REGIONAL CONCENTRATION IN THE USA AND EUROPE: WHO FOLLOWS WHOM?

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Contents:

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1. Introduction and plan of the paper[1]

Most economists agree or assume that geographic concentration is higher in the USA. This "common knowledge" has raised the question as to whether European manufacturing would move towards a more concentrated regional pattern[2]. The European Union has abolished trade barriers, has created a Single Market and finally a common currency. These policies have reduced transaction costs in Europe dramatically. Although shifts in production to the best possible locations boost productivity, the prediction that regional concentration would increase in Europe has not been entirely welcomed. Fears of higher regional inequality, the potential clustering of dynamic activities in central areas, and the de-industrialization of the periphery are seen as disadvantages of spatial concentration. Finally, the question has been raised as to whether industry shocks might asymmetrically effect the member states of the Monetary Union.

This paper investigates whether the "common knowledge" that regional concentration in Europe is lower than in the USA can indeed be expected, based upon the existing theoretical predictions, what empirical evidence is available so far, and whether the result can be supported by a new data set. Secondly, we ask, whether concentration is expected to increase and actually is increasing over time. This is specifically interesting for Europe and for the period after 1992 (the enactment of the Single Market Program), but is also investigated for the USA, where concentration trends will be

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[2] Krugman (1991a), Midelfart-Knarvik et al. (2000).

influenced by economic forces proper (including technical forces). As to the best of our knowledge, we present the first comparison of European and US regional concentration for value added, where European data are disaggregated into regions roughly comparable to US- states. Other comparisons of regional concentration were made mainly for employment; comparisons using value added were confined to US states versus European countries (some or all EU-member countries). The new data set refers to 70 European NUTS-1 regions and 49 US regions (48 US states plus the District of Columbia). It enables disaggregation into 10 identical sectors of manufacturing; data cover the period up to at least 1995; for employment in the EU, up to 1998[3].

Section 2 provides a very short overview of the theoretical predictions pertaining to regional concentration and its expected dynamics. Section 3 reviews the existing empirical literature. Data and indicators are introduced in Section 4. The main empirical results are presented in Section 5. Robustness is tested, and caveats are listed in Section 6. Section 7 endeavors to explain which economic forces may lie behind the revealed trends, while the last section provides the conclusions.

[3] For the USA, 1996 is also the last year for which employment data is available.

2. Determinants of regional concentration

In this section we search for theoretical predictions, first about differences between regional concentration[4] in the US and Europe and secondly regarding how concentration can be expected to change over time. The latter point can be split into two questions, one dealing with the impact of economic forces proper (which should hold for all economies) and the other investigating the specific impact of integration (a process which accelerated in Europe during the nineties, due to the Single Market Program). From the multitude of models and hypotheses available, we primarily concentrate on predictions of traditional trade theory, of new trade theory and - probably most adequate for the question of regional structures - on New Economic Geography.

Traditional trade theory – based on perfect competition and homogenous products – predicts that countries will specialize in products which use intensively the relative abundant factor. The regional concentration of relevant inputs translates into the regional pattern of production. In former times, natural resources were the most important inputs, leading for example to the large shares of paper and wood products in northern European countries, or of steel and chemicals in such central European regions as the Ruhrgebiet, the Saargebiet, or Elsass-Lothringen. Later the availability of capital and skills led to the concentration of machine tools in Baden Würthemberg and of cars in the Denver region, while labor intensive textiles and apparel moved south in Europe and partly out

[4] We use the terms regional, spatial and geographic concentration interchangeably. Geographic concentration has to be distinguished from firm concentration in industries (as addressed in Industrial Organization and Competition Policy). Geographic concentration (as the distribution of activity over regions) is related to the specialisation of industries (the

of the country in the US. During the last several years, the availability of immaterial resources has increasingly determined specialization, giving a competitive advantage to regions with skilled labor, educational facilities and universities. The concentration of computer, software and telecommunications in Massachusetts and the Silicon Valley (Saxenian,1994) may reflect a regional specialization based on human capital (and spillovers).

New Trade Theory features imperfect competition, increasing returns to scale and heterogeneous products. The theory does not address differences in endowments; they are implicitly assumed to be rather similar for developed countries with high incomes. Existing centers of specialization can be the result of first mover advantages, which allow firms to move down the cost curve. Pervasive economies of scale suggest that large firms and regional concentration for narrowly defined industries are not exceptions, but rather the rule. Economies of scale, similar endowments and positive transport costs make it profitable to produce at locations with a large home market. Regional policy and infrastructure can enforce and enlarge this type of specialization. At the same time, specialization and regional concentration is seen as less problematic, since each region can specialize in certain, rather similar industries, and engage in intra regional or intra industry trade.

New Economic Geography stresses economies of scale, as well as forward and backward linkages and spillovers; the models allow for product heterogeneity. The regional structures of factor inputs

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distribution of activities in a specific region), since both terms look at the same "data hill" from different perspectives; see Aiginger, Davies 2000). For an extended survey on the theoretical literature see Wolfmayr-Schnitzer 1999

emerge endogenously. Agglomeration is favored by linkages, economies of scale and spillovers. Congestion in the core, the costs of commuting and the rising prices of immobile factors, such as wages and rents, lead to dispersion (Fujita, Krugman, Venables, 1999, p. 346). Regional concentration is "in general" higher, if transport costs are low. There could however be a second part to a U-shaped relationship - where concentration decreases if transport costs decrease further - due to the better access of peripheral regions to the core markets. The New Economic Geography furthermore emphasizes the role of history: a specific de-concentrated or concentrated pattern might seem to be optimal from today's point of view, but given the historically pattern of the industry structure, a certain break-even point has to be reached, in order to establish a new –more or less concentrated structure as an "equilibrium".

Summarizing the predictions, the regional concentration of production depends on the concentration of inputs, the degree of economies of scale, the importance of linkages and spillovers versus congestion costs and wage dispersion, and last but not least transport costs (which first favor concentration, and then eventually work in favor of dispersion). Applying these theories to a prediction of relative concentration in the US versus Europe, we would expect a higher level of regional concentration in the US, mainly due to lower transport costs[5] and to the unrestricted forces of economies of scale. The US was able to build its industrial landscape from scratch, as the industrial area emerged and economies of scale were a pervasive feature of this developmental

[5] Transport costs incorporate transport costs proper, as well as the effects of borders and differences in national laws, etc.

stage. As the population was shifting towards the West, firms had the opportunity to commence large scale production wherever the conditions were best. At the start of industrialization in Europe, not only the population, but also production, demand and skills were already dispersed across regions (Karsten, 1996). To a certain extent, firms had no other choice than to locate where skills were available. In many industries, firms could not produce at a minimum efficient scale (specifically in small countries), since national borders and preferences did not enable pan European optimization. This form of dispersed production continued to persist, even as integration and the harmonization of rules eventually allowed the optimization of exports and investment at the European level, since the "break-even point" towards a more concentrated pattern is different from the "sustain point" for the dispersed pattern (Fujita et al., 1999). For a long time, many small countries at least had some plants with which to serve the domestic market; see the steel and paper and food industries. Given the lower transport costs, and the historical situation at the start of the industrial age, it is a plausible "prediction" that regional concentration should be higher in the US.

As for the prediction regarding dynamics over time, we have two effects: on the one hand, there is the effect of integration on the regional structures within Europe, while on the other hand, concentration depends on the changes in economic forces proper (including technical forces). As to the first, integration is expected to set free the forces of economies of scale and should lower transport costs. According to nearly all theories, this would imply rising concentration. However, there could be counter forces in a fundamentally integrating economy, insofar as first of all, the set up costs for new plants decrease and secondly, resources become more evenly distributed. If a

large economic region eventually harmonizes its laws, and standardizes qualifications and business rules, it becomes easier to locate identical "clones" in different countries, while previously each plant had to some extent be adapted to the national environment and business culture. Lower set up costs for new plants lead to dispersed production. Secondly, in an integrating economy, local abundance, for example in skills and research, which shaped the old form of specialization, becomes less likely. This process is furthermore supported by regional policy, research and mobility programs.

On the other hand, there are economic forces unrelated to integration: if the importance of economies of scale at the plant level decreases due to technical reasons (for example because physical capital loses importance relative to human capital, or because the service component gains importance), dispersion could become the prevailing trend. Natural resources, as well as financial strength and skills will become more evenly dispersed over time, based either on regional or innovation policy, or due to the acceleration of the speed of diffusion of new technologies (for example, via telecom and internet). If linkages and spillovers increase concentrations is expected to rise. On the other hand, congestion costs favor dispersion. It is interesting that for these economic forces, many models, while different in structure and focus, predict a U-curve for the impact of

transport costs on concentration: if transport costs decrease, then activities will first agglomerate. If they decrease further, centrifugal forces will eventually begin to dominate.[6]

How concentration will develop over time is therefor less easy to predict. Integration is generally expected to increase regional concentration, since economies of scale can then work without limits and transport costs decrease. There are at least two possible forces acting towards dispersion: the declining set up costs of plants and the increasing similarity of inputs (the dispersion of knowledge and skills, and the mobility of resources). As to the economic forces proper (i.e. those unrelated to integration), the New Economic Geography stresses that linkages, economies of scale and spillovers favor concentration, while communting costs, congestion and immobile factors favor de-concentration. The theory therefore does n o t provide an unambiguous prediction, neither for the impact of integration nor for the effects of economic forces proper. The research strategy is to learn from European data, specifically about the impact of the forces of integration, as well as from the US data regarding the impact of economic forces proper.

3. Previous literature

As empirical evidence of the "common knowledge" that regional concentration is higher in the USA, most authors refer to Krugman (1991a); this result was derived by comparing the

6 In more elaborate models, industries differ with respect to the importance of returns to scale, linkages, spillovers and main factor input. Thus, at the same time, industries intensive in skilled labor or research might agglomerate, while low wage industries might move to the periphery. See Ottaviano and Puga (1997), Fujita et al.(1999), Krugman 1998, Wofmayr-Schnitzer (1999), Bruelhart (2001) for surveys.

employment data for four US regions (Northeast, Midwest, South, and West) with four large European countries (Germany, France, the United Kingdom, and Italy). Krugman, however, also reported that regional concentration declined between 1947 and 1985, and that the "high water mark of manufacturing localization in the USA (...) was reached probably in the 1920s" (Krugman, 1991a, p. 80). Kim (1995) confirmed this tendency. Midelfart-Knarvik et al. (2000)[7] extend Kim's data over another ten years, comparing concentration at the level of EU member states with levels of concentration in US states. Their focus is development over time, and not a direct comparison of the USA and Europe, since their regional aggregates are different in size. The main result is that regional concentration is continuing to decline in the USA, while Europe is exhibiting a "waved-shaped pattern" of increasing and decreasing concentration; the latest decrease was relatively small at the country level. Braunerhjelm et al. (2000) find regional specialization to be higher in the USA in six of eight sectors. They emphasize that the USA is more regionally clustered, but less polarized, since each region specializes in certain activities and labor is very mobile. Molle (1996) and Hallet (2000) focus on European development over time. Molle uses employment data at a rather aggregated level; the important message of his results is that regional concentration is declining over the long run; his data covers the period ranging from the sixties to the eighties. Hallet uses value added data, which is more disaggregated than both Molle's and ours, including

[7] Whether the concentrated structure in the USA helped to predict the future of an integrated Europe was questioned by Karsten (1996), who explains the more dispersed structure in Europe as a result of the dispersion of skills and the historical dispersion of production at the start of the industrial revolution.

some broad service sectors. He confirms that concentration declined in Europe from the mid-eighties to the mid-nineties. See also Appendix 3 for a synopsis of the available literature.

4. Data and indicators

The construction of the data sets

We use a new data set on value added and employment for regions in Europe and the USA. The data set is based on estimates by the US Bureau of Census and EU Regio Data (Hallet, 2000); information was also provided by national statistical offices and research institutes (WIFO, IFO etc.). Firstly, data for specific years missing in the Regio and Census data were attained by means of interpolation, thus completing the data set. Secondly, as compared to Hallet (2000), country level data for Austria and Greece were disaggregated into the regional dimension, and some of the data for Germany were corrected. Thirdly, the extremely large metal industry sector, which would have accounted for more than one third of value added, was split into metal products, machinery, and electronics and electrical equipment mainly by use of employment shares. On the other hand, some industries were aggregated for the USA, where industry data were available at a more detailed level. The upshot of this is that we have a complete data set for value added for 49 regions in the USA and 70 NUTS regions in Europe[8]. It covers the period 1987 to 1995 (EU), respectively 1996 (USA), and is disaggregated into 10 manufacturing industries. Complementarily, we have employment data for the US states and for European regions, in the latter case covering

the period up to 1998. The regions now covered are by far not of the same size and shape, but at least comparable according to some rough indicators (see Appendix 2): the average population of a region is 4.9 Mio in Europe and 5.3 Mio in the USA, employment in manufacturing is 357.000 and 339.000 respectively. The difference in value added is larger since value added per employee is higher in the USA (and both variables are calculated differently in both areas). Skewness does seem to be similar for employment and value added. However, the population in small US states is lower than in small European regions (as indicated by differences in the mean and median).

The activity variable

The use of value added as the central activity variable has definite advantages. This is the variable that is used to calculate GDP. The majority of available studies have examined employment[9]. As compared to the use of employment data, using value added as the activity variable eliminates differences in productivity levels, as well as differences in the productivity gradient between the core and periphery. Maybe even more important is that recent employment trends have been blurred by the increasing shares of part time work and labor leasing (the latter being far more popular in the USA). Compared to the focus on production value - the activity variable preferred by Midelfart-

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[8] For a full description of the data and methods see Leitner (2001).

[9] Braunerhjelm et al. (2000) do not specify their activity variable. Comparing GDP and GDP per capita between Europe and the USA does however suggest the use of value added data. Their main result is that although the USA is more concentrated across states (as measured by a higher coefficient of variation), this concentration is more than matched by a more highly concentrated population, so that GDP per capita is less concentrated and the USA is more clustered but less polarized.

Knarvik (2000) - the use of value added prevents double counting. In addition, changes in the degree of vertical integration or outsourcing will not bias the results: value added data focus on that part of production, which is generated at the specific location.

Summing up, the data set covers 10 manufacturing branches for 49 US states and for 70 European NUTS1 regions. It contains figures for all regions for the core period 1987 to 1995; in some cases, the data extend beyond this period.[10]

Definition of concentration and the indicators used

Geographic concentration is the extent to which activity in a given industry (or in manufacturing as a whole) is concentrated in just a few regions. We use geographic concentration as a synonym for regional and spatial concentration. Several indicators, which can be used to measure regional concentration, are available. We chose the following four: CR10%, CR30%, the CV, and the Gini-Coefficient (for definitions, see Appendix 1).

Concentration rates: these measure the value added shares of the largest regions. Though primarily used in industrial organization, concentration rates are well established in economic geography, due to their simple calculation and the fact that they can be interpreted intuitively. Taking account of the different numbers of regions, we did not fix the absolute number, but rather

[10] Data on employment in Europe cover 76 NUTS1 regions and are available up to the year 1998. The designation 'NUTS' stands for 'Nomenclature of statistical territorial units'. The 15 EU member states (NUTS0) contain 77 NUTS1 regions, 206 NUTS2 regions and 1031 NUTS3 regions. Despite the basic aim of presenting regions of comparable size

the deciles. We report the share of the first decile (CR10%) and that of the first 3 deciles (CR30%)[11].

The coefficient of variation (CV): many studies use the standard deviation of the shares of individual regions as an indicator of concentration. If all regions have the same share in an industry activity, the standard deviation is zero; if one region attracts all the activity, it is maximized. The coefficient of variation - as opposed to the standard deviation - downgrades the impact of differences between the 70 regions in Europe and the 49 in the USA on the result.

The Gini coefficient: this coefficient compares the actual distribution of activities with an even distribution; regions are ranked according to the amount of activity in an industry relative to overall activity. The coefficient increases relative to the extent that regions are not equally large. Gini coefficients are the indicators most often used in economic geography.

All these indicators measure the absolute concentration. In the section on robustness, we also calculate a relative indicator, in which the share of a region in a specific industry is compared to its share in total manufacturing. The economic questions addressed – whether the core wins at the

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at the same NUTS level, NUTS1 regions differ greatly in terms of area, population, economic weight and administrative powers.

[11] If the deciles are to be truly comparable, exact calculations must be used to divide certain regions. Since the US data are available for 49 states, CR10% includes data for the four largest states plus 90% of the value added (or employment) of the fifth largest state. For Europe CR10% sums up the value added of the 7 largest regions.

cost of periphery and whether Europe follows the more concentrated US – suggest the use of absolute indicators.

5. The main results

The general trends for value added

According to three of the four indicators, the level of regional concentration is higher in the USA. The difference is largest for the Gini, followed by the CR30% and the CV. It ranges between 5% for the Gini and 2% for the CV. This does not look large, but even the smallest of these reported differences is statistically significant (see Table 1). The outlier is the share of the largest decile (CR10%): it is 35.3% for Europe and only 34.1% for the USA. The higher concentration in Europe as indicated by the CR10%, can be reconciled with the evidence of the other indicators by the fact that the next four deciles contain higher shares of value added for the USA; specifically, the second decile is 2.4% larger for the USA (see Figure 1a).

Regional concentration is declining in Europe as well as in the USA. This holds true for all four indicators, for aggregate data, and for the weighted and unweighted averages of industries. The decline is statistically significant. For Europe, the decline varies between 2.7% for the Gini and 4.3% for the CR10%. For the USA, the decline is strongest for the Gini (-3.7%) and least for the CR30% (-2.3%). There is a certain extent of convergence in the picture, since that indicator which is initially highest decreases fastest in both Europe and the USA. The greatest difference in the picture is that in the USA, the decline is relatively smooth over time, while in Europe the decline

was slighter before 1992 and stronger during the Post Single Market Period. When the indicators are regressed on time, nearly all coefficients are significant[12], but the t-values and coefficients of determination are higher for the USA (see Table 2), indicating a stronger and more stable decline in US concentration.

The industry pattern

While overall concentration is higher in the USA, this does not hold for all sectors[13]. Minerals, transport, food and textiles exhibit a definitely higher regional concentration in the USA. To provide a feeling for the quantities involved, 5 states in the USA produce 49% of textiles[14]; 7 regions in Europe together produce only 41% of textiles. For food, the largest regions in the USA have a 36% share and a 28% share in Europe (see Table 3a). In chemicals and metals, the levels of concentration are higher in the USA, but the differences are smaller. According to the CR10%, Europe has higher levels of concentration in electronics, machinery, paper and miscellaneous. [15]

As for the dynamics, regional concentration is declining in the majority of industries. For the USA, the only exception is textiles, which became the most highly concentrated industry. For Europe, the

[12] The only exception is the CV for Europe, which is declining, but the coefficient is not significant.

[13] We use the terms "sectors" and "industries" for the 10 branches for which data are available. "Textiles" refers to textiles, clothing and leather; "food" refers to food, beverages and tobacco; "electronics" refers to electronic and electrical equipment. For more detailed information on the industry dimension see Leitner (2001).

[14] More exactly 4.9 states; textiles include apparel and shoes.

[15] The difference between the USA and Europe is larger if we sum up or take weighted averages of the trends across industries, instead of calculating the concentration for aggregates. This implies that each industry is more concentrated regionally in the USA, while the aggregate activity is dispersed relative to that of the average of industries. Recall that this

steepest decline was in metals, machinery and electronics - all of which are dynamic industries encompassing high tech sectors. The only sectors with significant increases are again textiles and secondly food. Textiles are moving south and partly out of the EU, thereby concentrating in a few regions, mainly in Italy and Portugal. In two industries and only in these two, is Europe moving into the direction of higher concentration, as historically given in the USA.

6. Robustness of the results

Concentration is lower in Europe – however not for all indicators- and it is decreasing in both the USA and Europe. These results, though significant according to the usual test, are based upon a rather short time span. We want to test their robustness by looking at employment as an activity variable, by extending the time period, and by identifying the regions behind the main trends.

The difference in the level of regional concentration is about twice as high, if employment is chosen as an activity variable.[16] The share of the largest three deciles (CR30%) is 4% higher in the USA; for the Gini, differences can amount to as much as 10%. Most of the assessments available in the literature are based on employment and use the Gini; evidently, the literature has involuntarily used this combination of activity variable and concentration indicator, which exemplifies the largest difference between the USA and Europe.

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is a second order effect, in the sense that it compares aggregates with industries within the USA. Even the lower concentration at the aggregate level is higher – to the extent described above – than in Europe.

Regional concentration is declining significantly in the USA for all indicators. The extent varies between -5.8% for the CV and -2.5% for the CR30%. For Europe, the concentration indictors show a decline of -1% for the CR30% and -1.2% for the Gini. The difference between the concentration levels in the USA and in Europe with respect to employment thus closed quickly, with the USA moving down to the European level (see Table 4).

Employment data are available for Europe up to 1998. The additional three years reveal that the trend of decreasing concentration did not revert. For the overall Post Single Market Period (1992 – 1998), concentration decreased between -1.2% for CR30% and -4.7% for the CV (see Table 5).

The robustness of the results is further supported by studies using longer time series (up to 1998) and disaggregation into 99 industries. These are, however, performed at the country level: Aiginger et al. (1999) and Aiginger, Davies (2000), show that regional concentration at the country level decreased specifically between 1992 and 1998. This is independent of whether value added, production, employment or exports are used as the activity variable.[17]

The rational behind the larger difference in employment concentration compared to value-added concentration is that the productivity difference is greater between large industrial regions and

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[16] See the lower part of Table 1. Again the share of the largest decile reveals a deviating picture. It is 1.1% higher in Europe for employment, and it is not declining over time.

[17] Midelfart-Knarvik et al. (2000) use more highly aggregated data and confirm higher regional concentration in the USA. The data also reveal a downward trend in the latest period (ending in 1994/97), but the authors assess it as

those regions with low levels of output in manufacturing. Secondly, the lower speed of de-concentration in European employment (as compared to the USA) is consistent with a decrease in this "productivity gradient". However, such an analysis goes beyond the scope of this paper and perhaps also beyond the quality of the data.[18]

Looking at the regions behind this trend, we see that the states with the highest shares in manufacturing lost value added shares in the USA between 1987 and 1995 (see Table 6). New York's share in value added dropped from 7.07% to 5.48%; that for California fell from 11.58% to 10.69%. Other industrial states that lost were Ohio, New Jersey and Massachusetts. Among the top ten states, only Texas and North Carolina could substantially increase their shares in production (Illinois, Michigan and Pennsylvania had small increases). The lowest 3 deciles increased their shares in manufacturing from 3.58% to 4.39%. In Europe, three of the top four regions lost shares, specifically Lombardy, Nordrhein-Westfalen, and Baden-Wuerttemberg. Niedersachsen, Bassin Parisienne and Bavaria were the only top ten regions with increasing shares in European manufacturing output. The three lowest deciles increased their shares from 5.37% to 5.59%.

"minuscule". Aiginger et al. 1999 and Aiginger, Davies (2000) report that the decline in concentration is not large, but it is however statistically significant.

[18] Value added and employment data are from different sources. Also, slight statistical changes in some member states regarding the regional definition of the European NUTS1 regions may hamper full equivalence and/or matching between the two variables.

The greater weight of small European regions is evident if we use indicators of relative concentration. Relative concentration measures the share of an industry in a region relative to the overall share in manufacturing. The indicators show that the smaller European regions – as defined by the size of manufacturing – are relatively more specialized in Europe. This is however not the question in which economic geography is interested, namely agglomeration in rich or central regions. Indicators of relative concentration are increasing in Europe, as well as in the USA (in the first case, more strongly), implying that small regions are increasingly specialized.

7. The economic forces behind the main results

Our results in general confirm the "common knowledge" that concentration is higher in the US. This is consistent with the fact that it was possible to build up industries from scratch at the beginning of industrialization. Our results show however that the difference between the US and Europe is not really all that large and depends on the indicator used. It is surprising how sketchy the available evidence has been, considering that it has served as the basis for the "common knowledge".

As for the dynamics of concentration, the European data show that the de-concentrating forces are stronger than those which work towards concentration. The time shape and the regional pattern suggest that the impact of integration is behind this development. Smaller and peripheral countries are increasing their shares in production, partly getting better access to thick markets and losing their locational disadvantages in industries with economies of scale, partly because they are catching up in terms of skills and research. The data for the US show an even steeper decline in

regional concentration, on the one hand starting from a more highly concentrated structure. The US data indicate that the economic forces have also favored dispersion. As seen from the perspective of the theoretical hypothesis, this could mean that economies of scale or spillovers[19] are losing importance, and/or that congestion costs, as well as the prices of immobile factors like land and wages are rising. In light of the many studies supporting the importance of clusters specifically in dynamic technical industries (Porter, 1990, Saxenian, 1994), we would not suppose that the importance of linkages or of spillovers has decreased, but rather that congestion costs increased and/or the supply of skills and research became more dispersed. Seen from the two parts of the U-curve, the evidence favors the proposition that the US has long since been on the upper end (indicating dispersion). De-concentration has been less fast in Europe in the eighties, perhaps due to the lower starting level of concentration, but since then has been promoted by the Single Market Program.

The deepening of integration reduced the disadvantages of smaller countries. Greater integration has enabled industries with economies of scale or activities with spillover effects to select locations wherever conditions were best. In a Europe with national borders, there were advantages to locating activities with increasing returns in regions with a large "home market". European Regional Policy favoring peripheral and underdeveloped regions may have contributed to this force. The increasing shares in total manufacturing of Ireland, Portugal, Sweden, Finland and Austria are

[19] Lower economies of scale at the plant level can coexist with economies of scale at the firm level (e.g. in research,

evidence of this trend, as are the decreasing shares of the core regions and large countries in research (Aiginger et al., 1999). The distribution of productivity and wages had previously been rather uneven in Europe, but – in contrast to the USA – it did not lead to the migration of firms or labor.

This leads to a third fact. It is well known in the literature[20] (although only indirectly investigated here) that productivity in industrial and non-industrial areas in the USA does not vary extremely, while the productivity gradient is larger in Europe. These smaller differences in productivity in the USA could be the consequence of a quicker diffusion of technologies. Diffusion equalizes the productivity advantage stemming from first mover advantages or from clustered research in general. The difference is narrowed either by the establishment of plants in different regions by a single, large firm, or by the patenting or copying of the best methods by independents. Interregional spillovers, knowledge transfer, the high mobility of researchers, engineers etc., and finally the mobility of firms and employees eliminate productivity differences. Another possibility could be that wages are following productivity more quickly, thus making it rather expensive to remain in an industrial area[21]. If productivity levels off, and wages rise in an industrial area, production in the periphery (where wages have not yet risen) becomes comparatively cheaper. And the higher mobility of firms, together with lower unit costs of production, favor the relocation of

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marketing) and with dynamic economies of scale (first mover advantages) and oligopoly rents.

[20] Braunerhjelm et al. (2000), Boldrin, Canova (2001).

plants into rural areas. In Europe, the mobility of firms is lower, trade unions seek to limit regional differences in wages, and regional authorities try to prevent relocation. The consequence is a larger difference in productivity.[22]

The new evidence reported here should raise interest in the trends and encourage further investigations, particularly if the data series grow longer and more indicators are available for the regional level. For the time being, we can maintain that the developments illustrated by the data can roughly be explained by forces proposed to be relevant by economic geography.

We have to keep in mind the caveats of the material covered: the period for which data are available is rather short; the disaggregation into the industry dimension is not very deep. The regions in the USA and in Europe - albeit better than the country dimension used for Europe in other studies - are still not similar in size and structure. The analysis focuses on manufacturing, not on total activities. This is a disadvantage, since manufacturing today comprises less than one third of GDP. However, this is the sector for which regional concentration was reported as being higher in the USA, and it was for manufacturing that asymmetries were predicted to arise in a unifying Europe. Furthermore, the driving forces of agglomeration, economies of scale, spillovers and

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[21] In fact there are two effects: higher wages attract labor, but also decrease profits

[22] The historically higher productivity gradient in Europe as compared to the USA has been flattening out over the last ten years. This can be seen in the higher speed of dispersion in employment, as compared to that in value added. The equalization of productivity across regions in Europe could be attributed to the increasing mobility of knowledge, the higher mobility of firms, and the decreasing importance of trade unions and subsidization, which has been taking place in Europe over the past decade.

linkages were first emphasized for manufacturing, even if we today realize the importance of knowledge, linkages and spillovers to services and to industry- service relations.

8. Conclusions and caveats

This paper introduces a new data set for a roughly similar number of regions in the USA and Europe, disaggregated into 10 identical industries. To the best of our knowledge, it enables the first comparison between US and European regional structures of manufacturing for value added, where European data are broken down into 70 regions. Past comparisons with the USA have mainly implemented employment data or focused on Europe at the country level. It is surprising upon which scarce empirical evidence a fact, implicitly assumed as "common knowledge" has been built.

Our first main result is the confirmation that regional concentration is higher in the USA than in Europe. However, the extent is not large and it differs according to the indicator used. It is largest for the Gini coefficient, least for the CV. The first decile of regions contains a higher proportion of total manufacturing in Europe; it is mainly the second decile, which establishes the result of higher regional concentration in the USA.

Secondly, the regional concentration of value added is declining significantly, both in the USA and in Europe. The pattern is smoother over time in the USA, and has been more pronounced in Europe only since 1992. The latter result contradicts specifically fears of increasing concentration

in the wake of the Single Market Program. Europe is not following the US in the direction of higher regional concentration. If anything, the US is following Europe in the direction of lower regional concentration. Nevertheless the USA has moved in this direction for a long time, starting from a very high level.

In the USA, four industries are more highly concentrated by a large margin, two by a smaller margin. For three industries plus miscellaneous, the concentration is higher in Europe. The majority of industries are de-concentrating. Two important exceptions exist for Europe. Food and textiles are concentrating; in the case of food, this is a consequence of the opening of segmented national markets; with respect to textiles, this development was induced by production shifts to the South (or even out of the EU). In these industries, and only in these, is Europe following the USA in the direction of higher concentration. In the majority of industries, and in the aggregate, the USA is converging towards the European concentration level from above.

The difference in the level of regional concentration is greater for employment, implying that focusing on this indicator exaggerated the differences in the available literature. Concentration indicators for employment are falling steeply in the USA, accounting for roughly half of the former difference in less than 10 years. The different speeds of de-concentration, exhibited by employment and value added respectively, could be attributed to a historically steeper core periphery gradient in productivity for Europe. More exactly, the productivity difference between industrial and non-

industrial regions has been larger in Europe. The gradient is however decreasing in Europe; this is the second trend in which Europe is following the USA.

We must also mention the restrictions of our analysis. We present empirical evidence, which we interpret in light of theories and other evidence, but we do not test the theories. The period is rather short, the disaggregation not very deep, and we focus on manufacturing. The regions compared are still not similar in size and structure (even if the 70 regions used for Europe are far more adequate for a regional analysis than the EU member states usually analyzed). We focus on absolute concentration. We find that using value added instead of employment enriches our knowledge. The differences in regional concentration are not as large as usually suggested, and Europe has not shifted to the more concentrated pattern of the USA. If anything, Europe has de-concentrated since 1992. In the USA, manufacturing has been de-concentrating over a long period of time, converging to the lower level of European concentration from above.

Appendix 1: Indicators, Formulas and Notation for Geographical Concentration

Let us use the following notation for regional concentration shares:

(1) $s_{ij}^{C} = \frac{X_{ij}}{\sum_{j=1}^{J} X_{ij}}$, (2) $s_i = \frac{\sum_{j=1}^{J} X_{ij}}{\sum_{i=1}^{I}\sum_{j=1}^{J} X_{ij}}$ and (3) $s_j = \frac{\sum_{i=1}^{I} X_{ij}}{\sum_{i=1}^{I}\sum_{j=1}^{J} X_{ij}}$.

(1) is the share of region j in the manufacturing sector i from the corresponding total. (2) is the share of sector i in total manufacturing and (3) is the overall manufacturing share of region j in total manufacturing with X_{ij} being either the amount of value added or the number of people employed in the manufacturing sector i in region j. The superscript C indicates that we measure concentration.

Concentration Rates (deciles): $CR_{n,i} = \sum_{j=1}^{n} s_{ij}^{C}$

This formula is used to sum up the shares of the largest 10% and 30% of regions. For CR10% n = 4.9 for the USA (i.e. the four largest states plus 90% of the fifth largest) and n = 7 for Europe (value added data are available for 70 NUTS1 regions).

Coefficient of Variation: $CV_i = STD_i / (1/J)$

is the standard deviation of the regional concentration shares (1) relative to their average 1/J where J is the total number of regions, calculated for the individual branches, as well as total manufacturing.

Gini-Index: $GINI = \frac{0{,}5 - \frac{0{,}5}{J}\sum_{j=1}^{J}(S_{ij-1}^{C} + S_{ij}^{C})}{(1-1/J)/2}$

where S_{ij} denotes in ascending order the cumulated shares of regional concentration s_{ij}. Since it is normed to the area of maximal inequality – cf. the denominator – it can be used without any problems of adjustment for comparisons, ranging from 0 to 1. However, the Gini-Index places relatively more weight on the middle sections of the distribution of regional shares s_{ij},

Appendix 2: Comparison of the size of regions in the EU and in the USA

		EU	USA
Number of regions		77	49
Population in 1000	Average	4861	5327
	Median	4582	3738
Value added in manufacturing in Mio ECU	Average	18717	42885
	Median	12917	31857
Employment manufacturing in 1000	Average	357	339
	Median	254	233

Appendix 3: Empirical Literature concerning (regional) US and EU comparisons

Author, Year	Variable	Regional Level	Sector Level	Indicator	Time Period	Main Result
Krugman, 1991	Employment	4 US States/4 EU Countries	2-digit Industries	Industry percentage	1947-1985*	Regional concentration in the USA is higher than in Europe **
Braunerhjelm et al., 2000	Not specified; employment and/or value added	49 US States/50 EU NUTS1 Regions	8 Sectors	Rel. Hoover-Balassa, coefficient of variation	1970-1994	Regional specialization in the USA is higher in 6 of 8 sectors; USA more clustered (higher CV of GDP), but less polarized (lower CV of GDP/capita)
Midelfart-Knarvik et al., 2000	Employment, production value	51 US States / EU Countries	21 US Industries / 36 EU Industries***	Gini	1970-1997	Higher US concentration; Constant decline in the US; "Waved" shaped pattern in EU with "not very significant decline" in EU

* The principle goal in Krugman (1991) is to compare US and EU regional specialization for the above period. The comparison of the USA and EU with respect to regional concentration, which has been so prominently cited, seems to refer to 1985.

** The main result is based on evidence of larger regional specialization in the USA. Krugman compares regional concentration in the USA and in Europe directly only for the car industry.

*** The study by Midelfart-Knarvik et al. (2000) reports that EU industries have been aggregated up to the US level; the report contains results only for unweighted averages of industries.

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Table 1: Differences in the level of concentration between the USA and Europe

	CR10%		CR30%		CV		Gini	
	Average 1987-1995							
Value added								
EU	35.3269		66.3903		1.0532		0.5106	
USA	34.0606		68.2343		1.0743		0.5374	
USA minus EU	-1.2663		1.8440		0.0211		0.0267	
USA relative to EU	0.9642		1.0278		1.0200		1.0523	
t-value	-8.66	***	9.04	***	4.05	***	17.54	***
Employment								
EU	33.4715		64.2898		0.9724		0.4762	
USA	32.3991		67.1295		1.0416		0.5232	
USA minus EU	-1.0724		2.8397		0.0693		0.0471	
USA relative to EU	0.9680		1.0442		1.0712		1.0989	
t-value	-6.77	***	29.76	***	13.25	***	43.69	***

***, **, * denotes 99%, 95%, 90% of significance, test for identity of means.

Table 2: Concentration of value added over time

		1987	1995	R2	t-value	Significance	1987-1995 Relative
Total manufacturing		Concentration indicators		Regression on time			change
CR10%	EU	35.982	34.439	0.502	-2.656	**	-4.287
	USA	34.593	33.324	0.808	-5.426	***	-3.667
CR30%	EU	67.233	65.561	0.823	-5.710	***	-2.488
	USA	68.870	67.257	0.904	-8.099	***	-2.342
Coefficient of variation	EU	1.075	1.034	0.150	-1.111		-3.853
	USA	1.098	1.041	0.916	-8.727	***	-5.146
Gini	EU	0.519	0.505	0.826	-5.764	***	-2.695
	USA	0.545	0.525	0.936	-10.135	***	-3.653
Weighted average over industries							
CR10%	EU	40.046	38.354	0.557	-2.967	**	-4.224
	USA	41.111	39.797	0.799	-5.272	***	-3.196
CR30%	EU	70.446	69.645	0.761	-4.719	***	-1.137
	USA	73.960	72.434	0.894	-7.665	***	-2.063
Coefficient of variation	EU	1.255	1.204	0.374	-2.043	*	-4.038
	USA	1.325	1.277	0.829	-5.833	***	-3.570
Gini	EU	0.561	0.550	0.756	-4.661	***	-1.887
	USA	0.603	0.588	0.904	-8.116	***	-2.461

***, **, * denotes 99%, 95%, 90% of significance of linear time trend.

Table 3a: Regional concentration of manufacturing in comparison (CR10%; value added)

	USA			EU			USA	EU	Difference USA-EU	t-value	Significance
	1987	1995	1995-1987	1987	1995	1995-1987	Average 1987-1995				
Minerals	37.343	35.127	-2.215	29.542	30.943	1.401	36.540	30.438	6.102	17.824	***
Chemicals	39.222	38.632	-0.590	37.433	35.804	-1.629	38.771	36.572	2.199	11.741	***
Metal Products	43.216	41.255	-1.961	42.194	38.165	-4.029	41.468	39.757	1.711	4.216	***
Machinery	39.759	40.018	0.260	48.204	43.360	-4.844	38.882	46.005	-7.123	-13.624	***
Electronics	45.969	46.625	0.656	51.289	46.056	-5.233	46.710	49.335	-2.625	-4.504	***
Transport Equ.	50.158	46.104	-4.054	44.421	42.629	-1.793	49.386	42.289	7.098	17.588	***
Food & Beverages	35.374	34.983	-0.391	28.058	29.518	1.459	35.825	28.403	7.422	33.235	***
Textiles & Clothing	48.295	50.644	2.349	39.661	42.124	2.463	49.338	41.480	7.858	22.606	***
Paper & Printing	37.352	34.200	-3.151	39.907	40.488	0.581	36.293	40.073	-3.780	-15.939	***
Misc. Manf.	31.486	30.075	-1.411	32.512	31.667	-0.845	30.720	32.108	-1.388	-8.814	***

***, **, * denotes 99%, 95%, 90% of significance, test for identity of means.

Table 3b: Regional concentration of manufacturing in comparison (Gini; value added)

	USA			EU			USA	EU	Difference USA-EU	t-value	Significance
	1987	1995	1995-1987	1987	1995	1995-1987	Average 1987-1995				
Minerals	0.558	0.537	-0.021	0.440	0.461	0.020	0.549	0.451	0.098	24.797	***
Chemicals	0.627	0.620	-0.008	0.556	0.554	-0.001	0.621	0.554	0.067	51.268	***
Metal Products	0.618	0.602	-0.016	0.585	0.558	-0.027	0.604	0.568	0.035	13.196	***
Machinery	0.610	0.597	-0.014	0.631	0.596	-0.035	0.599	0.616	-0.017	-4.637	***
Electronics	0.627	0.618	-0.009	0.658	0.622	-0.035	0.624	0.645	-0.021	-5.322	***
Transport Equ.	0.674	0.652	-0.021	0.596	0.586	-0.010	0.668	0.582	0.086	35.839	***
Food & Beverages	0.563	0.560	-0.003	0.423	0.445	0.022	0.567	0.426	0.141	46.625	***
Textiles & Clothing	0.680	0.687	0.007	0.581	0.593	0.013	0.685	0.589	0.097	57.340	***
Paper & Printing	0.546	0.519	-0.027	0.551	0.558	0.008	0.535	0.553	-0.018	-15.681	***
Misc. Manf.	0.517	0.499	-0.018	0.529	0.501	-0.028	0.507	0.512	-0.005	-1.408	

***, **, * denotes 99%, 95%, 90% of significance, test for identity of means.

Table 4: Concentration of employment over time

		1987	1995	R2	t-value	Significance	1987-1995 Relative
Total manufacturing		Concentration indicators			Regression on time		change
CR10%	EU	32.946	33.170	0.301	1.737		0.680
	USA	33.297	31.490	0.946	-11.080	***	-5.429
CR30%	EU	64.386	63.713	0.432	-2.310	**	-1.045
	USA	68.265	66.575	0.858	-6.502	***	-2.476
Coefficient of variation	EU	0.957	0.961	0.254	1.544		0.436
	USA	1.075	1.012	0.932	-9.828	***	-5.848
Gini	EU	0.476	0.470	0.232	-1.453		-1.242
	USA	0.535	0.515	0.935	-10.017	***	-3.631
Weighted average over industries							
CR10%	EU	37.536	37.543	0.164	1.171		0.019
	USA	39.553	37.560	0.953	-11.901	***	-5.040
CR30%	EU	67.629	67.267	0.232	-1.454		-0.537
	USA	72.983	70.584	0.983	-19.975	***	-3.288
Coefficient of variation	EU	1.132	1.147	0.456	2.425	**	1.306
	USA	1.264	1.177	0.963	-13.436	***	-6.846
Gini	EU	0.524	0.521	0.067	-0.709		-0.639
	USA	0.588	0.563	0.980	-18.620	***	-4.329

***, **, * denotes 99%, 95%, 90% of significance of linear time trend.

Table 5: Employment concentration for pre and post Single Market Period in the EU

	1987	1992	1998	1987-1992	1992-1998	1987-1992	1992-1998
	Concentration rates			Absolute Change		Relative Change	
CR10%	32.946	34.128	33.204	1.182	-0.924	3.588	-2.707
CR30%	64.386	64.526	63.762	0.140	-0.764	0.217	-1.184
CV	0.957	0.994	0.948	0.038	-0.047	3.934	-4.707
Gini	0.476	0.480	0.471	0.004	-0.009	0.750	-1.895

Table 6: Share of value added for the Top-10 regions vs. lower deciles

US Top 10					EU Top 10			
		1987	1995	1987/1995 in %		1987	1995	1987/1995 in %
California	CA	11.58	10.69	-7.7	Nordrhein-Westfalen	7.65	7.405	-3.1
New York	NY	7.07	5.48	-22.5	Baden-Wuerttemberg	6.48	6.216	-4.1
Ohio	OH	5.91	5.80	-1.9	Bavaria	6.23	6.273	0.7
Illinois	IL	5.37	5.48	2.0	Lombardia	4.60	3.774	-18.0
Texas	TX	5.19	6.44	24.0	Ile de France	4.18	4.053	-3.1
Michigan	MI	5.17	5.19	0.4	South East (UK)	3.51	3.224	-8.2
Pennsylvania	PA	4.72	4.72	0.2	Sweden	3.33	3.141	-5.7
North Carolina	NC	4.20	4.53	7.8	Bassin Parisienne	3.27	3.494	6.9
New Jersey	NJ	3.70	2.82	-23.8	Hessen	2.87	2.717	-5.2
Massachusetts	MA	3.15	2.54	-19.5	Niedersachsen	2.81	3.089	9.9
Sum of Top 10 regions		56.05	53.67	-4.2		44.93	43.39	-3.4
Low 10%		0.43	0.50	15.9		0.40	0.46	16.1
Low 20%		1.48	1.97	32.5		2.26	2.30	1.9
Low 30%		3.58	4.39	22.8		5.37	5.59	4.1

Figure 1a: Share of value added in deciles (average 1987-1995)

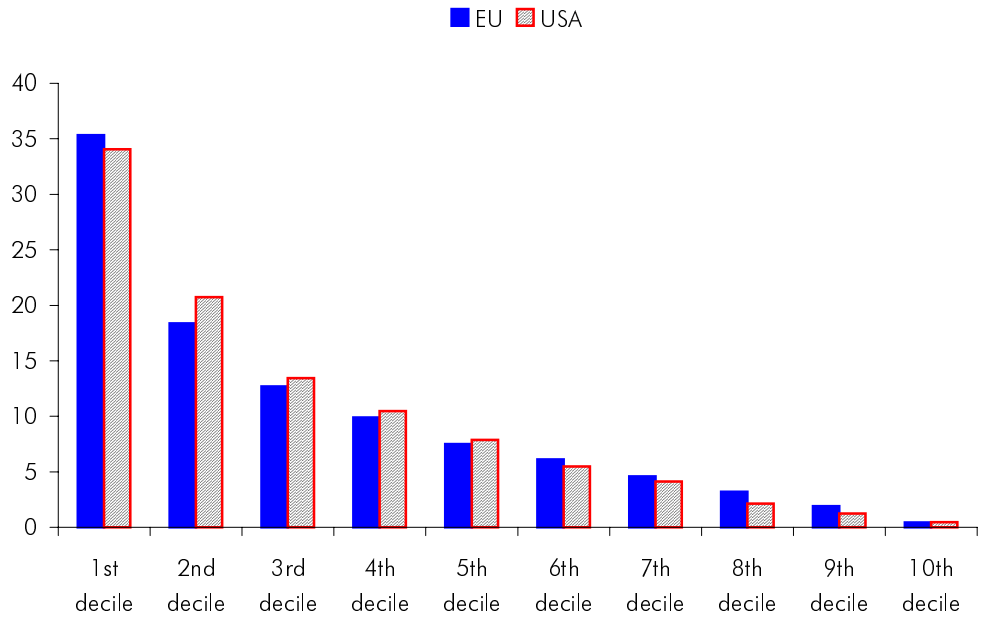


Figure 1b: Share of employment in deciles (average 1987-1995)

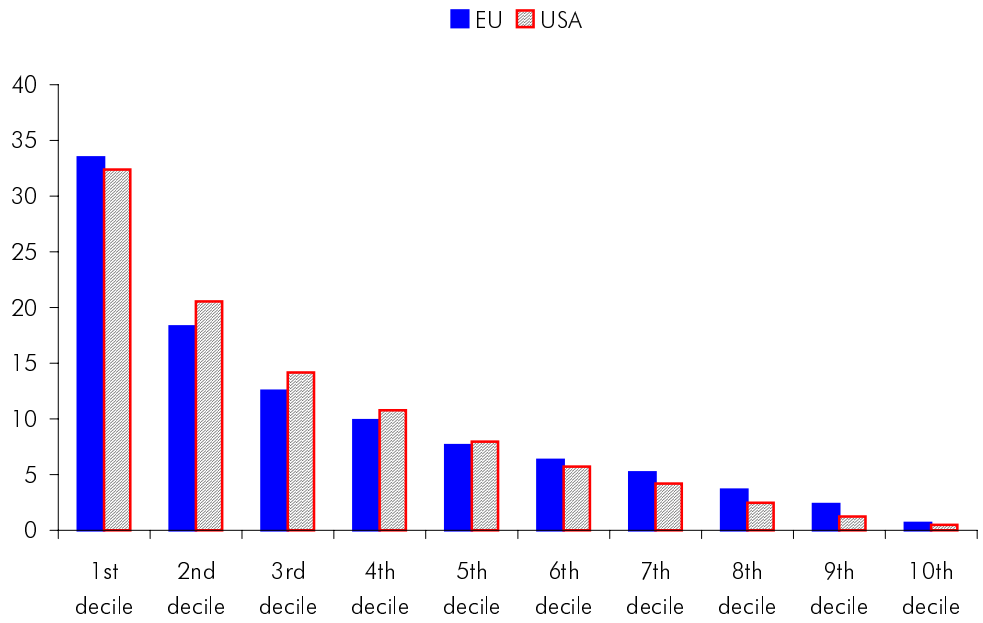
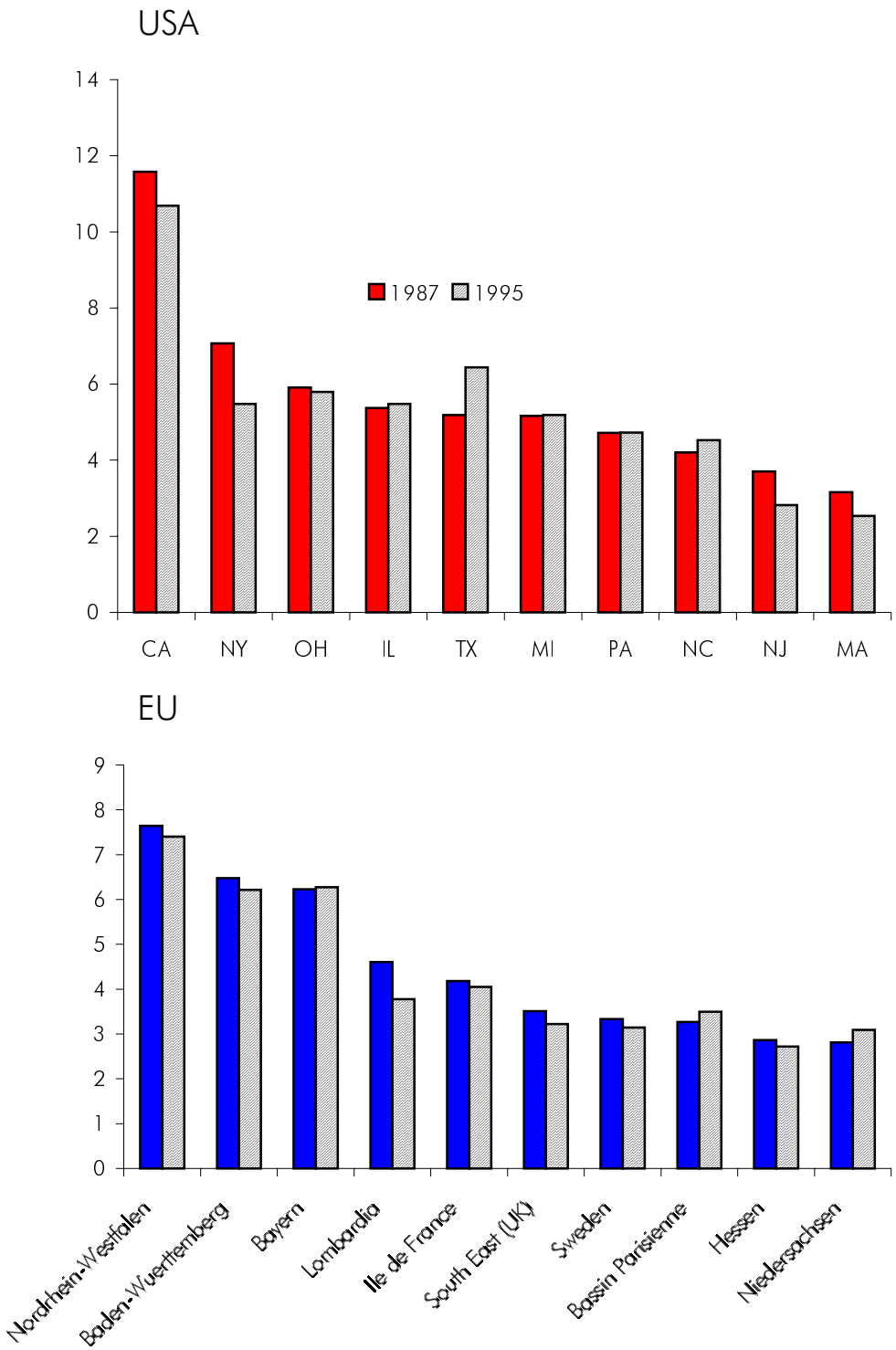


Figure 2: Share of value added in the largest regions



Abstract

REGIONAL CONCENTRATION IN THE USA AND EUROPE: WHO FOLLOWS WHOM?

This paper investigates differences in the regional concentration of manufacturing in the USA and in Europe. Empirical evidence that regional concentration is higher in the USA has led to the prediction that integration might induce Europe to follow the USA in the direction of higher spatial concentration. We show that the predictions of available models regarding the impact of integration are ambiguous, and that empirical evidence of the differences between regional concentration in the USA and Europe are confined to either employment data or to regional entities not really comparable (states in the USA versus countries in Europe). We use a new data set which includes data on value added and employment for an approximately comparable number of regions in the USA and Europe. Manufacturing is disaggregated into 10 sectors. Data extend into the nineties, for European employment to 1998, thereby including up to six years following the implementation of the Single Market Program. The main result is that the level of regional concentration is indeed higher in the USA, although the difference is much less than suggested by past studies, which relied on employment figures. Regional concentration has been declining over time, faster in the US thus converging to the lower European level from above. In Europe, this tendency has been specifically evident since the installment of the Single Market Program.

JEL: F02, F15, L60, R12

Keywords: regional concentration, location of industries, Single Market effects

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