in which contemporaneous values of the explanatory variables affect migration decisions. We then consider lagged explanatory variables, assuming that migration decisions are based on past values and behaviours (Greenwood 1985). In order to get a more complete picture of how different explanatory variables affect regional net migration over time, the model is consecutively estimated with different lag structures imposed on all independent variables. As a result, the dynamic model is successively estimated with a zero to five-lag structure for all explanatory variables (i.e., in six separate regressions). Regarding the specification of the used estimator, the lagged net migration rate is classified as endogenous in all regressions.[10] Moreover, the first and the second lag have been chosen as (internal) instruments for the endogenous variables in all regressions. The use of more instruments with a higher number of time lags did not significantly change the results. Our dynamic model adopts the following form:

$$\begin{aligned}\text{Net-migration}_{i,t} \;=\; & \alpha + \beta_1 \text{Past-migration}_{i,t+(n-1)} + \beta_2 \text{Economic-growth}_{it-n} + \\ & \beta_3 \text{unemployment}_{it-n} + \beta_4 \text{young-population}_{it-n} + \\ & \beta_5 \text{agglomeration}_{it-n} + \beta_6 \text{Living-standards}_{it-n} + \\ & \beta_7 \text{national-growth}_{it-n} + \beta_8 \text{Social-welfare}_{it-n} + \\ & \beta_9 \text{Social-filter}_{it-n} + \epsilon_{it}, \end{aligned} \tag{1}$$

where all variables are as described in Table A.1 in the appendix; α is a constant, i is the regional index, $i \in [1; 133]$, t is the temporal index, $t \in [1990; 2006]$, and ϵ is the idiosyncratic error term.

by introducing the national growth-rate in order to control for national effects.

[8] The regions excluded due to missing data are: Ceuta and Melilla, Canary Islands, all French overseas departments (Guadaloupe, Martinique, Guyane, Réunion), Länsi-Suomi, Trento, Açores, and Madeira.

[9] By introducing the national growth-rate as a control variable the effect of spatial autocorrelation is minimized (Rodríguez-Pose, Crescenzi 2008, 72). National growth rates are included as the ratios of GDP (PPS) volume changes between the current and the previous year over the GDP (PPS) level of the previous year.

[10] In the first dynamic model regression (no lags) both the lagged net migration rate, as well as the regional growth rate, have been classified as endogenous variables. National growth rates of the country to which a particular region belongs were introduced to minimize problems of spatial autocorrelation.

Source: authors' own calculations

Figure 1: EU-15: Regional growth rate and net migration rate, 1990-2006

4 Empirical Findings

4.1 Regional net migration patterns in the EU: graphical analysis

Before considering other potential determinants of migration, we analyse the relationship of the latter with pecuniary factors. Figure 1 plots the average regional growth rate of each region against the corresponding net migration rate over the period 1990-2006. With the exception of a few outliers, almost all data observations are distributed along an imaginary horizontal band, indicating that on average, differences in regional growth rates across EU regions cannot clearly be associated with significant differences in regional net migration rates alone.

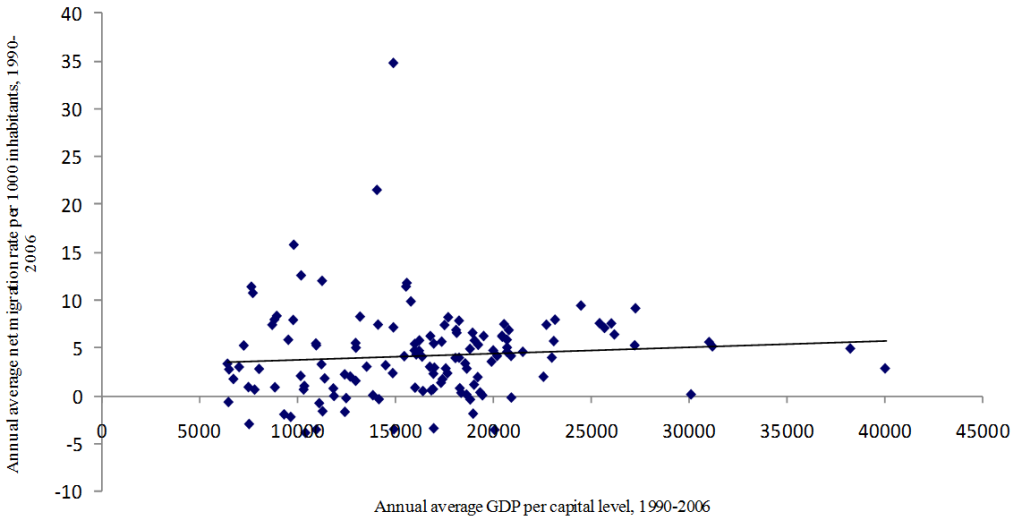
Figure 2 depicts the relationship between regional net migration rates and regional living standards (GDP per capita). The linear trend line seems to indicate the presence of a marginally positive relationship between regional living standards and migration. This relationship however is not significant.

Finally, Figure 3 depicts the relationship between the average net migration rate between 2000 and 2006 and the average net migration rate between 1990 and 1999. The linear trend indicates a strong positive relationship, suggesting a strong persistence of European migration patterns at the regional level. The positive relationship between current and past migration rates remains significant even when we control for other factors.[11]

4.2 Determinants of net migration across European regions: regression results

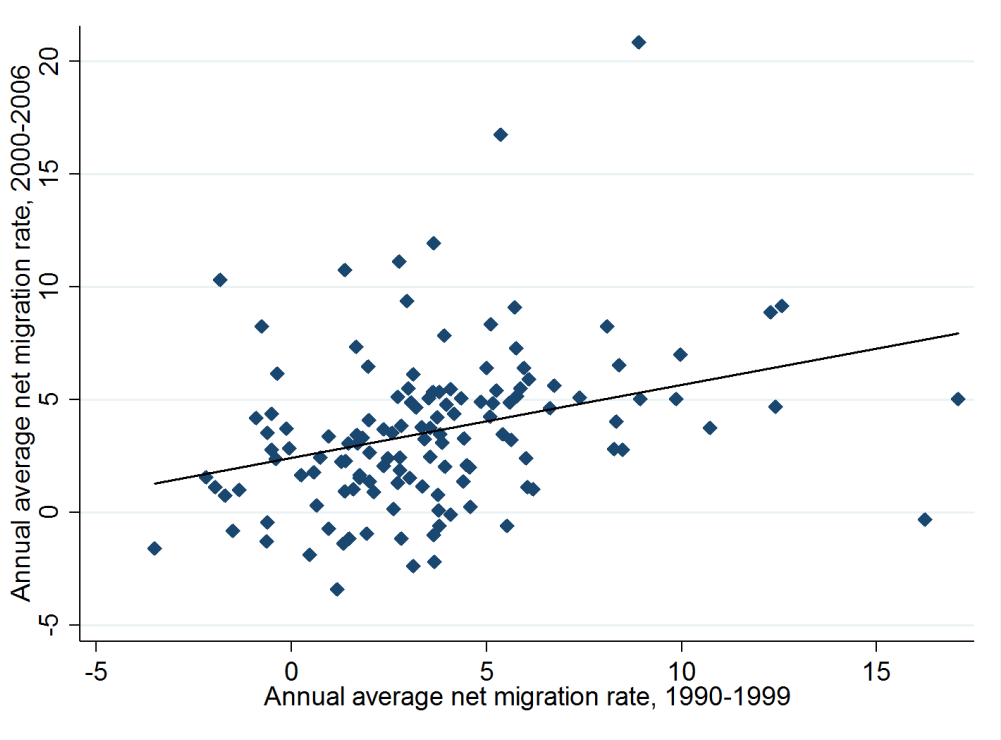
Table 1 reports the regression results when using heteroscedasticity robust system GMM estimations. According to the results, past migration flows are extremely significant in all six model specifications (at a 1% level of significance) and show a positive, albeit with the passing of time, a declining influence on current net migration. Past migration trends are thus more relevant in the short-run than in the medium-run. This result is in-line with Figure 3 and confirms the presence of a certain path dependency, meaning that current migration flows towards a particular region are determined by migration chain effects and by the migration destination selection of earlier migrants (Massey, Gracia 1987, Shah, Menon 1999). In other words, the higher the number of immigrants in a particular host region, the higher the migration flows towards this particular region. However, network

[11] A simple cross-section analysis confirms a significant partial correlation between current (2000-2006) and past migration (1990-1999), which holds after introducing all the considered determinants of migration and country dummies (results upon demand).



Source: authors' own calculations

Figure 2: EU-15: Regional living standards and net migration rate 1990-2006



Source: authors' own calculations

Figure 3: EU-15: net migration rate 2000-2006 and net migration 1990-1999

Table 1: EU-15: Regional net migration in the European Union: Dynamic panel data analysis

Regression	(1)	(2)	(3)	(4)	(5)	(6)
Time variation	t	t-1	t-2	t-3	t-4	t-5
Lagged net migration rate	0.774*** (0.058)	0.795*** (0.053)	0.709*** (0.062)	0.645*** (0.066)	0.587*** (0.069)	0.478*** (0.080)
Regional unemployment rate	-0.451* (0.235)	-0.392** (0.188)	-0.100 (0.267)	0.227 (0.308)	0.306 (0.394)	0.432 (0.485)
Regional growth rate	0.114** (0.048)	-0.030 (0.058)	-0.018 (0.042)	0.041 (0.038)	0.055 (0.046)	-0.058 (0.06)
Region's share of young people	-0.069 (1.231)	0.698 (1.185)	0.805 (1.953)	1.013 (2.609)	1.669 (3.269)	2.389 (4.057)
National growth rate	-0.176* (0.091)	0.186** (0.078)	0.385*** (0.076)	0.306*** (0.089)	0.356*** (0.104)	0.563*** (0.095)
Regional wealth	-0.005*** (0.002)	-0.002 (0.002)	-0.002 (0.003)	-0.001 (0.004)	-0.001 (0.005)	-0.002 (0.006)
Regional agglomeration	0.007 (0.014)	0.001 (0.011)	0.001 (0.015)	-0.002 (0.02)	0.001 (0.026)	0.001 (0.039)
Social Filter	0.029** (0.013)	0.016* (0.009)	0.035*** (0.013)	0.038** (0.017)	0.041* (0.022)	0.046 (0.029)
Social welfare spending	0.001 (0.003)	0.005* (0.003)	0.002 (0.002)	0.005* (0.003)	0.001 (0.003)	0.001 (0.002)
Constant	3.178* (1.459)	0.479 (1.45)	-0.083 (2.396)	-0.434 (3.119)	-0.805 (3.829)	-1.291 (4.645)
Hansen-J	0.723	0.758	0.391	0.176	0.078	0.003
F (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Observations	1956	1925	1796	1667	1538	1409
Number of instruments	146	147	131	116	102	89

Notes: Standard errors are in parentheses below all coefficients. *, **, *** respectively denote the 10%, 5%, 1% significance levels. National wealth and Regional agglomeration have been rescaled by 100, while the social welfare variable by 1,000.

effects among migrants seem based on more recent migration flows than those farther in the past, as signalled by the declining coefficient, once time lags are added (see Columns (1) to (6), Table 1).

Results show that pecuniary factors tend to have a more nuanced effect on regional migration in Europe than what could have been expected according to dominant migration theories. A region's growth rate only has a significant influence on contemporaneous net migration movements. Once we consider lags, the region's growth rate has no significant effect. Regional economic dynamism – as a proxy for higher earning opportunities – thus seems to have no major impact on individual migration decisions. A region's standard of living, calculated as the regional GDP per capita, seems to have no significant effect in most regressions (only significantly negative in the contemporaneous model – column 1 of Table 1). These results place the proclaimed predominance of potential pecuniary rewards as the main lure for migrants across European regions into perspective. In addition, regional agglomeration – proxied by population density – which under certain circumstances may also serve as a potential alternative indicator of earning opportunities, is shown to have no significant influence on regional net migration. Overall, agglomeration on a regional level does not seem to be an essential driver of regional migration in Europe.[12]

[12]See Deas, Hincks (2014) for an analysis of differentials in regional migration patterns in Europe between urban areas and other types of areas, and also between large and small urban areas.

The insignificance or weak significance of the coefficients for pecuniary migration incentives places the focus on other regional aspects, which are likely to be at least as important as monetary perspectives for the attractiveness of European regions towards potential migrants. One of these factors is the regional unemployment rate. Unemployment, as expected, has a significant effect in model specifications (1) and (2), pointing to a negative short-run correlation with the net migration flows. The relevance of unemployment also suggests a cyclical component of migration flows (in line with Huber 2004). Regions where individuals have a lower probability to find a job are on average characterized by a net outflow of people. However, the influence of the unemployment rate diminishes over time, becoming completely irrelevant after specification (2). Any effect of past unemployment rates on current workers' decisions to migrate completely disappears after two years. Hence, a region's unemployment rate is rather important for migration decisions in the very short-run, but wholly irrelevant in the medium- and the long run.

The estimation results in Table 1 further show that the regional ratio of young people relative to other regions has no significant influence on regional net migration movements. The coefficient of the share of young people in a region displays a negative influence on regional net migration, however only up to a lag of two years. Regions with a higher than average share of young people are more likely to experience a migration outflow than regions with an older population structure. Besides lower migration barriers and higher lifetime earning-perspectives of an investment in migration for young movers (Borjas 1989, Zimmermann 2005), the outflow of (young) people may also reflect higher competition among the young for available jobs in regions where the population is relatively young. Faced with high competition for available jobs, young people may therefore be forced to leave their home region in order to find a job somewhere else.

A further interesting result is that the national growth rate is strongly significant over time, showing a positive relationship with the regional net migration rate – with the exception of model specification (1) – indicating that the level of past national economic growth rates is of some relevance for current migration decisions, in line with recent results for European regions (i.e., Sardadvar, Rocha-Akis 2015). This could point to the conclusion that national economic growth rates are a much more visible wage signal than their regional counterparts. Social welfare payments, measured as the ratio of national welfare spending over national GDP multiplied by regional GDP have a very weak positive impact on net migration. However, a significant influence could not be reported for regressions (1), (3), (5) and (6). This could highlight the limited time horizon (around three years) of the influence of past social welfare spending on current migration decisions. Put differently, regions with a well-developed social system tend to attract migrants only in the short-run.

Finally, the social filter index, describing the territorially embedded innovation enhancing character of a region, shows a significant and positive correlation with the regional net migration rate in regressions (1) to (5). This points to the general high importance of (innovation-enhancing) social conditions in order to attract migrants. Hence, territorially embedded characteristics, such as the existence of a favourable educational environment and the associated opportunities for migrants to increase their own productivity through interaction with each other (Rudd 2000, Acemoglu, Angrist 2001, Di Addario, Patacchini 2008) seem crucial in the potential of any European region to attract migrants.

Decomposing the social filter into its individual components yields interesting results. First, among the factors that compose the social filter index, educational variables are highly important. The level of education of the employed labour force has a strong positive influence (0.7174) on the filter index. The presence of a high-tech or high-skilled labour force tends to attract people, once all other factors are controlled for. These findings support – to some extent – the hypothesis that highly educated people are more likely to move to areas with an already highly skilled labour force and with industries requiring highly skilled labour. People eligible to work in such industries will find (better paid) jobs and are therefore more likely to migrate. The educational level of the total regional population also has a positive influence (although not as strong (0.0514)). The slight positive impact of the latter variable may signal a positive influence of a good regional educational system on net migration movements. Second, the composition of

productive resources in a region, proxied by the relative number of people employed in agriculture has a negative influence in the framework of the social filter (-0.6948) and impacts net migration negatively. Regions with a more backward sectoral composition (high percentage of workers in the agricultural sector) therefore tend to lose people.[13]

4.3 Robustness

A number of statistical robustness tests have been performed in order to assess the robustness of the dynamic migration models. Some of them are reported below the respective regression results at the bottom of Table 1 and referred to in this section. The F-test of joint insignificance of the explanatory variables is in all cases strongly rejected at a 1% level. The Hansen-J statistic reported in Table 1 is only significant for the last two regressions (using a four and five year lag structure), reflecting the general validity of the instrument set in most specifications.[14] Regarding potential multicollinearity issues, Variance Inflation Factor (V.I.F) tests have been performed on pooled-data versions of the different model specifications. Given that our model is based on panel-data estimations with non-negligible individual fixed effects, the V.I.F test based on pooled regressions can only deliver limited results. The results of the V.I.F. tests (available upon request) reflect no concern for multicollinearity.

In an additional exercise we consider a static specification similar to that in equation (1), but excluding past migration. This static version follows a heteroscedasticity-consistent cluster-specific fixed effects model (FEM). The results are reported in Table A.2 in the appendix. These findings are qualitatively similar to those obtained in our dynamic specification, and support the relevance of region-specific characteristics beyond pecuniary factors in explaining net migration flows across European regions: our social filter is strongly significant in five out of the six estimations. Social welfare spending is also significant in four out of the six estimations. The main difference with our dynamic specification in Table 1 is that without controlling for past migration, the regional economic wealth becomes statistically significant in most specifications.

5 Conclusions

The main purpose of this paper has been to assess the role of pecuniary factors in comparison to other alternatives as a major driver for migration. Given the substantial growth and income disparities across the EU's regions, we examined the question of whether total regional migration in the EU follows money and contrasted these findings against other potential migration drivers. The impact of money and other relevant factors on migration has been analysed by means of a dynamic migration model covering 133 European regions and a time horizon of 17 years. The presented results tend to cast doubt on the relevance of traditional migration theory for recent regional migration trends in Europe. The results give little support to the idea of migration following regional wealth or economic dynamism. It is therefore hardly possible to claim that migration across EU's regions mainly follows the money, in contradiction with most traditional migration theories where money is reported to play an essential role in shaping individual migration decisions. The findings may however, also point to the fact that substantial migration barriers still exist in the EU, which may result in a likely reduction of possible monetary rewards to migration.

The findings suggest that other factors, such as the likelihood of finding a job, past migration trends and the presence of migrants from a similar origin, social security related

[13] In order to get an idea of whether significant differences regarding inter-regional migration patterns exist among European Member States, we run additional regressions for selected EU Member States. The results are reported in Table A.3 in the appendix and reveal important differences across EU countries in the factors that determine migration patterns. While in some countries pecuniary migration incentives seem to exert some influence on inter-regional net migration, this is not the case in all of the others. Unemployment and youth generally play a more important role in almost all Member States analysed.

[14] A small caveat of the regression results reported in Table 1 is the large number of instruments (especially in the first two regressions with 1 and 2 lags respectively) compared to the number of individuals (133). According to Roodman (2006), too many instruments can lead to an over fit of the endogenous variables (Roodman 2006, 40).

aspects, or the availability of a good educational system, and further human capital related regional characteristics are decisive elements for migration flows at the EU regional level. The influence of these factors also varies according to the time frame considered. Whereas some – mainly unemployment, past migration trends, and social welfare spending – operate fundamentally in the short-run, others, such as the presence of an adequate social filter, have an association with net migration trends which is longer lasting. In addition, the significant positive results of the social filter index reinforce the view that it may be easier for high skilled rather than for low-skilled workers to find jobs in other regions and thus, to move. This may also hide the fact that highly educated people are much more sensitive to inter-regional wage and employment differentials. This paper set out to reveal some new insight on migration determining factors on an EU-wide regional level. It may however, also be understood as a call for further research in order to develop policy recommendations concerning inter-regional mobility in the EU and beyond. Further studies could be conducted by means of gravity models in order to directly link sending and receiving regions. In addition, it would also be interesting to see how migration movements are influenced by the size of regional manufacturing and services sectors, as well as to explicitly investigate the role of human capital and education on EU-wide regional net migration rates.

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A Appendix

Table A.1: Data sources and exact definition of the variables

Variable	Exact definition	Source
	Dependent variable	
Net migration rate	Net migration standardised by the region's population (per 1000 inhabitants)	Eurostat + authors' own calculations
	Explanatory variables	
Annual regional growth rate	Growth rate of GDP PPS per inhabitant standardised by the average annual growth rate of all regions	Eurostat + authors' own calculations
Level of a region's standard of living	Regional GDP PPS per inhabitant	Eurostat
National social welfare expenditure	National social expenditure/cap. over national GDP/cap. multiplied by regional GDP/cap. (all in PPS)	Eurostat + authors' own calculations
Regional unemployment rate	Regional unemployment rate standardised by the average annual unemployment rate of all regions	Eurostat + authors' own calculations
Regional agglomeration	Population density	Eurostat
Region's share of young people	People aged 15-24 years as % of total population and measured as the deviation from the annual mean value of all regions	Eurostat + authors' own calculations
National growth rate	Growth rate of national GDP per inhabitant	Eurostat + authors' own calculations
	Social Filter	
Agriculture employment	% of total employment	Eurostat
Employed people with tertiary education	% of total employment	Eurostat + authors' own calculations
Population with tertiary education	% of population	Eurostat + authors' own calculations

Table A.2: EU15: Regional net migration in the European Union: Static panel data analysis

Regression	(1)	(2)	(3)	(4)	(5)	(6)
Time variation	t	t-1	t-2	t-3	t-4	t-5
Regional unemployment rate	-3.866***	-3.987***	-3.171***	-2.243**	-1.537	-0.547
	(0.938)	(0.985)	(1.026)	(1.067)	(1.042)	(1.038)
Regional growth rate	0.042**	-0.097	-0.096*	-0.059	-0.054	-0.111*
	(0.077)	(0.061)	(0.053)	(0.05)	(0.052)	(0.058)
Region's share of young people	-7.450*	-9.239**	-10.597***	-9.741**	-7.578	-4.380
	(4.275)	(3.614)	(3.73)	(4.461)	(5.405)	(6.37)
National growth rate	-0.506***	-0.187*	-0.056*	0.099	0.063	0.042
	(0.109)	(0.109)	(0.099)	(0.093)	(0.088)	(0.093)
Regional wealth	0.025	0.050**	0.051**	0.057**	0.068***	0.089***
	(0.017)	(0.022)	(0.022)	(0.023)	(0.023)	(0.024)
Regional agglomeration	1079.000	0.554	0.363	0.257	-0.118	-0.615
	(0.772)	(0.813)	(0.858)	(0.989)	(0.935)	(1.161)
Social Filter	0.202**	0.130	0.219**	0.271***	0.290***	0.309**
	(0.09)	(0.082)	(0.083)	(0.084)	(0.086)	(0.121)
Social welfare spending	0.004	0.009**	0.008***	0.011***	0.005	0.008**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Constant	6337.000	6180.000	6353.000	3684.000	0.004	5.047
	(4.718)	(5.427)	(5.7)	(6.317)	(6.74)	(7.225)
R2 within	0.222	0.224	0.214	0.196	0.171	0.157
F (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Observations	2054	1925	1796	1667	1538	1409

Notes: Standard errors are in parentheses below all coefficients. *, **, *** respectively denote the 10%, 5%, 1% significance levels. National wealth and Regional agglomeration have been rescaled by 100, while the social welfare variable by 1,000.

Table A.3: Regional net migration within EU countries. Static panel data analysis

Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Country	Austria	France	Germany	Italy	Netherlands	Spain	United Kingdom
Regional unemployment rate	4.886	2.696*	-7.735***	-3.783***	7.172**	-4.573**	2.153*
	(3.215)	(1.402)	(2.379)	(1.306)	(3.069)	(1.93)	(1.154)
Regional growth rate	0.245	0.094	0.343***	-0.009	-0.275**	-0.377**	0.49
	(0.172)	(0.076)	(0.06)	(0.073)	(0.11)	(0.149)	(0.184)
Region's share of young people	77.676***	21.379	13.361**	-14.608**	-48.773**	25.918**	35.900***
	(8.827)	(21.235)	(5.333)	(6.967)	(17.89088)	(10.613)	(7.252)
Regional wealth	0.005	0.283**	0.07	-0.073	0.006	0.0173**	-0.086
	(0.039)	(0.103)	(0.057)	(0.051)	(0.065)	(0.126)	(0.074)
Regional agglomeration	-0.019	-0.005	-0.007	0.015**	0.007	0.029*	0.003
	(0.03942)	(0.009)	(0.00381)	(0.006)	(0.015)	(0.01645)	(0.007)
Social Filter	0.047	-0.5176*	-1.184**	0.0427***	-0.211	-0.2706	0.232
	(0.366)	(0.299)	(0.52)	(0.071)	(0.165)	(0.308)	(0.265)
Social welfare spending	-0.016**	0.009	-0.020**	0.018**	0.036	0.008	-0.015
	(0.007)	(0.029)	(0.008)	(0.007)	(0.024)	(0.112)	(0.008)
Constant	-83.638	-64.811**	9.125	25.468*	47.581**	-54.89	-29.89
	(8.653)	(29.97)	(8.55)	(13.362)	(20.105)	(18.11)	(6.79)
R2 within	0.529	0.37	0.553	0.627	0.326	0.68	0.131
F (p-value)	0.0001	0.000	0.000	0.000	0.002	0.000	0.000
Observations	144	352	160	304	192	256	192
Heteroscedasticity (statistic)	8.28	22.634	29.952	72.869	19.123	25.446	4.397
Normality test (p-value)	0.006	0	0.09	0.002	0.002	0.27	0

Notes: Standard errors are in parentheses below all coefficients. *, **, *** respectively denote the 10%, 5%, 1% significance levels. All model specifications include region-specific and year fixed effects. National wealth and Regional agglomeration have been rescaled by 100, while the social welfare variable by 1,000.

Resources

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WooW-II: Workshop on open workflows*

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Abstract. This resource describes WooW-II, a two-day workshop on open workflows for quantitative social scientists. The workshop is broken down in five main parts, where each of them typically consists of an introductory tutorial and a hands-on assignment. The specific tools discussed in this workshop are *Markdown*, *Pandoc*, *Git*, *Github*, *R*, and *Rstudio*, but the theoretical approach applies to a wider range of tools (e.g., *LaTeX* and *Python*). By the end of the workshop, participants should be able to reproduce a paper of their own and make it available in an open form applying the concepts and tools introduced.

1 Background

As in most social sciences, virtually no training is provided in regional science on workflow design and choice of appropriate tools, especially not from the viewpoint of open science (Healy 2011, Arribas-Bel 2014). Students and young researchers typically receive no guidance as to why or how they should adopt habits that favor the open science principles in their research activity. This is unfortunate, because learning and adopting new tools and workflows require a large time investment, which will only pay-off in the long run. The best time to get started is early in the career when one still has (some) time available to invest. Therefore, this workshop is specifically aimed at young researchers and covers the main ideas behind a well-designed workflow with openness, transparency and reproducibility in mind. At the same time, the content provides an introductory, hands-on overview of a set of free tools that have been designed with such values in mind.

We do not get into every detail of each tool. Instead, we aim to give a gentle introduction, to provide further material, and to place these in the appropriate context. Specific emphasis is set on how certain tools contribute to building a coherent open workflow and how they relate to each other. The main areas reviewed are: mark-up languages such as *Markdown*; reference managers – particularly those open and free such as *Bibtex*, which are compatible with LaTeX; conversion tools such as *Pandoc*; open environments for statistical computing such as *R* or *Python*; version control systems such as *Git*; and online hosting on open repositories such as *GitHub*. At the end of the workshop, participants should be able to reproduce a paper of their own and make it available in an open form applying the concepts and tools introduced. Materials are organized on a website that is openly hosted on *GitHub* and licensed using Creative Commons meaning that access, remix and redistribution are permitted.

*The creation of this workshop is generously sponsored by the European Union's Seventh Framework Programme "Foster" (see as well https://www.fosteropenscience.eu/event/workshop-open-workflows).

2 Description of the resource

The structure of the workshop is organized in two main blocks. The first session introduces basic concepts such as open science, transparency and reproducibility. Here, we stress the relevance of paying attention to the way science is carried out and connect it to the choice of tools that allow such values to be seamlessly embraced in the day-to-day practice of quantitative research in social science. The second, longer, part of the workshop includes four sessions with hands-on overviews of specific tools that have been designed with open science principles in mind and that hence provide the ingredients of a well-thought-out open workflow. The delivery alternates presentation time with hands-on practice, allowing participants to get a real taste of what using the tools implies and therefore experience their advantages.

The five sessions are presented as follows:

1. In this three-hour session, we introduce the concepts of workflow, openness and reproducibility. In the first part, we argue why these concepts are important and what as social scientists we can learn from data scientists. Our main argument is that, although reproducibility is often infeasible in the social sciences, we should strive for research to become as reproducible as possible.

2. In this two-hour session, we introduce the concepts of version control and task automation. The first hour relates to keeping track of changes as they occur throughout the process, while the second hour allows us to break up the different components of an analysis and have them automatically run, when needed, in the correct sequence. The two tools we use to explore these ideas practically are *git* and *make*.

3. In this two-hour session, we introduce the concept of markup languages and working with the terminal. In particular, we focus on *Markdown*, a very lightweight markup language (and probably the fastest way to create slides), and *RStudio*. This enables writing part of a paper in *Markdown* using *RStudio* for document elements such as headers, links, formulas, tables, and references. Using *RStudio* also allows for exporting to better-known formats, such as *docx*, *HTML* and *pdf*.

4. In this three-hour session, we provide an overview of the main ideas behind making data analysis reproducible and transparent. We use the *R* statistical platform in combination with *RStudio* for two main reasons: (i) it works the best out of the box for our purposes and (ii) currently most researchers probably work with this combination for reproducibility.

5. In this final 90-minute session, we introduce how one could make their reproducible research open. This essentially means making use of repositories such as *Github*, which not only serves as a backup repository, but as a method of collaboration with known and unknown authors. Further, we show that making slides in *RStudio* is simple and why authors might prefer to publish a document in *HTML* instead on paper.

3 Resource links

- Website: http://darribas.org/WooWii/
- Materials: https://github.com/darribas/WooWii

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Making Educational and Scholarly Videos with Screen Capture Software

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Abstract. This resource describes several options for making educational videos using "screencasting", or "screen capture" software. The author, who has over 300 screencasted videos on YouTube and indexed on his website www.burkeyacademy.com, describes the software and hardware tools needed, including some open source and free-to-use tools. Links to some "how to" videos are included, as well as some links to other example videos demonstrating novel professional uses for screencasting.

1 Overview

Video has truly evolved into a powerful tool in education over the last decade. While instructors have been showing educational films for many decades, evolving from film to VHS and DVDs, these videos have until recently been costly to produce and distribute. With the advent of YouTube, distribution of videos became much easier, yet most faculty were stuck in the mindset that an educational video ought to consist of a video of a professor at a chalkboard, mimicking a standard classroom setting.

In 2006 Sal Kahn, MIT graduate and founder of the now-famous Kahn Academy, began to change this perception. With his simple style of digitally hand - writing brightly colored text on a black background, the user is virtually looking over his shoulder as he talks them through math problems. Using a digital graphics tablet and stylus, he drew letters, numbers, and simple pictures on his screen, capturing this image along with his voice in order to help his younger relatives learn basic mathematics. Soon his videos exploded in popularity: there was a craving for this kind of educational content. Soon, many imitators followed, including myself in 2010.

The great advantage of screencasting lies in its flexibility. Anything that can be shown on a computer monitor can be captured: text, drawings, real-time use of statistical or mapping software, animations, PowerPoint slides, or even other video clips. Some examples can be seen in some still images taken from the author's videos in Figures 1–3.

This technology can prove valuable as a lecture component for online courses, for supplemental or remedial instruction outside the classroom, or for "flipping the classroom" (i.e. having students view lectures outside of class, so that in-class time can be used for solving and discussing problems (Berrett 2012)). Pedagogical studies have found that the supplemental material can have measurable benefits (Evans Jr. 2011, Vondracek 2011). Additionally, novel uses are still being developed: for example, Thompson, Lee (2012) record videos while reading their students' papers in order to give more conversational (and thus more instructive) feedback to students than scribbles in the margins of a paper can provide.

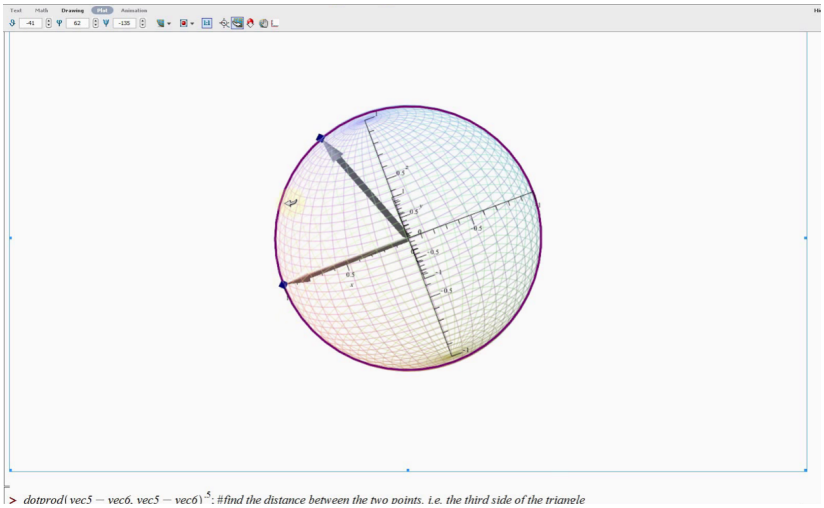

Figure 1: Video in Maple on Great Sphere Distances

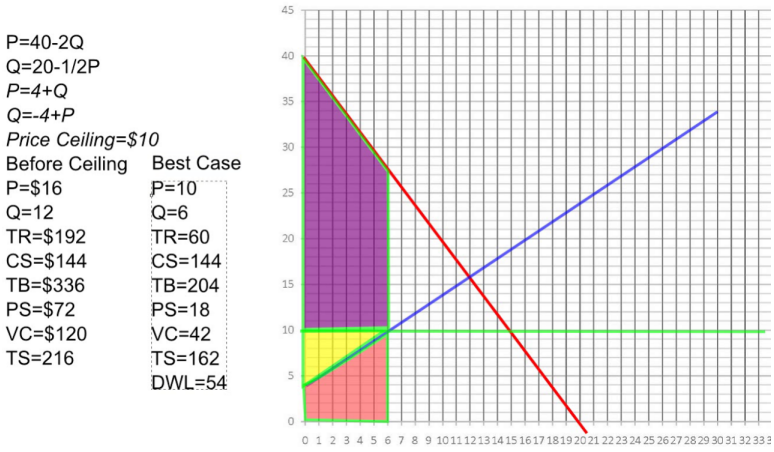

Figure 2: Using InkScape to Perform Welfare Analysis of Price Ceiling

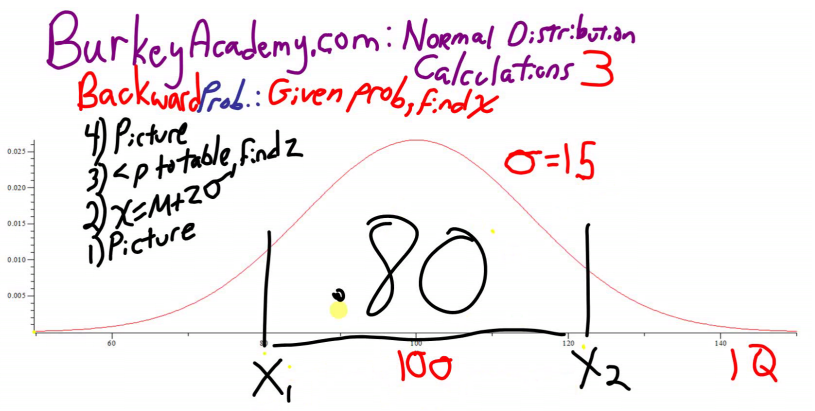

Figure 3: Using Windows Journal with Stylus to Discuss the Normal Distribution

Regional science is by its nature a highly visual field, and one that demands that students and teachers familiarize themselves with a wide variety of software tools such as GIS and statistical software. Screencasting is a wonderful way to demonstrate the use of these tools, and to share many types of research-related visualizations that may not be nearly as effective in a static print form. In this paper I will outline the basic software and hardware tools that one can use to create screencasting videos. Then, I will give some helpful tips and best practices for those starting out with these tools. Lastly, I will provide links to several examples of innovative uses of screencasting videos, including video supplements to journal articles, and instructional videos that will help you make instructional videos!

2 Tools of the Trade

Please don't be intimidated by the volume of the details below. If you want to save the details for later, please skip to section 3 or just watch the "Getting Started" videos listed at the end of this document. It is easy to get mired in the details and give up, but I encourage you to just make your first video – the details can wait.

2.1 Hardware

I use Windows PCs for making my videos, so that will be the focus of my discussion.[1] For recording low resolution videos (e.g. 800x600 or less), a basic, older PC should do the trick. However, if you want to capture your entire monitor at 1920x1080 while making maps in ArcGIS, then a beefier computer is called for.

No matter what kind of videos you plan on making, a decent-quality microphone is a must. I recommend using a USB headset, with a headphone and boom microphone that can be adjusted. A USB connection normally provides cleaner audio than 3.5mm plugs, though these headsets cost a bit more. However, Logitech makes several nice units (e.g. PC960, H340, H390) that can be bought for between 20-40 Euro at your favorite online retailer, though many other good manufacturers can be found.

If your goal is to capture a voiceover for PowerPoint, or demonstrate software usage, then this is all you need on the hardware side. However, what if you want to draw, derive equations, or do other writing-intensive tasks? One common option is to simply use a webcam to film as you write on a piece of paper and describe what you are doing.[2] Another option (that Sal Kahn uses) is to purchase a "digitizing graphics tablet" (e.g. the Huion H610 Pro). This is basically a large version of a laptop touchpad with a stylus-pen for precise input. The downside is that, although the input shows up on your computer monitor, it can be difficult to learn the hand-eye coordination required, since when one writes with the stylus nothing is written on the writing surface itself.

Many newer laptops have touch screens, and touch displays are available for desktops as well. People commonly use these for drawing or writing, using a finger or a passive stylus (similar to a rubber pencil eraser). This method works well unless accurate writing is required (imagine trying to write the limits of a double integral with an eraser on a laptop screen). A tool I use is a laptop that is designed with both a touch screen and an active-digitizing stylus. This battery-powered stylus is extremely precise, but laptops with this design are fairly uncommon, and command a premium (particularly for ones with enough power to run software while recording HD video on the fly).[3] See Figure 4 for a comparison of using the active versus the passive stylus.

When it comes to investing in hardware I would advise going slowly—practice making videos on your existing hardware, and make sure you understand what you really need before investing in anything new.

[1] However, check the resources at the end of this paper for information on Macs and Linux.

[2] The company IPEVO makes several affordable webcams with stands designed to be used in this way, and double as document cameras and normal webcams also.

[3] A list of Windows Laptops/Convertibles with Active Digitizers can be found at http://forum.tabletpcreview.com/threads/list-of-windows-10-tablets-and-convertibles-with-stylus.67533/

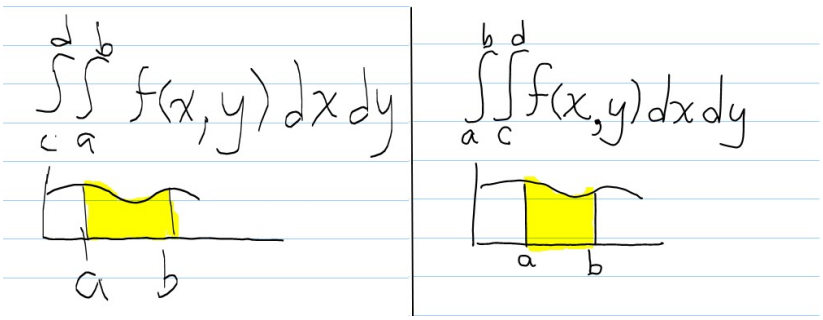

Figure 4: Passive Stylus on the Left, Active Digitizing Stylus on the Right

2.2 Software

There are three main software components you will need: Screen Capture Software, a CoDec, and video editing software. The main piece of software needed is the Screen Capture Software itself. For many years I have used the open source, free software, CamStudio. However, there are two problems with this software:

1. It no longer appears to be maintained regularly.
2. It has occasionally offered to install unwanted software as well, doing so even when you opt out.

Other free options that seem to work well are HyperCam and Screencast-O-Matic. Of course, there are many options for buying software for screen recording: Camtasia (by Techsmith) and Captivate (by Adobe) both seem to work well, and of course there are many others.

A critical piece of software that works with your Screen Capture Software is a good video CoDec – short for Coder/Decoder. This software works behind the scenes to compress your video, balancing quality with size. PCs come with some basic, poor quality Codecs pre-installed (e.g. Microsoft Video 1). Well-known commercial CoDecs are DivX's H.264 and H.265, commonly used to compress high quality video into a small file size. There are many free CoDecs out there as well, but the one I recommend is XVID (a sort of reverse-engineered H.264). It provides great quality video for the file size. Commercial Screen Capture Software will normally come with its own, good quality CoDec.

Another piece of software that you will need at some point is video editing software.[4] Again, the options abound, from Windows Movie Maker to higher-end products. The two basic tasks you might want to be able to accomplish are a) trimming off part of a video, and b) joining two pieces of video together. After making a video for 10 minutes, suppose something goes wrong. Simply stop the video, and cut out the mistake. Make a second clip finishing the video, and then join the two pieces together. I will give you one open source, free option: VDub. This program is difficult unless you have someone show you how it works, so I have included a link to a brief tutorial at the end of this document![5]

Another piece of software that you might want is something to help you make drawings on the fly. If you are using a mouse and want to draw mostly simple shapes (e.g. graphing lines), I recommend the free, open source Inkscape. If you are using a digitizing tablet or laptop with stylus, I like Windows Journal, or alternatively, Microsoft OneNote).

3 How To Do It!

3.1 Just do it!

People often ask me "How long does it take to write the script for one of your videos?" My answers is, "Zero". My philosophy is that I am not making "art", I am conveying information. I do not write a "script" when I give a lecture, and so don't write one when

[4] A big plus for Camtasia software is that it includes basic video editing capability.
[5] YouTube now has some basic online tools that can accomplish these tasks as well.

making a video. Most of us do not have time to spend several hours making a 15 minute video!

The most common type of video I make is right after teaching a class on a topic. Suppose we are reviewing supply and demand. I come back to my office after class, and go through the same basic material using screencasting. The ideas are still fresh in my head, and I just decide how to break the material up into manageable chunks and perhaps make three shorter videos: perhaps "Supply", "Demand", and "Equilibrium".

If I am doing a video on a new topic (not right after class), then sometimes I will type a brief outline to organize my thoughts before I get going. The best advice I can give is this: Do not make perfection your goal when making a video — your goal is to provide resources for your students and/or colleagues and you need to balance quality with the quantity of videos you can make.

3.2 Where the videos will go

At some point you need to decide where you will post your videos. Personally, I host all of my videos on YouTube. Additionally, I have a website that organizes my videos by topic, making it a bit easier to find what you are looking for than it can be on YouTube alone. YouTube has several advantages and features:

1. Wide distribution.
2. Ability to organize multiple videos into "playlists", of either your own videos or a mixture of your own and others' videos.
3. The ability to set videos as "unlisted" – that is, they do not have to be for public consumption. You can make a video for a colleague or for just your students by sharing the link with only those who you want to see the video.

However, you may want to host videos on your own site or server, or on your university's Learning Management System (LMS) (e.g. Blackboard or Moodle), if your videos will be primarily for in-house consumption. Note that YouTube will limit the length of your videos to 15 minutes or less until you verify your account using a valid phone number.

3.3 Best practices

There is a preference in the "video marketplace" for shorter videos in the 5-10 minute range. I try to be mindful of this, but at the same time realize that many topics simply cannot be explored in such a brief amount of time – most of my videos are in the 15-30 minute range. However, if there is a way to slice a topic into shorter bits, it will make it easier on the presenter as well as the viewer.

You need to decide the size of your "capture window" (i.e. how large, and how high resolution do you want your videos to be?). After some trial and error, you probably want to decide on a consistent choice for your videos – this will make future editing and combining of videos easier and more visually appealing. Standard sizes are 1280x720 or 1920x1080 for HD videos, or 854x480 for lower resolution videos. These dimensions all have the 1.78:1 widescreen ratio that is common on most modern devices and TVs.

My desktop monitors have a resolution of 1920x1080, and generally I will capture a window of around 1700x950. This allows the window to cut off the top and bottom window borders and margins of many software packages, leaves some room on the right side of the screen "off camera", and approximately keeps the 1.78:1 ratio. In the "off camera" area I will often place pre-made images or equations I can drag into the filmed area, or windows for other software that I want to drag into the frame at various points in the video.

As mentioned previously, don't over-prepare for a video, and don't shoot for perfection. However, you should be prepared enough that you:

1. Don't make too many mistakes.
2. Don't leave long, empty silences (you can pause the recording for a moment to collect your thoughts.

3. Don't fill silence with "ummm" or "ahhh", just as when public speaking!

4 Why Make Videos?

4.1 Videos for education

Now we discuss several interesting uses of Screen Capture Videos. The easiest way to get started is by making brief review videos for classes you already teach, covering the basic ideas rapidly, and perhaps going through the same or a similar example model, calculation, etc. This is especially useful when presenting the use of software when the course is not taught in a computer lab, and students may not have laptops in class with the software installed. These videos also prove their usefulness when students miss class, or when the professor must miss class or classes are cancelled.

However, videos like these are also very useful for students to review material before tests. When making these "review videos", you probably want to cover the same material in a much shorter time frame than a normal lecture for several reasons:

1. For most of your students, this will be a review.
2. Unlike in a classroom setting, time will not be used answering student questions.
3. You can cover material much more quickly without fear that a student might miss something, for videos can be rewound and watched again.
4. If you post these videos on YouTube for public consumption then many students looking for multiple perspectives or examples will already be familiar with the topic from their own classes.

4.2 Videos for colleagues or yourself

"Best practices" in research calls for good documentation: not just so that others can replicate your work, but so that you and your colleagues can remember and understand your process for creating that work. I sometimes find that it is easier to make a one minute video documenting which projection, datasets, tools, or transformations I used in a certain portion of a project, rather than writing it all down.

Regional Science Researchers are also known for using a wide array of software tools, and we are generous in sharing our code with colleagues. However, most of us are not proficient in Stata, SAS, Matlab, GAMS, ArcGIS, Python, R, and [insert one of dozens of options here]. Suppose you release a new package in R: it almost seems a requirement to supply cryptic, hard to follow documentation and examples. Including a link to a 10 minute video explaining the features, showing an example, and interpreting the output would be a great supplement for your potential "customers".

4.3 Videos as supplements to journal articles, and guides for authors

During my time as co-editor of The Review of Regional Studies, I have experimented with using screen capture videos in two ways. First, I experimented with making what one might call a "Video Abstract" for a research paper.[6] This gives authors the opportunity to give an overview of the paper in a more user-friendly, and perhaps more informative method than the typical abstract.

Also, similar to REGION, The Review of Regional Studies uses the Open Journal System (OJS) software for publishing. While this free system is wonderful in many respects, some operations are counterintuitive, especially for authors and reviewers who are unfamiliar with the platform. Thus, editors spend a lot of time fielding questions and correcting errors. The most common remedy is to type up several how-to guides with screenshots to help users register, submit, and review papers.[7] Instead, I have created

[6] Go to http://journal.srsa.org/ojs/index.php/RRS/issue/view/26 and look for the link called "Video Introduction".

[7] E.g. http://openjournals.wu.ac.at/region/page8.html.

several 5-10 minute videos to help authors understand how to register and submit a paper, submit revisions, and use our formatting template, for example.[8]

5 Conclusion

In this paper I have briefly introduced some of the tools, methods, and uses of Screen Capture Videos for educational and research use. Below I list links to some videos I made demonstrating how to make, edit, and post videos to YouTube using some free software tools.

YouTube Videos about making YouTube Videos

These videos focus on the Windows environment:

Video 1: About CoDecs: Install XVID Codec (optional, but will make smaller, sharper videos): https://youtu.be/tnAtLnT-cE4

Video 2: Using free HyperCam2 to record a basic video: https://youtu.be/i734w1SyMF4

Video 3: Using VDub to edit videos (cut off mistake, combine with second video segment): https://youtu.be/alkL0I˙1dks

Video 4: Post video to YouTube: https://youtu.be/EJqV2b4MqtU

Information on Other Platforms

On a Mac, the built-in QuickTime player also has the capability of recording video of your desktop. An additional benefit of this is that if you decide to purchase Camtasia, the price is much lower for Mac users! See https://support.apple.com/en-us/HT201066 for basic instructions.

On Linux, there are several free alternatives. They are listed at the following website: http://community.linuxmint.com/tutorial/view/1229

[8] http://journal.srsa.org/ojs/index.php/RRS, see "How-To" Videos in the right sidebar.

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