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## **The dynamics of Agglomeration: Evidence from Ireland and Portugal**

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May 2004

Online at <https://mpra.ub.uni-muenchen.de/5706/>  
MPRA Paper No. 5706, posted 20 Nov 2007 06:15 UTC

CORE DISCUSSION PAPER  
2003/43

**INDUSTRY MOBILITY AND GEOGRAPHIC CONCENTRATION  
IN THE EUROPEAN UNION**

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May 2003

**Abstract**

We study the pattern of geographic concentration of industries in EU countries and regions between 1972 and 1995. We find that changes in concentration levels were mainly due to industry mobility rather than historical accidents and past levels of concentration as often argued by the New Economic Geography literature.

Key words: Geographic concentration, industry mobility, Europe.

JEL classification: F14, F15, R12

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This research has benefited from financial support through the RTN research project "Specialization versus diversification: the microeconomics of regional development and the spatial propagation of macroeconomic shocks in Europe" of the European Commission (Grant No. HPRN-CT-2000-00072). Many thanks to Glenn Ellison for valuable advice and Antonio Teixeira for very useful suggestions. Also thanks to Marius Brühlhart, Martin Hallet and Colin Webb for the generous provision of the data. This text presents research results of the Belgian Program on Interuniversity Poles of Attraction initiated by the Belgian State, Prime Minister's Office, Science Policy Programming. The scientific responsibility is assumed by the authors.

## **1. Introduction**

According to Krugman (1991a,b) and Fujita et al. (1999) among others, the concentration of industrial activities across space is primarily influenced by historical accidents together with agglomeration forces, such as increasing returns to scale, high final demand or strong backward-forward linkages, which systematically drive the growth and decline of industrial centers. This framework has frequently been used to assess the possible implications of the European integration process on the location of economic activities, see, for instance, Krugman and Venables (1996) for a theoretical analysis and Amity (1998), Brühlhart (2000), Hallet (2000) and Midelfart-Knarvik et al (2000) for empirical evidence. In particular, these authors try to see whether geographical concentration is likely to have risen due to economic integration. Empirical results remain rather inconclusive, however, with evidence showing a mixed-pattern depending on the geographical scale and the industries being considered, see Combes and Overman (2003). Importantly, however, Dumais et al. (2002) have recently shown for the US that industries are extremely mobile and that non-historical factors attributable to randomness in industries' location play a major role in geographical concentration. We investigate whether such a conclusion can also be drawn for the European case.

## **2. Empirical Analysis**

We utilize two data sources covering the EU 15 members: (1) country-level employment data for a panel of 36 manufacturing industries over the period 1972-95 from the OECD's STAN database<sup>3</sup>, and (2) region-level Gross value added (GVA) data at constant prices from the European Commission REGIO database for a panel of 17 broader industries, namely manufacturing (9 sectors), agriculture, construction, energy, and services (5 sectors), located in the 113 EU NUTS 2

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<sup>3</sup> The data for Ireland was not available in STAN and we had to instead draw on the Forfás employment survey which is an exhaustive employment survey of all manufacturing firms in Ireland.

regions<sup>4</sup>. While the former allows more detailed sectoral classification for manufacturing and is comparable to that used in most other empirical studies of industry location in Europe, the latter data enables us to consider the location in the context of the continuing rise in services activities (from 57 per cent to 67 per cent of total gross value added between 1980 and 1995) in Europe relative to the decline of other traditional industries like manufacturing (from 26 per cent to 21 per cent) and agriculture (from 4 per cent to 2 per cent). Additionally, since the kind of agglomeration forces generally depicted in the economic literature are mostly local in nature, it seems appropriate to also use regional classifications that go beneath national boundaries.

We start from the simple geographic concentration index described by Dumais et al. (2002):

$$G_{it} = \sum_c (s_{ict} - s_{ct})^2 \quad (1)$$

where  $s_{ict}$  is the share of industry  $i$  in country  $c$  and  $s_{ct}$  is the country's share of employment in the average industry at time  $t$ .  $G_{it}$  is thus the sum of squared deviations of the industry's country share of employment from the country's share of employment in the average industry. To derive an aggregate measure of  $G_{it}$  we consider its simple mean across industries,  $G_t$ . The time pattern of this variable is given in Table 1 using both STAN and REGIO data. As one would naturally expect the level of concentration is higher when considering countries rather than region. According to columns 1 and 2, and as been found by previous studies, the geographic concentration of manufacturing industry has increased over the whole period. In addition, the rise in the concentration appears to be deeper when using STAN rather than REGIO probably indicating the possibility that some important productivity adjustments have occurred over the period. The third column of table 1 shows in turn that the concentration of industries is lower and relatively more stable when including other non-manufacturing industries which simply translates into the fact that

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<sup>4</sup> NUTS refers to the standard regional classification system used by Eurostat, the European statistical office. The

services activities are more evenly distributed than manufacturing industries. Aggregate agglomeration patterns can mask considerable equilibrating forces involving large changes in industry location as shown by Dumais et al (2002). Accordingly, one can treat the change in the share of industry  $i$  in country  $c$  as a function of (a) the difference between initial country-industry share and the country's average share and (b) the growth of the country's average employment share in a simple regression:

$$s_{ict} - s_{ict+1} = \alpha + \beta(s_{ict} - s_{ct}) + \gamma(s_{ct+1} - s_{ct}) + \epsilon_{ist} \quad (2)$$

where  $\alpha$ ,  $\beta$ , and  $\gamma$  are estimated coefficients and  $\epsilon_{ist}$  is an estimated error term orthogonal to the regressors. Using (1) and (2) one can easily show, see Dumais et al (2002), that the change in  $G$  over time can be decomposed as follows:

$$G_{t+1} - G_t = (2\beta + \beta^2) + (1/I) \sum_{cs} \epsilon_{ist}^2 \quad (3)$$

where  $I$  is the total number of industries in the data. The first term in (3),  $(2\beta + \beta^2)$ , can be thought of as the effect of mean reversion on changes in geographic concentration and depends on the extent of the gap between  $s_{ict}$  and  $s_{ct}$ . If  $\beta$  is positive then industry centers are growing, thus causing an increase in concentration. If, in contrast,  $\beta$  is negative then current industry centers are declining in importance (relative to non-centers), thus causing mean reversion. The second term of (3),  $(1/I) \sum_{cs} \epsilon_{ist}^2$ , which is always positive, captures the effect of randomness on changes in geographic concentration and reflects the degree of heterogeneity in changes in country-industry employment for countries with initial similar shares. Our results of estimating (2) and calculating (3) are given in Table 2. For the entire sample period  $\beta$  is estimated to be

-0.06 with the STAN data, thus suggesting that countries which in 1972 had a low share of a typical EU industry experienced on average a rise in their share by 6 per cent by 1995. While the fact that  $\beta$

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regions concerned here are all located in continental Europe only, see Hallet (2000) for more details.

is negative implies that mean reversion took place in the location of European industry, this equilibrating process, reducing agglomeration by 12.34 per cent, was not enough to counteract the heterogeneity across countries' and industries' growth since randomness on its own increased agglomeration by 57.63 per cent. We also divided our data into four sub-periods and conducted the same exercise. We observe some differences across sub-periods, especially between 1985 and 1990 (which corresponds to the setting up of the Single Market Program) where mean reversion has had a larger impact than randomness. The results of our decomposition using REGIO data are shown in the lower two parts of Table 2. For the manufacturing industries the  $\beta$  coefficient is found to be negative and is larger in absolute terms relative to the one found with the country-level database for the overall period. The results by period also show that mean reversion has been taking place continuously - a result rather different to the one we got when using the country-level data. This evolution appears to be persistent and more pronounced here, implying that agglomeration forces and the role of history for industry location are especially important for regions rather than countries. Despite this, mean reversion appears to have been offset by randomness and industry mobility and the overall picture thus shows a rise in concentration. Mean reversion dominates only during the 1985-1990 period as for the country-level data. In the bottom part of table 2 we consider the results including the other non-manufacturing industries. Here also the evolution of the  $\beta$  term indicates a decrease in concentration, even more pronounced than when considering manufacturing industry alone. However, the decomposition into mean reversion and randomness indicates that the latter has been more than compensated by the former yielding to a relative stability in concentration.

## **Conclusion**

Our results then bring two important conclusions: (1) there has been mean reversion in concentration contrary to the general arguments made in the NEG literature about the possible impact of economic integration; (2) the observed rise in concentration of manufacturing activities is generally due to randomness in the distribution of countries' and regions' industrial growth, a feature which has not been yet considered by the empirical literature concerning the European case.

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## Tables

**Table 1 : Time pattern of Geographical Concentration Index\***

year	(1) <i>Employment Stan data</i>	(2) <i>GVA Regional data - manif. only</i>	(3) <i>GVA regional data - all sectors</i>
1972	0.0220	<i>n.a.</i>	<i>n.a.</i>
1980	0.0225	0.0048	0.0046
1985	0.0254	0.0050	0.0047
1990	0.0297	0.0049	0.0047
1995	0.0320	0.0054	0.0048

\* mean values of  $G_{it}$ , across industries, see eq.(1)

**Table 2- Decomposition of Geographical Concentration Index**

**(1) *Employment Stan data***

Period	$\beta$	% $\Delta G_t$	% $\Delta$ mean reversion	% $\Delta$ randomness
1972-1995	-0.06	45.29	-12.34	57.63
1972-1980	-0.04	2.17	-8.69	10.85
1980-1985	0.02	12.92	4.31	8.61
1985-1990	0.05	17.05	10.14	6.91
1990-1995	0.01	7.59	1.60	5.99

**(2) *GVA Regional data - manif. only***

Period	$\beta$	% $\Delta G_t$	% $\Delta$ mean reversion	% $\Delta$ randomness
1980-1995	-0.09	10.81	-18.00	28.81
1980-1985	-0.04	3.62	-8.22	11.83
1985-1990	-0.04	-1.53	-8.22	6.69
1990-1995	-0.01	8.61	-1.54	10.15

**(3) *GVA Regional data - all sectors***

Period	$\beta$	% $\Delta G_t$	% $\Delta$ mean reversion	% $\Delta$ randomness
1980-1995	-0.12	4.69	-21.79	26.49
1980-1985	-0.04	3.59	-7.53	11.11
1985-1990	-0.05	-1.53	-9.93	8.40
1990-1995	-0.04	2.64	-7.15	9.79