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Does transport accessibility condition regional specialisation in manufacturing across Europe?

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6 MANUFACTURING ACROSS EUROPE
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10 Abstract
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15 This paper focuses on the debate over the importance of infrastructure in the course of
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17 European integration. We aim at analysing whether the accessibility created by the
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19 improvement in the access to transport network has any effect on the European regional
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21 specialisation levels within manufacturing. Our results point to the conclusion that the
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23 higher the accessibility cost in a region, the higher its specialisation level. In essence,
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25 those regional economies being far (either because of an excessive time cost access or a
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27 lower potential accessibility) need to be more specialised in one or few manufacturing
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29 sectors than those other regional economies with lower accessibility costs.
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36 **JEL codes:** C14, R11, R12
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38 **Keywords:** regional specialisation, network access, manufacturing
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1. Introduction

The ongoing integration process in the EU has substantially increased trade flows between member states and led to higher specialisation levels. MIDELFART-KNARVIK, OVERMAN, Redding and Venables (2002) argue that specialisation might occur for several reasons: comparative advantages in endowments, proximity to markets (geography) and the existence of agglomeration economies. Any of these causes will tend to cluster firms and activities in particular locations which will induce an increasing regional specialisation. Since industries have dissimilar intra-industry trade, the impact of network access on specialisation in manufacturing sectors might differ.

In the present paper we want to analyse whether the accessibility created by transport infrastructure, and consequently the reduction in the costs of access to networks, can have any effect on the regional distribution of manufacturing activity in Europe. We determine whether accessibility, proxied by time cost to networks, impacts on European regional specialisation levels within manufacturing sectors. This is done through a regression analysis in which we control for the impact of other more traditional determinants of specialisation, such as human capital, the existence of a specialised regional labour pool, the presence of agglomeration economies, regional investments and innovation activities, among the main ones.

We do not use a monetary value of infrastructure but we support the idea that infrastructure is only important as a mean to achieving better accessibility so as to decrease transport costs and generate economic development. This is why we use an accessibility measure, through the ICON index (Centre Européen du Développement

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3 Regional), which reflects the connectivity of a region to interregional transport
4 networks. This index focuses on access—measured in terms of time—to the various
5 networks defined, allowing for variations in the quality of transport within a region as
6 well as between it and other regions. In our opinion, the use of an index that considers
7 network usage, including the quality of the network, instead of common measures such
8 as Gross Domestic Product per capita as a proxy for market potential (CLARK et al,
9 1969; KEEBLE et al, 1988) will provide us with more consistent conclusions. However,
10 since some caveats can be posed to the construction of such index, we carry out a
11 sensitivity analysis through the consideration of an alternative proxy for network access
12 such as the potential access indicator as explained in section 3.2.
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29 The present analysis is strictly limited to analysing manufacturing sectors, for which
30 information technology costs are not as relevant as they are in the case of service
31 analysis. On the contrary, manufacturing still depends on infrastructure endowment
32 levels, since such levels condition external trade relations. Hence, a greater time cost of
33 accessibility may be due to either a more highly congested transport infrastructure,
34 looking at present usage, or an insufficient infrastructure endowment provision. In fact,
35 according to some theoretical studies, such as HOLTZ-EAKIN and LOVELY (1996),
36 industry benefits more than other productive sectors from the improvement in the
37 endowment of infrastructure.
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53 The relevance of the European regional case is at least threefold. Firstly, transport
54 network policy has been one of the European Commission's main policies in decreasing
55 regional disparities. Trade accessibility has been a European policy goal in the service
56 of integration. Secondly, the European integration process has pursued the reduction of
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3 trade costs, among other barriers. Thirdly, and lastly, according to the 2001 EU White
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5 Paper on transport, there has been a continued rise in freight and passenger transport
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7 (EUROPEAN COMMISSION, 2001). Therefore, this paper is in the line of the debate
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9 over the importance of infrastructure endowment levels in the course of ongoing
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11 European integration.
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17 The rest of the paper is organised as follows. Section 2 discusses previous empirical
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19 contributions on European regional specialisation and the impact that network
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21 accessibility may have. Section 3 outlines the specialisation indices used in the paper
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23 and describes their main determinants, with a special emphasis on network accessibility.
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25 The fourth section presents our empirical evidence concerning the impact of
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27 accessibility. The final section sets out our conclusions.
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43 2. Previous evidence on European specialisation and the effect of network access

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48 At a country level, it has been observed that the overall specialisation of EU countries
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50 rose during the seventies and eighties. During the 1990s (AMITI, 1999; BRÜLHART,
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52 1998; WALZ, 1999). HAALAND, Kind and MIDELFART-KNARVIK (1999), most
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54 countries detected an average rise of about 11.4% (for a 1985-1993 sample period) in
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56 industry specialisation, and MIDELFART-KNARVIK, OVERMAN and VENABLES
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58 (2000) found a significant effect of geographical aspects as well as of factor
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3 endowments in driving these changes. These authors conclude that geography matters,
4 since industries dependent on forward and backward linkages locate close to centres of
5 manufacturing supply and demand. However, empirical evidence indicates that not all
6 countries became analogously specialised in particular manufacturing industries: slow-
7 growing and unskilled labour-intensive industries induced higher specialisation in some
8 countries, whereas those countries specialised in industries with large economies of
9 scale became less specialised. Additionally, production specialisation increased while
10 trade specialisation decreased (AMITI, 1999 or MIDELFART-KNARVIK, OVERMAN
11 and VENABLES, 2000). EU countries are becoming increasingly specialised, although
12 the changes are not particularly large.
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29 As regards regional analysis, there seems to have been an increase in specialisation on
30 manufacturing sector as a whole during the seventies and eighties (MOLLE, 1980;
31 BRÜLHART, 1998; WALZ, 1999). In addition, in a study of 17 branches of activity in
32 the EU-15 regions, HALLET (2002) found an increasingly similar pattern for most
33 regions reflecting the general structure change from manufacturing into services.¹ Some
34 articles have been oriented toward the analysis of the causes that could underlie the
35 existence of industrial agglomerations (AMITI, 1999; HAALAND et al, 1999;
36 ROSENTHAL and STRANGE, 2001; TIRADO et al, 2002; among others). Among the
37 main determinants, these papers have considered the impact of the existence of high
38 scale economies, human capital endowments, reliance on skilled labour, knowledge
39 spillovers, a favourable geo-economic position and initial specialization in sectors
40 showing scale economies. However, as far as we know, there are no existing papers that
41 have focused their attention on an analysis of the effect of network accessibility on the
42 specialisation pattern of economic activity. Hence, the main objective of the paper is to
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3 analyse the extent to which specialisation is affected by the accessibility generated by
4 transport infrastructures, while controlling by other determinants more traditionally
5 considered in the economic literature.
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12 No consensus exists regarding whether transport infrastructure, and specifically network
13 accessibility, contributes to regional polarisation or decentralisation. Part of the
14 literature supports the idea that regional development policies based on the creation of
15 infrastructure in lagging regions have not succeeded in reducing regional disparities in
16 Europe (VICKERMAN, 1991), while another strand highlights that a reduction of
17 barriers between regions has not yet been demonstrated as working to the disadvantage
18 of peripheral regions (BRÖCKER and PESCHEL, 1988). Irrespective of the result,
19 decreases in average levels of transport costs have not reduced the importance of
20 transport as a factor in the organisation of the spatial economy and the economic
21 fortunes of regions (RIETVELD and VICKERMAN, 2004).
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39 Although their aim was to analyse the impact of infrastructure on industrial location,
40 MARTIN and ROGERS (1995) conclude that a larger infrastructure endowment will
41 not necessarily enhance convergence, due to the different effects of domestic and
42 international infrastructures on industrial location. Improvements in domestic
43 infrastructure (infrastructure that joins points in the same country) in a poor region will
44 always bring firms to those regions (especially when the cost is assumed by a third
45 party). However, firms will tend to relocate in high-activity regions when international
46 infrastructure (the one that joins points in different countries) is improved and when
47 poor regions have a low level of domestic infrastructure. Therefore, in the first stages of
48 integration, the presence of high trade costs between regions causes economic activity
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3 to be located in different regions so as to supply markets locally. However, the decrease
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5 in trade costs and the advancement in integration favour industrial specialisation in the
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7 region with the largest market size, with firms and workers clustering there together
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9 (core-periphery models). In conclusion, in the early stages, the use of certain types of
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11 public investment to deepen an integration process, especially those devoted to
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13 improving network accessibility, may increase specialisation, since regions with weak
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15 competitive positions may be adversely affected (RIETVELD, 1995).
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24 3. Data on specialisation and its main determinants

25 3.1 Specialisation measures

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31 For the measurement of specialisation, we use annual employment levels (in thousands)
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33 for an EU15 regional sample using the Cambridge Econometrics database in the 2002-
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35 2007 period. As for the territorial breakdown, we have chosen NUTS 2 level as our
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37 spatial unit to perform our analysis given that this is the highest disaggregation for
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39 which statistical information is available. However, in Europe there exists a great
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41 heterogeneity in the size and scope of this administrative division. In this regard,
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43 COMBES and OVERMAN (2004) have stated that measures should be comparable
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45 across spatial scales. The concern comes from the fact that spatial inequality measures
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47 are sensitive to the definition of regions because of the presence of either geographic or
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49 economic size differences. According to the geographical size, our sample comprises
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51 regions combining the NUTS 0, 1 and 2 classifications, which allows us to achieve a
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53 more homogeneous database with respect to the area of the regions. The result is a
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55 division of Europe in 130 sub-national units (which, from now on, we simply call
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regions). NUTS-2 regions are used for Greece, Finland, France, Italy, Portugal, Spain, Sweden, and NUTS-1 regions for Austria, Belgium, Germany, the Netherlands and the United Kingdom. We consider Ireland, Denmark and Luxembourg as single regions (NUTS-0). The sector classification considered for data on employment is NACE R17 (Classification of Economic Activities in the European Community aggregated to 17 industries), which is the highest sectorial disaggregation for which regional statistical information is available. We therefore measure the degree of specialisation of each region in these 17 industrial branches.

Two specialisation measures are going to be computed: one absolute and one relative. In absolute terms, we measure the degree of specialisation through the Herfindahl index:

$$H_j^S = \sum_i (s_{ij}^S)^2 \quad \text{where } 0 \leq H_j^S \leq 1 \quad (1)$$

where s_{ij}^S represents the share of employment in industry i in region j as part of the total employment of region j .

The relative measure we use for proxying specialisation is the dissimilarity index. This alternative relative inequality measure is computed to check the robustness of the results to the selected specialisation measure:

$$DS_j = \sum_i |s_{ij}^S - s_i| \quad (2)$$

where s_i is the average share of employment for each sector across all regions. We will use these two measures of specialisation to analyse to what extent the results we obtain

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3 on the impact of network accessibility on specialisation may depend on the index used
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5 to proxy for the concept of specialisation.
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10 3.2. Determinants of specialisation 11 12 13 14

15 As the main determinant of specialisation in which this paper focuses, we use a
16 connectivity time cost to whole infrastructures from each node (the ICON index) as a
17 proxy for a region's connectivity to interregional transport networks, allowing for
18 variations in transport quality.² In this index, the idea of proximity is considered to be
19 the adequateness of connections to the main transport networks rather than physical
20 distance. The ICON index was computed for NUTS2-3 regions for the year 2001 by
21 ESPON (MCRIT research group). This measure considers connectivity to transport
22 terminals by car (minutes) weighted by the area for all NUTS. The ESPON (2005)
23 report defines ICON as follows: "It evaluates the accessibility of any place based on its
24 minimum access time by road to the closest transport nodes (e.g., the closest motorway
25 entrance, the closest railway station, the closest commercial port...) and is evaluated as
26 an aggregation of the values obtained independently for each considered transport
27 network in proportion to its relative contribution to regional transport endowment". The
28 choice of this measure is relevant since the European Commission has seen transport
29 infrastructure improvement as a key policy to reducing regional disparities in the EU
30 (i.e., the promotion of the European Transport Network). The generic expression of the
31 connection of a given point to a given transport terminal or connection node is as
32 follows (ESPON, 2005):
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$$\text{ICON}_{k,j} = f(t_{a,j}, t_{w,j}, t_{g,j}) \quad (3)$$

$$\text{ICON}_j = \sum_{k=1}^N p_k \cdot \text{ICON}_{k,j}$$

where k represents each network, t_a represents the minimum time or cost required to reach the closest access node (or terminal) of the network, t_w indicates the utility of a transport terminal which depends on the number and characteristics of the services supplied and their relation with the specific mobility demands of each connected place; and t_g reflects some identifiable problems in the node itself or in the network. Then, partial values were summed up in proportion to the economic value of each transport sector (p_k).³

However, this index is not beyond criticism. In this regard VICKERMAN, SPIEKERMANN and WEGENER (1999) note that the ICON index definition does not allow for capturing needs, i.e. it does not reflect the potential usage of the different modes. For instance, a region could have a huge underutilised capacity in a specific mode and therefore the ICON would not be capturing the real accessibility. A further criticism refers to the non availability of sectorial utilisation of the modes so that we can not take account of current mode usage and the transport intensity of sectorial production. Despite these criticisms, we prefer to use a physical rather than a monetary value of infrastructure, since according to its definition, the ICON index is a very good proxy for the usage of transport networks. In addition, the indicator includes a spatial impedance term (travel time, cost or inconvenience) that describes the ease of reaching other such destinations of interest. Thus, the quality of the network is considered.

Another indicator of network access that can be used as an alternative to the ICON index is the one defined by the region's accessibility index in which the travel time

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3 between NUTS3 region j and any other NUTS3 region l within the EU as well as the
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5 corresponding markets (measured by GDP or population) can be taken into account by
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7 equation (4):
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$$10 \quad A_j = \sum_{l=1}^m \text{GDP}_l \cdot e^{w \cdot \min(t_{\text{rail}}(j,l), t_{\text{road}}(j,l))}, j \neq l \quad (4)$$

11
12 where m equals the number of European NUTS3 regions, t_{rail} and t_{road} the travel time
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14 between region j and l by rail and road respectively. Parameter w is a weighting factor
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16 that fulfils the following condition: $e^{wT}=0.5$ for $T=180$ (120, 60) minutes.⁴ Data
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18 corresponds to the year 2003. Although the data are not initially given at NUTS2 level,
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20 we computed average values to obtain an approximate measure at this level. In fact, this
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22 alternative index represents a potential accessibility measure (see WEGENER *et al.*,
23
24 2002 for a classification of complex accessibility indicators) and we use it in order to
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26 check the robustness of our results to the consideration of different network access
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28 measures. Comparing both measures, one observes that ICON is easy to understand
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30 though it lacks of theoretical foundation whereas the potential accessibility measure
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32 presented above is founded on sound behavioural principles. However, the latter
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34 contains parameters that need to be calibrated and its values cannot be expressed in
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36 usual units. This is why we will use both measures and check the sensitivity of the
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38 regression results to their usage.
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52 Although analysing the impact of network access is our main goal, in this paper we
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54 need to control for other variables which may also explain specialisation. Specifically,
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56 literature on the determinants of specialisation at the regional level places the stress on
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58 the next: human capital and the existence of a specialised regional labour pool, the
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60 presence of agglomeration economies, regional investments and innovation activities.

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3 These variables are introduced in the empirical specification lagged one period so as to
4 avoid contemporaneous effects. For most variables, the statistical information is taken
5 from the Cambridge Econometrics database. In the remaining of this section, we review
6 some of the ideas in the economic literature on the relationship between such variables
7 and regional specialisation.
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17 To account for regional labour pool effects, we use several variables such as the level of
18 regional compensation per employee⁵ and human capital endowment levels measured
19 through the share of people attaining higher education⁶. High wage levels in a region as
20 a consequence of a labour pool would seem to imply a higher specialisation of workers,
21 which in turn would lead to a greater specialisation in economic activity. Although a
22 positive impact is expected, it is more inconclusive for the case of specialisation within
23 manufacturing sectors since this kind of specialisation would rely more on the
24 technological intensity in the manufacturing sectors.
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39 When analysing the extent to which regional wages have an impact on specialisation,
40 we are consequently considering in part those caused by *human capital*. For example,
41 COMBES, Duranton and Gobillon (2008) demonstrate that individual skills account for
42 a large fraction of existing wage disparities with strong evidence of the spatial sorting of
43 skills. Also, as pointed out by KALEMLI-OZCAN *et al.* (2003), human capital may be
44 a better indicator of development than per capita GDP since, among other reasons,
45 education improves the monitoring of managers (cf., ACEMOGLU and ZILIBOTTI,
46 1999). Further, it might be thought that the transferability of skills, when searching for
47 jobs, is more easily achieved when human capital endowment is high. Therefore, human
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3 capital should be seen as a determinant of specialisation beyond merely its wage
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5 structure.
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11 In order to study the effects of agglomeration we include controls such as market
12 potential⁷ and regional density of population. BRÜLHART and MATHYS (2008) claim
13 that theoretical approaches consider agglomeration as a process that leads to the spatial
14 concentration of economic activity. Empirically, the literature has measured
15 agglomeration by means of regional employment density, market potential or regional
16 size, which in all cases are the outcome of the agglomeration processes. Although we
17 would expect a positive impact of these agglomeration variables on regional
18 specialisation, FUJITA *et al* (1999) and FUJITA and THISSE (2002) indicate the
19 existence of possibly contradictory effects. While agglomeration economies may, on the
20 one hand, attract a wider variety of industries to larger regions, with enhanced
21 diversification, there may also be specific agglomeration economies in certain activities
22 which would induce higher specialisation levels in larger regions. In line with the
23 debate regarding the theoretical lack of consensus on the impact of agglomeration on
24 specialisation, the empirical literature is also inconclusive. On the one hand,
25 KALEMLI-OZCAN *et al.* (2003) report in the case of a sample of countries, including
26 the US, Japan and a number of EU states, that population density has a positive effect
27 on specialisation, while EZCURRA *et al.* (2006) report a negative statistically
28 significant effect of market potential on European regional specialisation. However, in
29 our opinion, this latter analysis cannot be deemed considered conclusive as it only
30 examines two cross sectional periods and considers very few covariates.
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3 Finally, we account for other regional features such as regional investments and
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5 innovation activities. It is sensible to think that large innovative regions, or those with
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7 high investment activities, will tend to impact significantly on the local development of
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9 industrial clusters, so that a higher specialisation level can be expected in them. This
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11 argument is particularly true in concentration/deconcentration processes resulting from
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13 growth pole strategies (PARR, 1999). We proxy for technological regional
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15 characteristics by means of the number of patents in each region as a percentage of
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17 GDP⁸, whereas regional investments are taken straightforward from Cambridge
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19 Econometrics Database. See Table 1 for a review of the construction and statistical
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21 sources of all the variables considered in our model.
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30 [Table 1 about here]
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34 4. Main results 35 36 37

38 4.1 Network accessibility and regional specialisation: Descriptive analysis 39 40 41 42

43 Firstly, in Figure 1 we show the kernel density function of regional specialisation within
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45 manufacturing sectors. Remind that a high value for the specialisation index denote a
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47 great difference in the specialisation of such region with respect to the representative
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49 European region when we use a relative specialisation measure (Dissimilarity index); in
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51 other words, regions are more specialised regarding employment levels when greater
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53 values in the specialisation measure are seen. The figure shows a high probability mass
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55 around the average value, although there is a higher dispersion in the case of regions
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57 with high levels of specialisation. Note that the Dissimilarity index shows the higher
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3 dispersion in its distribution but in general terms one could conclude that the two of
4 them offer very similar patterns. In Figure 2 we have therefore chosen one of them, the
5 absolute specialisation measure (the Herfindahl index), in order to show its
6 geographical distribution for the initial and the final considered years (2002 and 2007).
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8 The maps show that the most specialised regions within manufacturing sectors are
9 located in northwest Spain, southern Portugal, northern Italy and some regions
10 belonging to France, Finland, Greece and UK. Slightly changes are observed over time
11 for this index.⁹
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[Figures 1 & 2 about here]

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29 After analysing the spatial distribution of specialisation, Figure 3 provides a look at
30 regional accessibility data for the above-mentioned European regions and for four
31 different network access measures: the ICON index and the Accessibility measure as
32 described in section 3.2 for 60, 120 and 180 minutes. According to the estimation of the
33 kernel density function, we find strong differences across regions. In addition to the
34 high degree of dispersion, the figure seems to show that the distribution of the ICON
35 index has a stronger dispersion than the regions' accessibility measures. Additionally,
36 there seems to be a strong peak at the right of the distribution, which would point to the
37 possibility of some regions being trapped at high levels of the accessibility index, that
38 is, high levels of accessibility costs. Anyway, both measures (ICON and Accessibility)
39 show strong differences in their distributions despite having been designed to proxy for
40 the same concept. Therefore, using both of them in the regression analysis will allow us
41 to have a robustness analysis of our results on the impact of network access on
42 specialisation according to different network access measures.
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6 Also, giving a hint of the geographical distribution of the network access indicators,
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8 Figure 4 shows a different pattern for both kinds of measures. That is, Spanish regions,
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10 southern French regions, southern Italian regions and Scandinavian regions are the ones
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12 showing the highest cost for time accessibility (ICON index). Notwithstanding,
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14 mapping the accessibility index at 60 minutes, we find out that the higher values are
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16 observed for German regions and some Scandinavian regions. Our accessibility
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18 indicators at different time (60, 120 and 180 minutes) show very similar spatial
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20 distributions. For this reason, we only report one of these maps. Therefore, we can
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22 argue that both accessibility indicators represent alternative approaches to regional
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24 network access.
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32 [Figures 3 & 4 about here]
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36 4.2 The role of network accessibility on regional specialisation 37 38 39 40

41 What we intend in this paper is to analyse the impact of network accessibility on
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43 European regional specialisation while controlling for other determinants of
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45 specialisation that have been already discussed in the economic literature. Additionally,
46
47 in an analysis of sectorial specialisation, spatial effects could be quite naturally present
48
49 and if so, their absence in the regressions could affect the estimates.¹⁰ Consequently, our
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51 final specification is therefore the following:
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$$58 H_{j,t}^S = \gamma' X_{j,t} + \lambda \sum_{j \neq l} w_{j,l} \cdot H_{l,t}^S + u_{j,t} \quad (5)$$

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3 where the period analyzed is $t = 2002, \dots, 2007$ for the set of European regions
4 $j=1, \dots, 130$. The endogenous variable, H , refers initially to the Herfindahl index,
5
6 although in a second step we will use the Dissimilarity index. The vector $X_{j,t}$ collects the
7
8 regional macroeconomic variables that are useful for proxying the determinants of
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10 specialization as predicted by the literature mentioned in section 2, namely Network
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12 access, Human capital, Compensation per employee, Market Potential, Density of
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14 Population, Investment and Number of Patents. Note that in equation (5) we consider a
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16 spatial lag of the endogenous variable, in other words, the average of the specialization
17
18 index in the connected regions (a spatial lag model). We denote the connectivity matrix
19
20 by W , where a typical element, w_{jl} (the degree of connectivity between regions j and l)
21
22 has a value greater than 0 if the regions j and l are connected and 0 otherwise. The latter
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24 implies that specialization levels in each region are potentially affected by specialization
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26 levels in their connected regions. Finally, $u_{j,t}$ represents the error term.
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36 Since we are estimating a panel data model, initially we considered the possibility of
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38 including spatial autocorrelation, if needed, through the use of one of the most recent
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40 contributions in the field which is the estimation suggested by KAPOOR et al. (2007).¹¹
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42 In their paper, they consider a panel data model with error components that are both
43
44 spatially and time-wise correlated. However, as broadly known, the spatial error model
45
46 has a difficult interpretation, and in our case, the spatial econometric tests (Lagrange
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48 multiplier) point to the accuracy of estimating a spatial lag model instead of the spatial
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50 error model. Therefore, we decided to use the method derived by ELHORST (2003) that
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52 considers a spatial lag model estimated with random effects, as suggested by the tests
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54 we have computed. These spatial autoregressive models are therefore estimated through
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56 the maximum likelihood method of estimation developed by ELHORST (2003).
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6 Tables 2 and 3 offer panel data estimations for our specification of interest when
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8 estimating the determinants of regional specialisation with special emphasis on the role
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10 of network access. Table 2 shows the results of the estimation when the dependent
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12 variable is an absolute specialisation index whereas the results obtained with the relative
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14 measure are given in Table 3.
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20 [Table 2 about here]
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24 Column (1) in Table 2 uses the ICON as the network access measure, whereas the
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26 estimation given from (2) to (4) are those obtained with the Accessibility indices with
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28 60, 120 and 180 minutes, respectively.
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34 In general terms, a main result should be highlighted from the estimations in Table 2:
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36 irrespectively of the index considered to proxy network access, their impact on regional
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38 specialisation is always significantly positive, although magnitudes are not comparable
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40 between both kinds of indicators. Therefore, irrespectively of the network access
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42 indicator, the higher the accessibility cost in a region, the higher the specialisation level
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44 within manufacturing sectors in such a region. In essence, our findings would rely on
45
46 the fact that those regional economies being far (either because of an excessive time
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48 cost access or a lower potential accessibility) need to be more specialised in one or few
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50 manufacturing sectors than those other regional economies with lower accessibility
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52 costs. In addition, the potential network indicator (Accessibility) shows that this effect
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54 increases with the accessibility time considered in the formula. In fact, the estimated
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56 coefficient is almost twice when we compare 180 to 60 minutes. That is, the higher the
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3 cost accounting for a larger distance, the greater the impact of connectivity on
4 specialisation.
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10 All in all, our results could seem to be against the idea signalled by MARTIN and
11 ROGERS (1995) that in the first stages of integration the presence of high trade costs
12 between regions causes economic activity to be located in different regions so as to
13 supply markets locally, and therefore an increase of diversification could be derived.
14 However, in the period we are considering in our estimations, 2002-2007, the
15 integration process in the EU is high enough, so that those regions that present higher
16 network access costs tend to be more specialised in one or few manufacturing sectors,
17 basically those in which they perform better, thanks to the decrease in trade costs that
18 are implied in an integrated area. According to WEEDEN (1974) regions perform best
19 in those industries in which they specialize, so that specialisation in those specific
20 sectors would allow them to overcome their greater accessibility costs. Hence, these
21 regions would seek to greater specialisation.
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41 As for the rest of covariates, we should not overlook the fact that the existence of a
42 regional labour pool could play a major role in explaining specialisation. The two
43 variables proxying for it, compensation and human capital, seem to have a significant
44 effect. Human capital presents a positive sign indicating that with high levels of human
45 capital there exists an easier transferability of skills when searching for workers and
46 therefore, it is easier to specialise in some manufacturing sectors. In the case of wages,
47 although compensation per employee shows a positive impact, it is observed that this
48 positive impact tends to decrease with the increases in the compensation (negative
49 coefficient for the squared term). This positive result (although decreasing in
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3 importance with wage levels) is in line with the idea that high wage levels in a regions
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5 as a consequence of a labour pool implies higher specialisation of workers, which in
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7 turn would lead to higher specialisation in the regional economic activity, or at least of
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9 manufacturing activity.
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15 On the other hand, agglomeration measured through market potential also explains
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17 increasing specialisation. In the cases of density of population, a significant impact on
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19 changes in specialisation was not observed. However, it is plausible that market
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21 potential captures the whole impact of the effects of agglomeration. The latter relies on
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23 the fact that the literature considers market potential as the best proxy for capturing
24
25 market size. Thus, our results are in line with those reported by KALEMLI-OZCAN *et*
26
27 *al.* (2003), who reported a positive impact of agglomeration on specialisation.
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29 Additionally, our results confirm the findings of DAVIS and WEINSTEIN (2003)
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31 whereby home market effects matter for industrial location as they do also for
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33 specialisation. BRÜLHART and TRIONFETTI (2004) argue that this *pull effect* leads
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35 to further specialisation attenuating the effects attributable to international specialisation
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37 (in our case those derived from European integration). Furthermore, and for this
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39 covariate, we included into our regressions a cross-effect between the market potential
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41 proxy and the network access measure (ICON), with the idea of capturing the joint
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43 effect of agglomeration and cost time access. The coefficient turned out statistically
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45 significant displaying a negative effect, thus, diminishing the impact of agglomeration
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47 when we account jointly both indicators. Additionally, although regional features such
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49 as the level of investment and innovation are considered, none of them ends up being
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51 statistically significant.
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3 Finally, we must remark the negative sign of the spatial lag of the endogenous variable,
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5 in other words, the negative impact of the average of specialisation levels in the
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7 neighbouring regions. In this sense, one should take into account that we are
8
9 considering specialisation within manufacturing sectors, so that if the neighbouring
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11 regions are highly specialised in specific manufacturing industries, the region under
12
13 consideration seems to have a higher tendency not to specialise but diversify its
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15 manufacturing activity. However, it is necessary to bear in mind that the spatial lag
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17 model has been estimated not because of any a priori on the impact that specialisation in
18
19 the rest of the regions may imply, but in order to avoid biases in the estimation of the
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21 parameters that are the focus of this paper as a consequence of the potential presence of
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23 spatial autocorrelation. In this sense, it must be clearly stated that spatial correlation
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25 seems to be present in our estimation, given the highly significant parameter we obtain
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27 for the spatial lag of the endogenous variable.
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36 So far in the discussion we have shown the existence of a positive impact of network
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38 access on regional specialisation. However, the results were obtained through the use of
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40 an absolute measure of specialisation. Table 3 offers the same results as before but
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42 through the consideration of a different relative specialisation index, as presented in
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44 section 3.1. In general terms, the results show that most of the conclusions presented
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46 above are maintained. As well as the signs and significances of the control variables are
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48 very similar to those in Table 2, we also conclude that network access seems to play a
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50 role in the levels of specialisation gained by European regions.
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[Table 3 about here]

5. Conclusion

The purpose of this paper has been to combine the topics of network accessibility and specialisation and try to determine whether the network accessibility brought by transport infrastructure has had any effect on the regional distribution of economic activity across Europe. We set out to determine if network accessibility, using time cost to networks as proxy, and alternatively a potential network access measure, conditions European regional specialisation levels in manufacturing sectors.

Among the main results obtained through a regression analysis that controls for the impact of other main determinants of specialisation, we have found that network accessibility has an impact on the specialisation within manufacturing sectors across European regions. Irrespectively of the network access indicator, the higher the accessibility cost in a region, the higher the specialisation level within manufacturing sectors in such a region. In essence, our findings would rely on the fact that those regional economies with bad network access (either because of an excessive time cost access or a lower potential accessibility) need to be more specialised in one or few manufacturing sectors than those other regional economies with lower accessibility costs.

It could be stated, therefore, that our conclusions are in accordance with RIETVELD and VICKERMAN (2004) who state that the death of distance, i.e. network access, is unmistakably premature. In line with these authors, one can no longer assume that the

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3 spatial distribution of economic activities will remain unchanged while “transport
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5 simply seeks to optimise how these activities are linked in space”.
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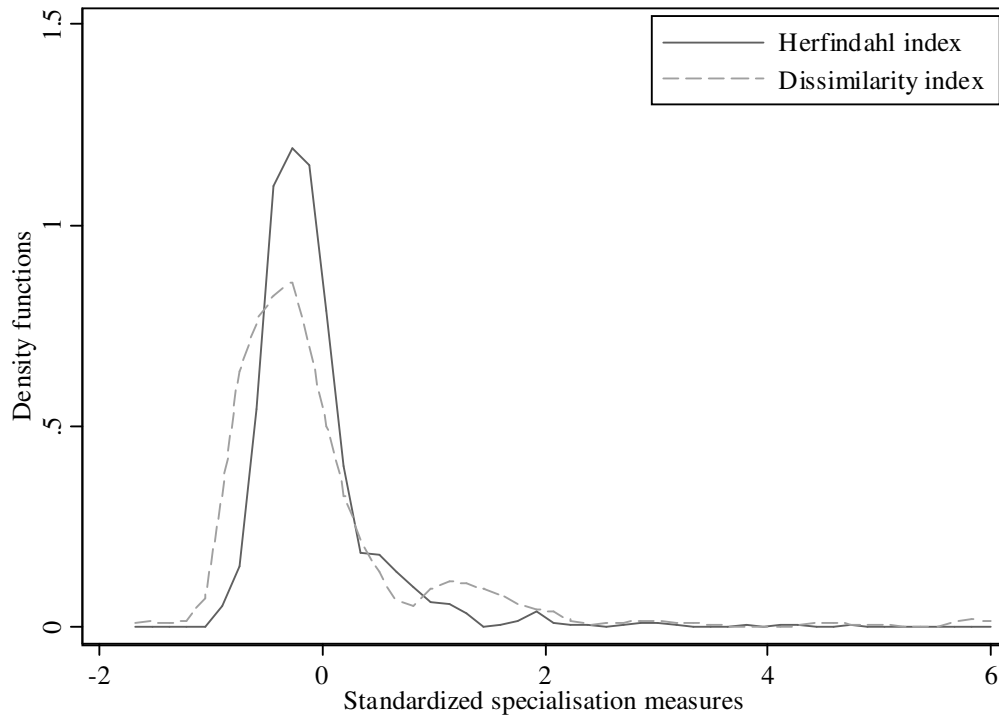
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Figure 1 Kernel distribution of Specialisation measures



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Figure 2 Geographical distribution of specialisation within manufacturing sectors: Herfindahl index

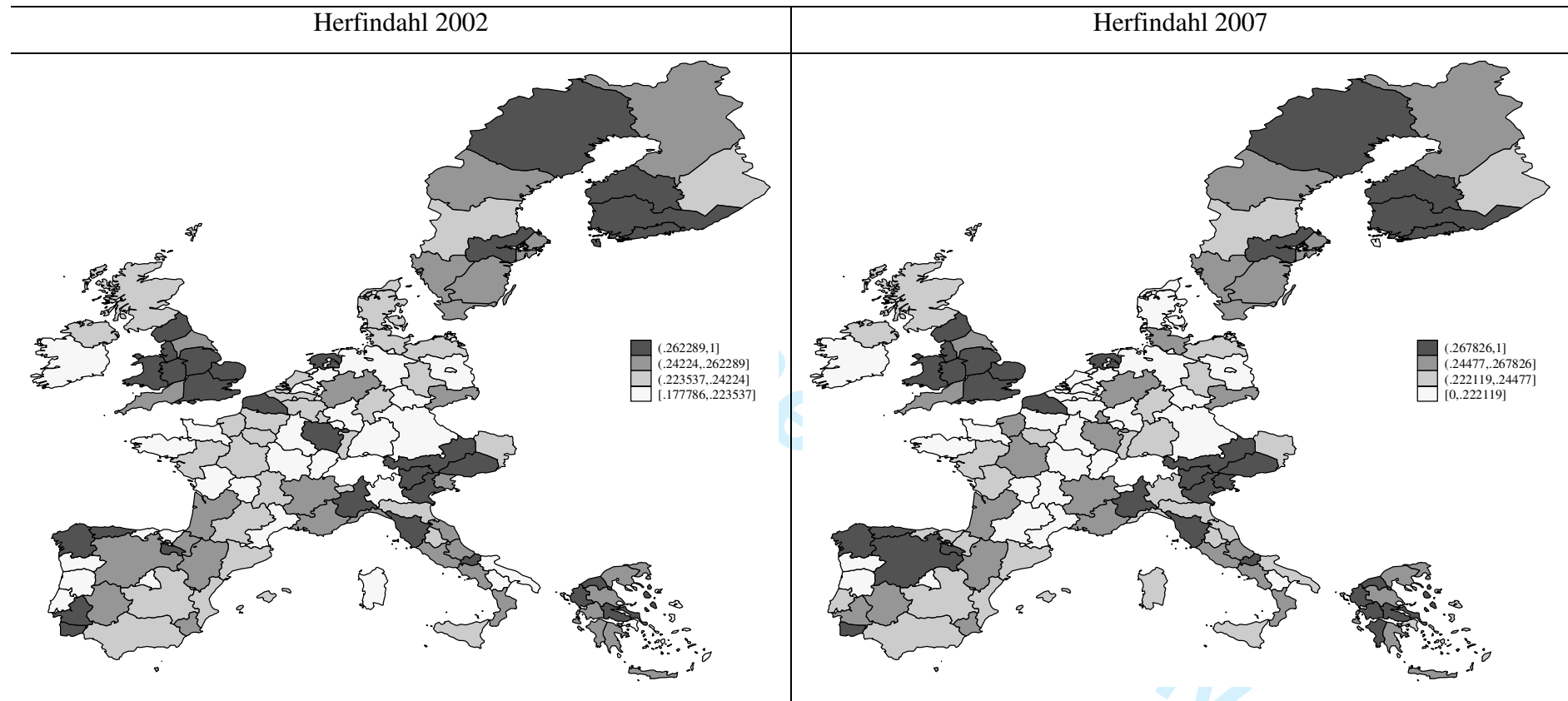
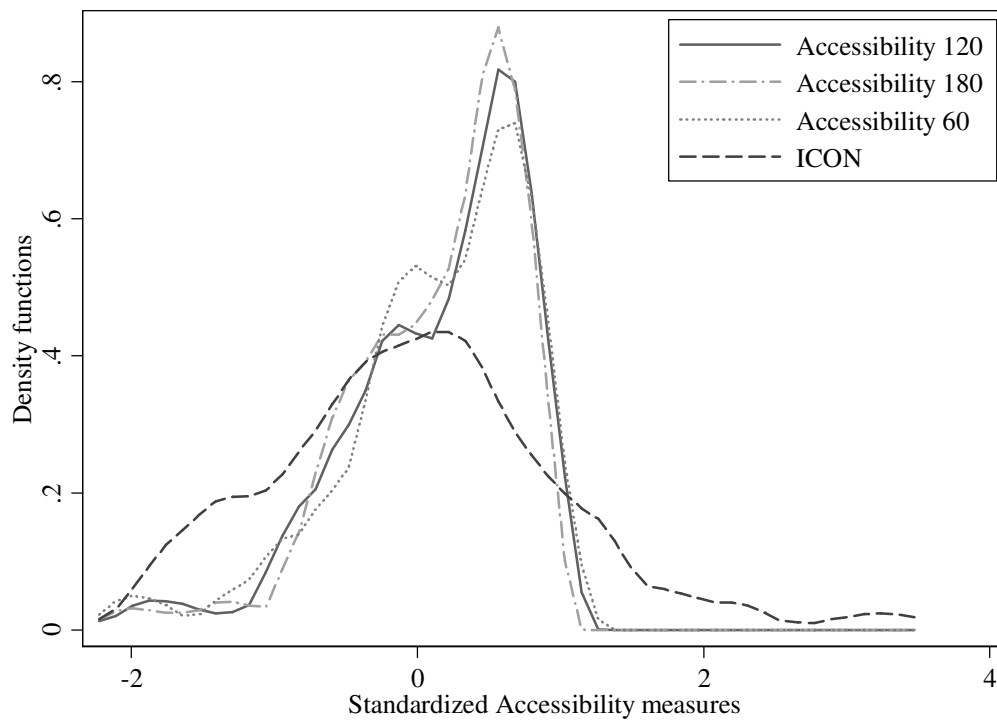


Figure 3 Kernel distributions of Network accessibility measures



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Figure 4 Network access measures

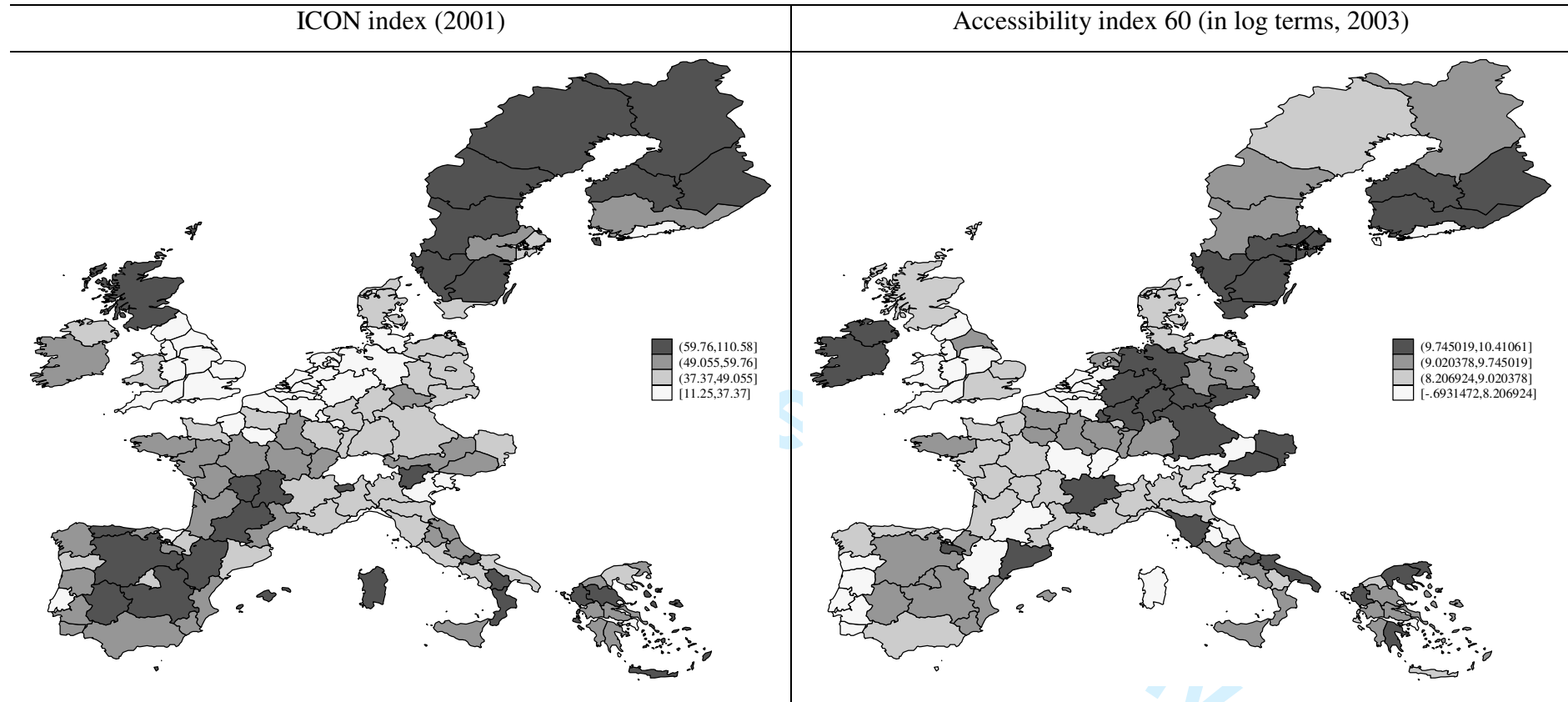


Table 1 Definition and sources of covariates

	Definition	Source
Investment levels	Total regional investment expenditure in million 1995 Euro	Cambridge Econometrics Database
Compensation per employee	Regional average compensation levels per employee in thousand Euro	Own computation based on Cambridge Econometrics Database & Geographical distance data
Market Potential	Regional Σ GDP over distance values between two specific regions	Database & Geographical distance data
Number of patents	Regional number of patents in percentage terms to regional GDP values	CRENOS & own computations
Human capital	Share of labour force attaining medium and higher educational endowments	Computations from the European Labour Force Survey
Density of population	Regional density= Number of inhabitants by region by squared km	Own computation from Cambridge Econometrics Database

Table 2 Panel data results. 130 regions. 2002-2007.

Dependent variable: Herfindahl index for specialisation

	(1) ICON	(2) Accessibility 60	(3) Accessibility 120	(4) Accessibility 180
Network access	0.0014 (3.048)***	0.0084 (1.907)*	0.0124 (2.735)***	0.0160 (3.516)***
Human capital	0.1738 (3.609)***	0.1744 (3.563)***	0.1592 (3.217)***	0.1452 (2.920)***
Compensation per employee	4.5690 (1.397)	6.7830 (2.098)**	4.9550 (1.497)	3.3000 (0.993)
(Compensation per employee) ²	-0.1450 (-2.464)**	-0.1900 (-3.329)***	-0.1580 (-2.689)***	-0.1280 (-2.173)**
Market Potential	0.0646 (3.757)***	0.0450 (2.557)**	0.0362 (2.017)**	0.0278 (1.541)
Density of population	-0.0009 (-0.067)	0.0032 (0.236)	0.0019 (0.143)	0.0012 (0.094)
Investment	0.3530 (0.621)	0.4580 (0.787)	0.3530 (0.613)	0.2780 (0.491)
Number of patents	-0.2168 (-0.181)	-0.5924 (-0.493)	-0.5912 (-0.493)	-0.5784 (-0.484)
Spatial lag of endogenous variable	-0.2361 (-5.217)***	-0.2361 (-5.224)***	-0.2361 (-5.218)***	-0.2361 (-5.217)***
Error component term	0.1961 (11.547)***	0.1923 (11.541)***	0.1944 (11.544)***	0.1978 (11.549)***
N·T	780	780	780	780
R ²	0.7589	0.7587	0.7590	0.7591

t-statistics reported into brackets. Note: ***, **, * denote significance at 1%, 5% and 10%, respectively.

Table 3 Panel data results.

Dependent variable: Dissimilarity index for specialisation. 130 regions. 2002-2007.

	(1) ICON	(2) Access60	(3) Access 120	(4) Access 180
Network access	0.0018 (1.701)*	0.0076 (0.773)	0.0158 (1.630)	0.0215 (2.270)**
Human capital	0.2053 (2.673)***	0.2156 (2.790)***	0.1982 (2.544)**	0.1838 (2.348)**
Compensation per employee	-2.8750 (-0.583)	-1.0380 (-0.210)	-3.0310 (-0.605)	-4.5860 (-0.912)
(Compensation per employee) ²	0.1310 (1.477)	0.0960 (1.094)	0.1290 (1.448)	0.1540 (1.723)*
Market Potential	0.1487 (4.150)***	0.1387 (3.242)***	0.1113 (2.466)**	0.0889 (1.927)*
Density of population	-0.0282 (-0.810)	-0.0220 (-0.626)	-0.0258 (-0.745)	-0.0275 (-0.806)
Investment	-2.2760 (-1.948)*	-2.0470 (-1.730)*	-2.3060 (-1.962)**	-2.4780 (-2.127)**
Number of patents	-3.2731 (-1.947)*	-3.3394 (-1.981)**	-3.4405 (-2.043)**	-3.5097 (-2.085)**
Spatial lag of endogenous variable	-0.2361 (-5.159)***	-0.2361 (-5.156)***	-0.2361 (-5.158)***	-0.2361 (-5.160)***
Error component term	0.0936 (11.435)***	0.0927 (11.434)***	0.0937 (11.435)***	0.0949 (11.436)***
N·T	780	780	780	780
R ²	0.9345	0.9345	0.9344	0.9343

t-statistics reported into brackets. Note: ***, **, * denote significance at 1%, 5% and 10%, respectively.

¹ The greater attention paid by the economic literature to the manufacturing sector when analysing the concentration of economic activity has been motivated by questions of data availability but especially by the fact that the study of manufacturing sectors is of particular interest due to a higher risk of relocation, arising mostly from greater tradability of industrial products.

² Typically, accessibility measures have used rather simple measures of distance or time as a means of estimating the prices of a region's industries. Thus a standard approach was to use the economic potential measurement following Keeble et al (1988), which measures the aggregation of regional incomes deflated by a function of distance. To make further progress, some improvements have undertaken more detailed analysis, defining a set of destinations for each origin-destination pair, which has then been used to define a composite time for this relation. Another option is to make use of a measure of the connectivity of a region to interregional transport networks, which allows for variations in the quality of transport within a region as well as between it and other regions; the index used in this paper follows this literature.

³ The aggregated ICON value for the network must lie between the minimum time to the closest connection alternative providing services above the minimum service level acceptable for any node or terminal and the minimum time to the closest alternative providing the maximum service.

⁴ Higher weights were accounted for the GDP that can be reached faster.

⁵ We included a square term to account for a possible non-linear effect for the levels of compensations per employee.

⁶ We are indebted to Salvador Barrios for providing preliminary computations from the European Labour Force Survey. Indeed, we obtained the percentage values of people in each region attaining low, medium or high education. We expanded the data in order to cover the whole period based on average growth rates. These data consider educational endowments once the effects of mobility have been noted.

⁷ We use the common formula for market potential data for each region j : $MP_{j,t} = \sum_{j \neq i} GDP_{i,t} / d_{ji}$ in

which GDP represents the level of Gross Domestic Product. Likewise, d_{ji} denotes the distance between two capital cities of regions i and j .

⁸ We thank Raffaele Paci and Stefano Usai from CRENOS for providing the number of patents at the regional level. Although the use of patents as a proxy for innovation is not without criticism, we consider it as this has been the proxy most widely used in the literature on innovation. Patents represent the outcome of the inventive and innovative process even though there may be inventions which are never patented, as well as patents which are never developed into innovations. However, the patenting procedures require innovations to have novelty and usability features and imply relevant costs for the proponent. This in turn implies that patented innovations, especially those extended to foreign countries, are expected to have economic, although highly heterogeneous, value (see Griliches, 1990 for a broader discussion on the topic).

⁹ We do not offer the maps for the case of the other specialisation measures in order to save space. However, they can be provided by the authors upon request.

¹⁰ We thank a referee for pointing out this issue.

¹¹ A referee suggested using this advanced method of estimation.