

The Single Market and Geographic Concentration in Europe

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Abstract

The stylized fact that regional concentration is lower in Europe than in the USA has led to the prediction that the creation of the Single Market might increase spatial concentration in Europe. This has raised some fears that the social and political burden of rapid change might counterbalance the economic gains, that the core might win to the detriment of the periphery, and that concentration of industry might make countries more vulnerable to asymmetric shocks in the Monetary Union. This paper uses a new disaggregated dataset to substantiate whether spatial concentration increased during the 1990s. Most other studies have not extended beyond the early 1990s or have used less comprehensive and detailed datasets. The main result is that geographic concentration did not increase, but rather decreased during the 1990s. Industrial patterns of geographic concentration and its dynamics partly conformed to the hypotheses provided by economic geography, trade theory, and industrial organization.

1. Introduction

The higher geographic concentration in the USA has raised the question as to whether an integrated Europe would also develop in such a direction. Since the early 1990s, the creation of the Single Market, liberalization, and the impact of telecommunications has significantly lowered transaction costs in Europe. At the political level, regional concentration is seen as potentially destabilizing, if activities concentrate in the core, if cyclical sectors concentrate in a specific country, or if rapid relocation generates high adjustment costs. The possibility that geographic concentration might aggravate the core/periphery pattern is discussed in Puga (1999); that it may increase cyclical risks in specific countries is raised by Paci (1997) or in OECD (1999). The stylized fact that regional concentration is much higher in the USA than in Europe has been established by Krugman (1991) in a comparison of four regions in the USA with four large countries in Europe, and confirmed in Kim (1995, 1997) and Midelfart-Knarvik et al. (2000).¹

This paper investigates how geographic concentration has developed specifically since 1992. While studies on trends in spatial concentration are not lacking in general,² there are few studies which provide data collected after the start of the Single Market program, at a disaggregated level. A new dataset enables an assessment of the geographic concentration in the activities of 99 manufacturing industries in the member states of the European Union over 14 years, specifically including the period 1993 to 1998 as the “post-Single Market period.”

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Section 2 describes the data and the indicators used. The main body of evidence is presented in section 3; robustness is checked in section 4. The trends are related to determinants proposed in theoretical models in section 5, using a small panel. We combine the results with related findings in the literature in section 6, and finally summarize the results. The main finding is that geographic concentration decreased in the 1990s, not to a dramatic extent, but statistically significant according to the usual tests. Differences across sectors exist and in general are consistent with the determinants proposed by theory.

2. Data, Variables, and Indicators

We use EUROSTAT data, which contains data for the new NACE classification for 14 EU member countries from 1985 to 1998. Their advantage is that (i) the dataset includes six years following the introduction of the Single Market, and (ii) it is available for 99 industries. Value added was selected as the main indicator of activity.³

Many indicators have been used for the measurement of geographic concentration. We chose three indicators which stress the absolute concentration of industries.⁴ The indicators chosen are (i) the share of the three largest countries (CR3), (ii) the Herfindahl (H), and (iii) the Entropy (E). Of these, the first is the most intuitive, but there is no *a priori* reason which defines how many countries should be included. The second and the third indicator are comprehensive, since they include information about the whole distribution. For the Herfindahl, the comprehensiveness is somewhat artificial, since it is well known that the very largest shares dominate the results. With respect to entropy, this effect is mitigated by multiplying shares and log shares. Therefore, the entropy is our preferred indicator: it gives the role of large countries a fair but not dominant share.

3. Main Results

The main trends and their significance are provided by (i) a nonparametric sign test, (ii) a cross-section test, and (iii) a time-series test. The nonparametric sign test investigates whether the given shares of increases or decreases are likely to be generated by chance. We test the full period as well the pre-Single Market period and the post-Single Market period. Equation (1a) tests for significance for each period, (1b) for the significance of the differences between the periods. The precise H_0 can be stated as follows (CR refers to any of the three indicators)

$$H_0: \begin{cases} \text{The share of increases } (p) \text{ is } 50\%. \\ p(\Delta CR_{i,ts-tr} > 0) = 0.5; \text{ ts, tr } \dots \text{ end and start years; } i = 1, \dots, 99. \\ T_{p,1992-85}, T_{p,1998-92}, T_{p,1998-85} \sim N(N/2; \sigma). \end{cases} \quad (1a)$$

$$H_0: \begin{cases} \text{Identical change in pre- and post-Single Market periods.} \\ p[\Delta CR_{i,1992-85}] = p[\Delta CR_{i,1998-92}] \end{cases} \quad (1b)$$

The next test is cross-sectional in nature and regresses the concentration rates of the individual industries for 1998 (a vector with 99 elements) on those for 1985 and 1992. Coefficients smaller than 1 indicate deconcentration:⁵

$$\ln CR_{i,ts} = a + b \ln CR_{i,tr} + \varepsilon_i \quad (2)$$

The third test is a time-series test, which regresses the annual concentration rates on a time trend, for each of the 99 individual industries. An increase is indicated by time trends with positive signs; a decrease by time trends with negative signs:

$$CR_{i,t} = a_i + b_i t; \text{ for each } i = 99 \text{ industries, } t = 1985-98 \quad (3)$$

While all three of these methods highlight specific aspects and have some limitations, together they are informative and represent the state of the art in the literature on geographic concentration.

Descriptive Statistics and Sign Test

The unweighted average of the share of the three largest countries decreased between 1992 and 1998 from 64.6% to 63.7%. About two-thirds of the 99 individual industries exhibited a decline. The downward trend is even stronger for the Herfindahl and about the same for entropy, which show declines of 5.3% and 2.0%, respectively. The difference between the trends in pre- and post-Single Market concentration is highly significant (Table 1).

Cross-sectional Evidence

We regress the indicators of geographic concentration for 1998 on those for 1992 to test for the post-Single Market effect. The coefficient is significantly less than one for all indicators. Again, similar effects, although less strong, are seen for the total period and the pre-Single Market period.⁶

Table 1. Trends in Regional Concentration of Value Added: Nonparametric Test

	Change (%)						Significance in each period ^a			Significance of difference 92/85 vs. 98/92 ^b
	1985	1992	1998	1992/85	1998/92	1998/85	1992/85	1998/92	1998/85	
<i>CR3</i>										
Level	64.6	65.0	63.7	0.6	-2.1	-1.5				
Share of decreases				42.4	62.6	58.6	1.53*	2.60**	1.73*	2.91*
<i>Herfindahl</i>										
Level	0.19	0.20	0.19	5.1	-5.3	-0.5				
Share of decreases				35.4	62.6	51.5	3.05***	2.60**	0.30	3.99*
<i>Entropy</i>										
Level	-1.98	-1.96	-2.00	1.0	-2.0	-1.0				
Share of decreases				40.4	66.7	58.6	1.95*	3.52*	1.73*	3.84*

Notes: Unweighted shares are used for indicators; entropy is inverted so that a lower value (higher absolute value) denotes decreasing concentration.

*, **, *** denote significance of 90%, 95%, 99%, respectively.

^a H_0 : Share of decreases and increases is 50% (equation 1a).

^b H_0 : Share of decreases 1998/92 is the same as share of decreases 1992/85 (equation 1b).

Source: WIFO calculations using EUROSTAT, SBS.

Table 2. Cross-section Test of Equation (2)

		a	t_a	b	t_b	For $b \leq 1$	R^2
CR3	1998/85	0.75	3.1	0.82	14.0	3.2***	0.67
	1998/92	0.53	2.2	0.87	15.0	2.3**	0.70
	1992/85	0.16	1.0	0.96	23.4	1.0	0.85
Herfindahl	1998/85	-0.26	-2.6	0.85	14.6	2.6***	0.69
	1998/92	-0.35	-4.0	0.82	15.6	3.4***	0.71
	1992/85	-0.03	-0.3	0.96	20.8	0.9	0.82
Entropy	1998/85	-0.28	-3.0	0.87	18.1	2.8***	0.77
	1998/92	-0.32	-3.7	0.86	19.4	3.2***	0.80
	1992/85	0.04	-0.6	0.97	27.5	0.8	0.89

*, **, *** denote significance of 90%, 95%, 99%, respectively.

Source: WIFO calculations using EUROSTAT, SBS.

Time-series Evidence

A third piece of evidence is the sign of the linear time trend in the concentration rates of the individual industries. In 43 industries, the term for the linear trend is positive; 21 of these cases are significant. A total of 56 industries exhibit a negative trend; in 26 industries, the trend is significant. The sign of the trend is negative and significant for total manufacturing. Without pretending that the trend will continue in the future, the results do show the tendency of decreasing concentration in the post-Single Market period.

These results support the picture drawn by the other tests (see Figure 1). Concentration did decline in the 1990s. Although the size of the decrease may seem small (about 2–5% of the value of the indicators), it is significant according to the usual standards of statistics.

4. Robustness and Extensions: Other Variables, Data, Core–Periphery

We have attained the result that concentration decreased during the Single Market period by using value added as an activity variable. However, the same result is true if we use nominal production, employment, or exports; for all these activity variables regional concentration was lower in 1998 as compared to 1992. If we rank the indicators according to the decrease in concentration between 1992 and 1998, the decrease is steepest for exports⁷ and least for production. The value added—the variable on which this paper focuses—ranges in the middle.

The EUROSTAT data are highly disaggregated, although they span a rather short period of time (14 years, see Figure 1). The STAN database (produced by OECD) enabled us to track concentration back to 1970. However, it is disaggregated into 23 industries only. The STAN data indicate that the classification and the level of disaggregation are not decisive with respect to trends. The peak in 1992/93 and the following decline in concentration are replicated in both databases.⁸

The data do not support the fear that the core wins at the expense of the periphery.⁹ Between 1992 and 1998, the share of the core decreased from 52.1% to 49.8%.¹⁰ The export share of the core also declined by 4 percentage points. The main winners among the countries on the periphery were Ireland, Austria, Spain, and Portugal. The

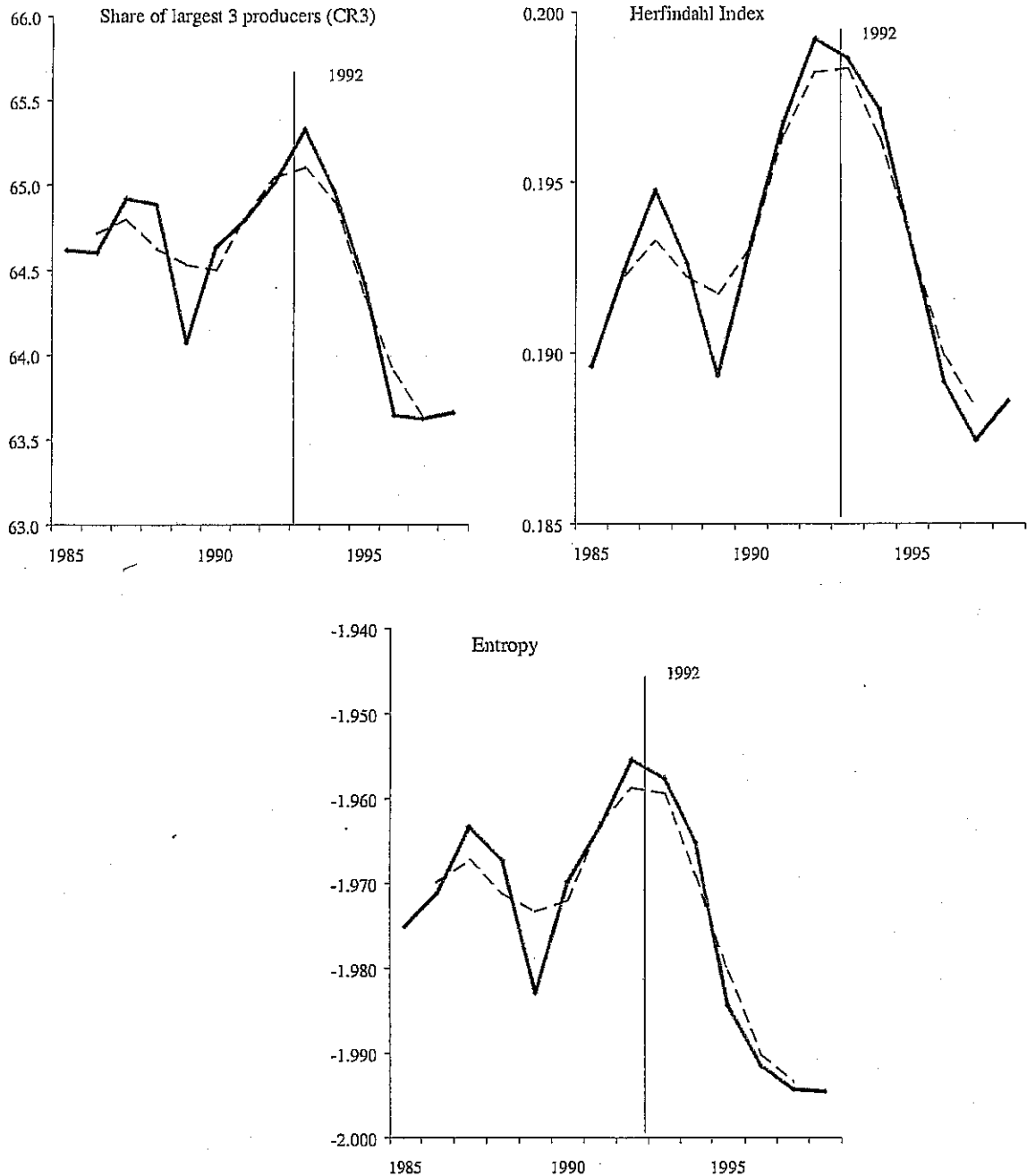


Figure 1. Main Result: Decreasing Concentration in the 1990s (unweighted average over industries; 3-year moving average (dashed line))

largest contributors to the loss of the core in value added in the 1990s were Germany, France, and the United Kingdom.

5. Determinants of Concentration: Theoretical Elements and their Reflection in Panel Regressions

Reflecting theories and hypotheses which explain changes in specialization and concentration, we realize that we cannot expect a uniform trend, since the impact of the Single Market program will come via different channels. Some determinants are addressed in trade theory, some in industrial organization, and some in economic

geography. Models about the impact of multinational firms add to the diversity of possible outcomes. There is no comprehensive theory which explains concentration, but the different strands can guide us as to which elements we should include in an empirical approach.¹¹ Traditional *trade theory* predicts that industries are concentrated in the countries with comparative advantage. In a world with transportation costs, as analyzed by the models of *new trade theory*, big countries gain a comparatively larger share in industries where product differentiation and internal or external economies of scale are important. A reduction in trade costs reduces concentration as the home bias—originally larger in large countries—is removed. Models of *economic geography* emphasize forward and backward linkages, spillovers, and scale economies as centripetal forces, while costs of commuting and congestion, or more generally costs induced by agglomeration, act as centrifugal forces (Fujita et al., 1999). At high trade costs, production follows demand which prevents the tendencies of concentration. At medium trade costs, forward and backward linkages cause agglomeration; while at low trade costs, higher wages and congestion costs in the core tend to disperse production activity.

Recent work on *multinational firms* (MNEs) suggests that the impact of MNEs on concentration depends on which cost component decreased faster in the course of the integration process (Markusen and Venables, 1998, 2000). Horizontal MNEs will concentrate production at the cheapest location if trade costs decrease. On the other hand, it is very likely that fixed costs for setting up a plant abroad will also fall in the course of the integration process. If this outweighs the fall in trade costs, we would expect deconcentration as the dominant trend. New models of economic geography, which explicitly consider the role of MNEs, demonstrate that the core–periphery pattern is weaker once MNEs are taken into account. Specifically, Ekholm and Forslid (2001) show that production spreads to both regions (in their two-region model) for a larger range of transportation costs. The reason is that for horizontal MNEs transportation costs do not matter any more so that the forward and backward linkages lose their weight as a centripetal force. If MNEs have a vertical organization with headquarter service and production geographically separated, the model implies that changes in trade costs produce gradual changes in concentration. Costless trade of headquarter services within the firm implies stronger tendencies to concentrate them than for production. However, vertical MNEs with intrafirm trade in intermediates weaken agglomeration tendencies. In her simulation exercises, Raybaudi-Massilia (2000) finds similar results and demonstrates that low plant setup costs exert the same effect as high transportation costs. She summarizes her results (p. 17) by confirming that “the tendency towards concentration of manufacturing production in ‘an industrial core’ . . . is dramatically reduced when allowing for both multinational corporations and exporters.” Summing up, MNE activity is important for concentration, but its direction depends on specific parameters. Hence it is important to include a variable in the empirical model below to find out the dominant influence.

We use a small panel based on the 3-digit industry data described above with two observations per industry (one for the period 1985–93 and one for the post-Single Market period) to explain changes in concentration by industry characteristics. Based on the theoretical arguments we use an industry’s skill intensity and capital intensity to reflect the determinants proposed by trade theory. We include a variable on the degree of trade globalization as a measure for overall trade costs and an index on the degree of intra-EU multinationality (see Davies et al., 1996) to reflect the importance of multinational firms. We want to stress that this approach does not allow any testing of theories; we have taken some hints from theoretical models as to which variables

Table 3. Panel Estimates for Changes in Geographic Concentration

Δ Entropy (85–92, 93–98)	Spec I		Spec II	
	<i>b</i>	<i>t_b</i>	<i>b</i>	<i>t_b</i>
Skill intensity	-0.01	-2.7**	-0.01	-2.3**
Capital intensity	0.04	1.4	-0.04	-1.5
Globalization × 100	0.43	1.5	-0.27	-1.2
Multinationality	-0.70	-1.4	-0.33	-0.5
Skill intensity × D93/98	—	—	0.00	0.2
Capital intensity × D93/98	—	—	0.15	3.5**
Globalization × D93/98	—	—	1.43	3.2**
Multinationality × D93/98	—	—	-0.74	-0.7
D93/98	-0.77	-0.9**	-1.99	-3.6**
Constant	-0.24	-0.8	0.34	1.0
<i>N</i>	183		183	
<i>R</i> ²	0.18		0.25	
σ	1.07		1.04	
Reset	2.4, <i>F</i> (3,174), <i>p</i> = 0.07		0.7, <i>F</i> (3,170), <i>p</i> = 0.57	
Heteroskedasticity ($\chi^2(1)$)	2.7, $\chi^2(1)$, <i>p</i> = 0.10		2.2, $\chi^2(1)$, <i>p</i> = 0.14	
Different parameters 83/92 vs. 93/98	—		4.8, <i>F</i> (4,173), <i>p</i> = 0.00	

Notes: Standard errors are heteroskedasticity robust. *Significant at 10%. **Significant at 5%. For definitions of the variables, see the Appendix.

to include and what results to expect. Additionally, we introduce a dummy for the post-Single Market period.

The estimations results in Table 3 strongly support the hypotheses of a break in 1992 and a significant downward trend in concentration.¹² Among the structural variables, we observe that skill-intensive industries deconcentrated faster on average, possibly due to the convergence in skill endowments. Industries with a high degree of intra-EU multinationality likewise experienced a decreased concentration; the estimated parameter is not significant. Highly globalized and capital-intensive industries in contrast exhibit a tendency of increasing concentration, but this is not significant in specification I.

In the second specification we introduce interaction terms between the post-Single Market period dummy and the other right-hand-side variables to infer which industry characteristic influenced concentration differently after 1992. The Single Market dummy now is larger and remains significant. Capital-intensive and highly globalized industries exhibited a significant stronger tendency of concentration after 1992, while the deconcentration tendency of skill-intensive industries remains the same. The impact of intra-EU multinationality is more pronounced in the post-Single Market period, but still not significant.

Although the estimation results are far from excellent, there are some useful results.¹³ The main result added to the prior evidence is that concentration decreased significantly even when it is controlled for industry characteristics, which are suggested by theory as determinants of concentration. We see that the deconcentration process occurs predominantly in skill-intensive industries, while capital-intensive and highly globalized industries experienced a process of further concentration since 1992. Of

course, we know that the period on which the results are based is short, so that we should not extrapolate the results into the future.

6. A Tentative Story Behind the Results

We have demonstrated that concentration decreases significantly according to the usual statistical techniques, however to a small extent. And we have shown that elements thought as important in diverse strands of theory prove important for the empirical trends. We now want to suggest what could have happened in this interesting period. This "story" goes beyond elements presented here; it should facilitate testing, falsification, and understanding if the sample period gets longer.

Geographic concentration is the result of many determinants, which partly counteract with each other. (i) In the 1990s, the effect of deconcentration dominated, to a considerable extent due to the effects of the Single Market. Specifically, the shares of the large producers (mainly the large countries) decreased, while the small countries, notably Ireland, Portugal, and Austria, gained market shares in general and in many industries. (ii) Some of the gains were the result of the expansion of existing firms, some the results of greenfield plants built in small countries which were no longer disadvantaged by small home markets. (iii) Skill-intensive industries are still predominantly located in the large countries (the "core"), but significantly less than before. This may result from the loss of forward and backward linkages and home market effects, but also to some degree from the fact that research endowments have become more dispersed themselves, as a result of the dissemination of research efforts and skills, *inter alia* by structural or mobility programs. (iv) Small countries on the periphery made use of cheaper wages (and structural policy, tax havens) to increase their shares; multinationals reinforced this trend towards deconcentration by spreading their investment into peripheral countries. Elements in the second half of the U modeled in economic geography thus dominate over the forces reflecting the first. (v) However, globalization increases pressure on concentration, forcing European countries to reduce locations in contended price-competitive industries (for example, as the textile industries have concentrated in southern countries).

This story is built on the evidence provided (specifically iii, iv, v) but also on conjectures and related work. It contains five elements which were numbered to encourage future research. It demonstrates that what happened can be consistent with some elements of the theories. In the following summary, we focus on what is proven and which caveats should be kept in mind.

7. Conclusions

The main result of this paper is that geographic concentration has declined during the post-Single Market period (1992 to 1998). The decline is evident according to three indicators of concentration, different in focus, but all stressing the role of large countries. It is significant by many of the usual standards of testing, but the average decline is not extremely strong and there are differences across industries. The trend is robust for changes in the variables and for the degree of aggregation. There had been no clear trend in geographic concentration in the pre-Single Market period; some indicators show a small increase, others suggest successive periods of declining and increasing concentration in the 1970s and 80s.

This result is less in line with the prediction that Europe would follow the more concentrated regional structure in the USA, with fears of a strong core, and unbalanced

development. It is more in line with the arguments favoring the second part of the U in modern economic geography; that lower transport costs during a later stage might decrease the dominance of market access and spillovers production disseminates through the centrifugal force of lower costs in the periphery. Small countries increase their market shares in technological industries and those in which large countries were dominant due to better market access. Concentration is related positively to research and skill intensity, but this effect is decreasing. Multinational enterprises seem to foster deconcentration, while globalization is tending to work in the direction of concentration.

This study does not intend to test theories. No comprehensive theory is available for explaining concentration; trade theory, industrial organization, and economic geography highlight specific aspects. We present stylized facts and try to put them together in a coherent tentative story, whose elements are, to some extent, definitely supported by the data, while to a certain degree they also call for future verification. But, decreasing geographic concentration—in fact, even nonincreasing concentration—is an important political and economic result. Nevertheless, we must acknowledge an important shortcoming of the analysis: the industries analyzed are still rather broad aggregates and countries are not the ideal unit for studying regional concentration. Finally, six years of post-Single Market evidence—though more than most other studies can supply—is too short a period to justify final conclusions regarding the effect of the Single Market program.

Appendix

Variable Sources and Definitions

Value added: EUROSTAT, WIFO calculations

Capital intensity: investment as a percentage of value added; WIFO

Skill intensity: share of high skilled labor minus share of low skilled labor/employment; OECD, Peneder (2001)

Product differentiation: standard deviation of unit values, across countries and 6-digit industries; WIFO

Globalization: exports plus imports relative to apparent consumption; EUROSTAT, WIFO calculations

Multinationality: see Davies et al. (1996).

Indicators on Concentration

We denote value added by X and industry shares by s . The index i refers to industries (industries 99 NACE 3-digit), j to countries (14 member countries of the EU), and t to time (1985 to 1998).

$$CR_n: \quad CR_{ni} = \sum_{j=1}^n s_{ij}$$

$$\text{Herfindahl:} \quad H_i = \sum_{j=1}^J (s_{ij})^2$$

$$\text{Entropy:} \quad E_i = \sum_{j=1}^J s_{ij} \ln s_{ij}$$

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Notes

1. However, the high water mark of concentration was reached in the US “probably in the 1920s” (Krugman, 1991, p. 80). Whether the more highly concentrated structure in the US could viably predict a similar situation in an integrated Europe was questioned by Karsten (1996).
2. Bruelhart (1995) reported that of the 18 industries, regional concentration rose in 14, with the largest increases in labor-intensive industries and some in the industries with increasing returns to scale. Amiti (1998, 1999) confirms rising concentration for a majority of industries, but again for the pre-Single Market era. For an overview on existing empirical literature see Aiginger et al. (1999).
3. The use of value-added data as the activity indicator (in contrast to sales or production) prevents the double counting of activities for an industry. Midelfart-Knarvik et al. (2000) propose using production, arguing that this indicator provides advantages if outsourcing is of the “out of industry type,” as is the case when services are outsourced to an increasing degree. Value added is on average one-quarter of production. Nominal value added instead of real is used, since price indices are missing and of low quality for many industries.
4. For an overview see Aiginger et al. (1999). Absolute concentration describes the distribution of the country shares in production *in a specific industry*, without comparing this distribution with that of the country shares *in total manufacturing* (as relative concentration does). We prefer absolute indicators for one theoretical and for one practical reason. On the theoretical side, models from economic geography predict concentration and the agglomeration of activities as such. On the practical side, indicators of relative concentration are dominated by extreme values for small countries.
5. This test is applied, for example, in Dalum et al. (1998). According to the convergence literature, the coefficient should be interpreted only jointly with the constant (for testing convergence from above); see also note 6.
6. Although this test is often used, it is known from the discussion on β -convergence that, strictly speaking, the combination of the coefficient and the intercept tells us whether the concentration decreased or increased over the period. A decrease in concentration occurs if concentration during the starting period was above the long-run level ($a/(1 - b)$), or convergence occurs from above. In the opposite case, we could observe rising concentration even if the estimated β is below unity. We calculate this for the period 1992–98. For CR3, Herfindahl, and Entropy, the value of 1992 lies in more than two-thirds of industries above the long-run value.
7. A possible explanation for the steeper decrease of concentration in exports is that, since then, the share of intraindustry trade has increased. Export data are available only since 1988, however.
8. The increase in regional concentration prior to the Single Market period has been reported by Amiti (2000) and Bruelhart (1995, 1998, 2001).
9. The core was defined as Belgium, Denmark, Germany, France, Italy, the Netherlands, and the United Kingdom. Changing the definition—for example by a different treatment of Austria, the United Kingdom, and Italy—did not change the results.
10. The share of the core has to some extent been deflated by the German unification. The overall decrease between 1985 and 1998 would be more pronounced without it; the decrease since 1992 would be less steep.
11. See Wolfmayr-Schnitzer (1999) for a survey.
12. We checked for multicollinearity by looking at the correlation of the right-hand-side variables. The interaction terms of the right-hand-side variables with post-Single Market period dummies in specification II proved to be not too much correlated with the other variables (below 0.7). So the estimation results are robust enough to infer structural changes in the post-Single Market period. The skill intensity and the multinationality index are positively correlated (0.35). Dropping the former in the basic specification without interaction terms makes the impact of the latter significant with the correct sign.
13. We have to acknowledge that we are explaining differences in the change of concentration with time-invariant industry characteristics; changes in these variables are unavailable.