

# Specialization Patterns of European Countries

Nicole Palan and Claudia Schmiedeberg

Preliminary Version – please do not quote

## **Abstract:**

This paper investigates patterns of structural change and specialization of Western European Countries for the period 1970 to 2005. We therefore assign individual countries to clubs, i.e. groups of countries which share common features, and analyze the development of both the clubs and their individual countries over time. Our results also show that structural convergence in Western Europe is mainly due to the convergence of Central European countries, while the three clubs, North, Central, and South Europe, are drifting apart from each other over time and the within-club heterogeneity of the North and South European countries remains largely constant. As expected, we find structural change in all countries, as they are shifting away from traditional manufacturing industries. Yet while Central and North European countries specialize in emerging high-tech manufacturing industries and high-skill services from the 1990s onwards, South European countries are not able to catch up.

JEL classification: O 11 F 14 F 15 P 27

Key Words: Structural Change, Specialization Patterns, Structural Convergence

## 1. Introduction

Economic integration on the worldwide scale has led to a gradual removal of both tariff and non-tariff trade barriers over the last decades. According to models of New Trade Theory and New Economic Geography the effect of lower trade costs is increasing specialization due to better exploitation of economies of scale and technological externalities on the one hand but could also lead to decentralization due to the declining importance of the size of home markets (Krugman 1991, Fujita et al. 1999). This topic hence is of special interest with regard to the development of production structures in Western Europe. In the early 1970s, the European Economic Community (EEC) only comprised the six founding members, i.e. Belgium, France, Germany, Italy, Luxembourg and the Netherlands, as well as Denmark and the United Kingdom, which both joined in 1973. Although intra-European quotas and tariffs were abolished, many non-tariff barriers remained to exist due to differences in national regulations (e.g. with regard to product standards, licensing procedures, indirect taxation), hindering the creation of trade and specialization. In 1986, not only Portugal and Spain became members of the EEC, but also the Single European Act, that aimed to complete the full integration of product (for both goods and services) and factor (both capital and labour) markets by 1992, was laid out. In particular, the objectives were the following: higher competitiveness by speeding up structural change and altering the specialization profile of countries towards high-wage and high-growth industries and facilitating the exploitation of both economies of scale and scope, e.g. by fostering co-operations among firms (Article 159 EC). The adoption of a common currency in 1999 as well as the enlargement of the European Union into Central and Eastern Countries in 2004 has led to a further removal of institutional and non-tariff barriers within Europe and unified former segmented national markets (for a more comprehensive historical overview see Watts, 2008). At the global scale, the progress of economic integration has been even more noteworthy. The guidelines provided by the GATT and from 1995 onwards its successor – the WTO - have fostered the international division of labour. By lowering tariffs and customs below 4 per cent at the end of the 20<sup>th</sup> century, exports on average grew by 6% annually, making total trade in 2000 22-times higher than in 1950 (World Trade Organization, 2008). The immense decreases in transportation and communication costs also have facilitated the globalization of production, have turned formerly untradeable services tradable and have accelerated the diffusion of knowledge and technology worldwide (Busse 2001). As a consequence, international competition between firms has become fiercer and production patterns are likely to have been affected by new export potentials for domestic firms. Moreover, inefficient high-cost producers have to exit

the market, especially in previously protected industries, while surviving firms will likely benefit from better opportunities to exploit economies of scale (Davies and Lyons 1996).

Given these developments, we aim to shed light on the development of industry structures in Western Europe. More precisely, we investigate specialization patterns of Western European Countries for the period 1970 to 2005, using country level employment data for both the manufacturing and service sector. Our hypothesis is that countries with similar characteristics have grown together while on the other hand countries with different characteristics are drifting apart. Therefore, we assign countries to clubs, i.e. groups of countries having similar economic structures, and analyze the heterogeneity both between the clubs and between the countries within each club. The objective of this study: is to identify the (dis-)similarities across Western European Countries and to answer the question whether lagging countries were able to change their economic structures such that structural convergence in the sense of catch-up to the technologically leading countries in Western Europe was attained.

The paper is structured as follows: section 2 gives a literature review, which we derive the hypothesis for the empirical analysis from. Section 3 is devoted to the methodology and data employed in this paper, before turning to results in section 4. Section 5 concludes.

## **2. Literature Review**

If we should expect structural convergence or divergence across Europe is not a priori clear, since the direction of specialization<sup>1</sup> patterns depends on the individual characteristics of industries and countries, as well as on the initial distributions of the labour force, wage differentials, labor mobility and transportation costs..

According to economic theory, the combination of better opportunities to exploit economies of scale, a decrease in both transport costs and non-tariff trade barriers leading to increasing factor mobility (Krugman 1991 and Fujita et al. 1999), wage differentials, strong intra-industry linkages (Venables 1996), comparative advantages (Ohlin 1933) and path-

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<sup>1</sup> In this respect it is important to distinguish between absolute and relative specialization patterns. Absolute specialization implies that a small number of industries exhibit high shares of the overall employment of a single country. Absolute specialization addresses the differences with regard to the industry mix of individual countries. Relative specialization refers to the deviation of a country's industry structure from the average industry structure of the reference group of countries. This kind of relative specialization reveals for instance comparative advantages of countries. In the following, we will only treat the phenomenon of relative specialization.

dependency in the evolution of industries (Fagerberg 2000) foster increasing specialization patterns of countries. In compliance with these arguments, larger countries (especially if located in the center of custom unions) tend to attract production in a large variety of industries that are dependent on intermediate inputs (Fujita and Rivera-Batiz 1988), such that larger countries should in general be less specialized than smaller countries.

Especially if home market effects, economies of scale and comparative advantages prevail, a high degree of specialization in small countries but only small degree of specialization in large countries is observable at early stages of integration (Fujita et al. 1999). This is due to the fact that large countries operate in many industries (and also a high concentration of overall production in core countries) whereas at lower trade costs larger countries become more specialized as opposed to de-specialization processes in smaller countries.

Centripetal forces are especially supported by economic integration since transaction costs decrease. In industries with strong economies of scale, the competitiveness of economic centers will further rise at the expense of periphery regions (Krugman 1980, Helpman and Krugman 1985) – even more so if labor is immobile. Industries become more localized as the advantages of supplying markets locally diminish (Venables 1996 or Fujita et al. 1999), so that it is more profitable to restrict production to a small number of locations with good access to input factors (capital, human capital and other resources) and large home markets<sup>2</sup> (Buigues et al. 1990 or Krugman and Venables 1995, Davis and Weinstein 1997) irrespective of the individual industry characteristics. Moreover, economic integration also allows for a better exploitation of comparative advantages due to labor productivity (Ricardo 1817), factor endowments (natural resources, skills) and factor intensity differences in production (Ohlin 1933 or Balassa 1963), enforcing specialization patterns of countries according to their competitive advantages. High wage countries are thus determined to specialize into high-productivity, high-tech and research-intensive industries in order to ensure further economic growth. Low-wage countries on the contrary will tend to move into the production of labour- and probably resource-intensive industries.

As both European and international integration processes we have to distinguish between industries in which European countries compete with other high-wage countries such as the

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<sup>2</sup> Home market effects are expected to lead to concentration only for intermediate levels of transport costs. For very high and very low transport costs, home market effects are negligible since either it is not cost-efficient to export goods to foreign places or transportation becomes so cheap that the distance between producer and consumer becomes irrelevant (Krugman 1991a).

US and Japan and industries where competitors are the South East Asian countries: In the latter case – which applies e.g. for the textile industry - all Western European Countries can be seen as high-wage countries which are likely to be affected similarly so that employment will drop in all countries. But, if this implies increasing specialization, depends on whether all countries are affected by reallocation processes at the same time. It is possible that some countries come under pressure sooner than others. In this case, divergence processes should set in first and only at later stages – when all countries are equally affected – convergence takes place. If competition stems from other industrialized countries, however, we expect different effects on individual countries according to their factor endowments leading to increasing relative specialization. Taken together, this implies structural convergence between Western European countries in mature and shrinking industries such as textiles and leather especially in later stages of our observation period. In contrast, the employment in capital-intensive and high-skill industries should have become more concentrated, reflecting endowment differences between Western European countries, and the importance of forward and backward linkages - leading to one-country specialization and structural divergence.

A further argument for specialization stems from the New Economic Growth literature: Whenever investments in new technologies and the accumulation of human capital differ considerably across countries, industries in which production crucially depends on specific skills and new technologies will be concentrated (Romer 1986). This strengthens our hypothesis that in high-skill industries European countries should diverge rather than converge, since human capital endowment differs between the European countries. Regarding emerging high-tech industries, divergence is also explained by evolutionary models which emphasize the cumulative and path-dependent character of technological change as an explanation for persistent economic structures (Fagerberg 2000). Whenever small and “random” initial events (also called “historical accidents”) have re-enforcing effects, long-term concentration processes are initialized (David 1985, 1986, 1988, 1992, 1993a, 1993b, 1994 or Arthur 1988, 1989, 1994). In such cases, other countries are not easily able to catch up over time. However, path dependent concentration processes are not necessarily stable over time, when first-movers are not able to cope with new competitors (in case of technology spillovers and technological progress in other countries), and specific and localized input factors turn into universal ones. Technology diffusion might also be the reason why convergence takes place in low and medium technology industries, where knowledge spillovers from high-tech regions to less developed regions are to expect (Posner 1961). As empirical findings show, however, the location patterns in traditional industries are not

particularly formed by technology diffusion processes but rather by cost-advantages (Krugman 1991b, Amiti 1998 and 1999, Brülhart 1998a, 2001, Gao 1999 or Midelfart-Knarvik et al. 2003). Taken together these arguments, patterns of divergence are likely in industries which exhibit economies of scale and are technology- and knowledge-intensive, since these industry characteristics are also likely to interact with path-dependencies causing catch-up potential to be smaller. Since economies of scale should prevail in economic centers – especially in core countries -, innovative, dynamic industries are expected to concentrate in the core regions whereas the periphery is left with mature industries facing fierce competition from extra-European low-wage countries.

In the service sector, economic integration might play a minor role, since many services are regionally bound and cannot be shipped like manufacturing goods. But with the developments in information and communication technology, spatial proximity has lost importance in many service industries. Technological progress in this area might also have influenced concentration of manufacturing industries by facilitating knowledge flows and promoting the location in the periphery (Gersbach and Schmutzler 2000). In service industries like financial intermediation, however, the ICT should lead to massive concentration as cost-competitiveness starts outweighing the advantage of proximity to end customers. On the other hand, regionally bound services like hotels/restaurants are not expected to show high degrees of convergence or divergence.

Empirical studies show an increase in concentration for industries such as Chemicals and Transport Equipment from the mid-1980s onwards, but starting from very low concentration levels (Midelfart-Knarvik et al. 2000). According to Fujita et al. (1999), larger countries are more likely to be persistently more specialized in large industries compared to smaller countries. This theory is also supported by empirical results. Brülhart (2001) states that the big core countries (France, Germany, and the UK) tend to be the least specialized when compared to the EU-average. Small core countries tend to be slightly more specialized (Austria, Belgium, the Netherlands). Only Cohesion countries (Greece, Ireland and Portugal) tend to be more specialized than the Scandinavian countries (Sweden, Denmark, Finland). According to Brülhart (2001) the reasons for the higher levels of specialization in smaller countries are manifold: first, in comparison to larger countries they have fewer natural resources (in fewer branches), moreover whereas in small countries economies of scale might still prevail, large countries are too large such that economies of scale prevail over the whole country. Amiti (1998) and Midelfart-Knarvik et al. (2000, 2002, 2003) moreover report

decreasing specialization patterns for Western European countries until the mid-1980s, but a reversal trend from then onwards. In general, they find a positive effect of becoming a member of the European Union on specialization.

### 3. Methodological Issues and Data

#### Data

The empirical analysis in this chapter is based on macro data of 14 EU member states (EU 15 without Luxembourg), covering the observation period of 1970-2005. The data is drawn from the KLEMS database (see Timmer et al. 2007). We focus on 20 manufacturing industries and 15 service industries, according to the NACE classification. Some industries are not included in the analysis: Data for utilities (electricity, gas and water supply), public administration and community services - like public waste disposal or cultural activities - is partly missing or available only at a highly aggregated level. The agricultural sector has been excluded as it would bias the results towards strong convergence in line with the three-sector-hypothesis, since employment in all Western European countries has shifted from the agricultural to the manufacturing and services sectors over the investigation period. To eliminate this well-known trend, we excluded the entire sector. We rely on employment data, captured in total yearly hours worked by employed persons, which is the most comprehensive and (for our purposes) robust measure of industry shares available for the time horizon of 1970 to 2005.<sup>3</sup>

#### Indices

For our analysis we use variations of the Krugman Index. In its original form, this index measures the differences between two countries  $A$  and  $B$  (Krugman 1991b):

$$K_{A,B} = \sum_{i=1}^I |b_i^A - b_i^B| \quad (1)$$

where  $b_i^A, b_i^B$  are the employment shares of industry  $i$  in country  $A$  and  $B$ , respectively. We use this index for a pairwise comparison of all countries for each year in the observation

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<sup>3</sup> Total annual hours worked are preferable to the number of employees, which can be biased by national and inter-temporal differences in working hours and the share of part-time workers. A drawback of employment data is a productivity bias: Countries with particularly low productivities in an industry appear more specialized in this industry when focusing on employment data rather than on output data. This could lead to a systematic underestimation of specialization if high productivity and specialization are correlated. To overcome this problem, output-oriented indicators such as value added or exports could be used, but the availability of reliable data on these variables over the entire observation period of 1970 to 2005 is limited due to exchange rate problems; moreover the valuation of services is critical.

period. Based on the original Krugman Index of Specialization,  $K$ , we then generalize the index to more than two countries, summing up the differences of a country's employment shares from the average employment share of a country group  $\bar{b}_i$ :

$$\hat{K}_A = \sum_{i=1}^I |b_i^A - \bar{b}_i|. \quad (2)$$

Similarly, we sum up the index values of all countries of a country group with  $a$  countries in order to measure the total heterogeneity within this group:

$$\hat{K} = \frac{1}{a} \sum_{\alpha=1}^a \sum_{i=1}^I |b_i^\alpha - \bar{b}_i|. \quad (3)$$

In this case, we divide the index by the number of countries to make the values comparable for varying numbers of countries within the country groups. Observing these indices over time, we can interpret diminishing values as a sign of, first, convergence of two countries towards each other ( $K_{A,B}$ ), second, of a country towards the country group ( $\hat{K}_A$ ), or third, of the entire country group towards its average ( $\hat{K}$ ). Analogously, increasing values are a sign for divergence.

In order to analyze which industries are the drivers of convergence or divergence, the index can also be constructed such that it focuses only on one industry  $i$ . In this case, we sum up the differences between the employment shares of all countries compared to the average employment share in that industry and then weight it by the number of countries.

$$\hat{K}_i = \frac{1}{A} \sum_{a=1}^A |b_i^a - \bar{b}_i|. \quad (4)$$

Obviously, the differences between countries are likely to be larger for large industries than for small (niche) industries, since we capture the deviation in absolute values instead of, for instance, percentages of the average employment share of the industry. Caution is therefore advised when interpreting the values and their development over time, since in many cases decreasing index values might be accompanied by decreasing employment shares (i.e. heterogeneity between countries diminishes over time in an industry, while at the same time the importance of the industry itself declines).



## Identification of Country Clubs

We contend that European countries are clustered in country groups due to their industry structure. This argument is based on the pairwise Krugman Specialization Indices in 1970, and on whether a further converging trend has appeared until 2005. Thus, we cluster countries which have low  $K$  values compared to each other and high  $K$  values compared to countries outside the club, so that heterogeneity within the club is minimized, as shown in Table 1. Above the main diagonal, we plot the values of the pairwise Krugman Specialization Indices in 1970. The lower the index value, the more similar were the economic structures of the two countries with respect to each other. Below the main diagonal, we plot the development of the respective  $K$  values between 1970 and 2005, relative to the initial value. A negative value hints towards convergence, whereas a positive value is a sign of growing heterogeneity between two countries.

**Table 1: Assigning Countries to Clubs**

|     | AUT    | BEL    | DK     | FIN    | FR     | GER    | GRC    | IRL    | ITA    | NL     | PRT    | ESP    | SWE   | UK    |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|
| AUT | x      | 0.318  | 0.327  | 0.331  | 0.292  | 0.280  | 0.375  | 0.375  | 0.337  | 0.352  | 0.352  | 0.280  | 0.373 | 0.301 |
| BEL | -0.087 | x      | 0.384  | 0.431  | 0.405  | 0.300  | 0.507  | 0.454  | 0.421  | 0.388  | 0.479  | 0.337  | 0.471 | 0.353 |
| DK  | -0.058 | -0.164 | x      | 0.310  | 0.281  | 0.357  | 0.475  | 0.301  | 0.435  | 0.226  | 0.479  | 0.396  | 0.343 | 0.366 |
| FIN | 0.142  | -0.004 | 0.251  | x      | 0.357  | 0.400  | 0.478  | 0.377  | 0.381  | 0.437  | 0.417  | 0.334  | 0.401 | 0.421 |
| FR  | -0.231 | -0.451 | 0.000  | 0.077  | x      | 0.276  | 0.450  | 0.357  | 0.303  | 0.275  | 0.483  | 0.400  | 0.360 | 0.208 |
| GER | -0.308 | -0.091 | -0.140 | -0.073 | -0.376 | x      | 0.497  | 0.444  | 0.338  | 0.346  | 0.508  | 0.413  | 0.370 | 0.224 |
| GRC | 0.051  | 0.049  | 0.223  | 0.070  | 0.051  | -0.011 | x      | 0.481  | 0.419  | 0.511  | 0.421  | 0.364  | 0.645 | 0.498 |
| IRL | -0.238 | -0.187 | 0.219  | 0.268  | -0.070 | -0.317 | -0.123 | x      | 0.389  | 0.358  | 0.506  | 0.348  | 0.453 | 0.438 |
| ITA | -0.161 | 0.074  | 0.094  | -0.164 | 0.276  | 0.078  | -0.117 | 0.161  | x      | 0.452  | 0.335  | 0.311  | 0.495 | 0.363 |
| NL  | -0.241 | -0.410 | 0.240  | 0.070  | -0.347 | -0.209 | 0.049  | 0.063  | -0.045 | x      | 0.489  | 0.459  | 0.395 | 0.338 |
| PRT | 0.325  | 0.265  | 0.329  | 0.324  | 0.172  | 0.111  | -0.174 | 0.064  | 0.117  | 0.183  | x      | 0.352  | 0.622 | 0.590 |
| ESP | 0.266  | 0.342  | 0.239  | 0.038  | 0.010  | -0.006 | -0.153 | 0.094  | -0.143 | 0.119  | -0.062 | x      | 0.536 | 0.445 |
| SWE | -0.019 | -0.151 | -0.411 | -0.157 | -0.027 | -0.091 | 0.046  | 0.034  | 0.053  | -0.012 | 0.131  | -0.047 | x     | 0.350 |
| UK  | -0.219 | -0.303 | -0.053 | -0.020 | -0.104 | 0.075  | -0.033 | -0.378 | 0.135  | -0.367 | -0.013 | -0.056 | 0.197 | x     |

Source: EU KLEMS database, March 2008.

Based on Table 1, we identify three clubs – one containing mainly the Central European countries (Austria, Belgium, France, Germany, Ireland, the Netherlands and the UK), a second group consisting of Southern European countries (Greece, Italy, Portugal and Spain) and a third club containing the Scandinavian Countries (Denmark, Finland and Sweden).

This classification method is somewhat arbitrary, since we do not use a fixed limit for the  $K$  values. Besides, there is not a “natural” number of country clubs, so that alternative patterns would be possible as well. To validate our classification we therefore calculate the index  $\hat{K}_A$

of each country  $A$  to each of the three country clubs we identified, excluding the country from the construction of each club. The country should be assigned to the club where  $\hat{K}_A$  is lowest.

In Table 2, we display these index values for 1970 and 2005. The lower the value, the higher is the similarity between the country and the club. The minimum values are marked in bold. In most cases, the decision about club affiliation is unambiguous, as both the pairwise comparisons and the comparison of the country with the club yield the same result. It can be seen that - with some few exceptions - the optimal club assignment is identical in 1970 and in 2005. Remarkably, with the exception of Portugal and the UK, all countries converge towards their own club in the period from 1970 to 2005, thus moving closer to the other countries within the same club.

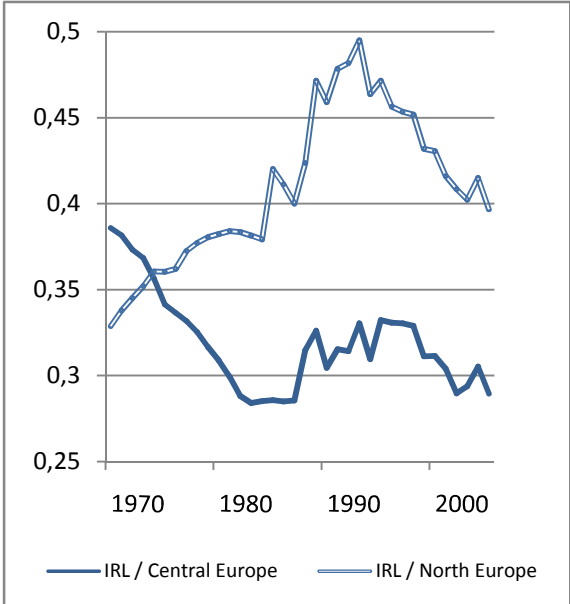
**Table 2: Krugman Indices - Assignment of Countries to Clubs**

|     | 1970           |                 |                 | 2005           |                 |                 |
|-----|----------------|-----------------|-----------------|----------------|-----------------|-----------------|
|     | Central Europe | Southern Europe | Northern Europe | Central Europe | Southern Europe | Northern Europe |
| AUT | .258           | <b>.256</b>     | .293            | <b>.182</b>    | .278            | .296            |
| BEL | <b>.318</b>    | .356            | .396            | <b>.224</b>    | .437            | .316            |
| DK  | .295           | .385            | <b>.254</b>     | .281           | .464            | <b>.236</b>     |
| FIN | .352           | .330            | <b>.323</b>     | .377           | <b>.328</b>     | .339            |
| FRA | <b>.201</b>    | .314            | .269            | <b>.122</b>    | .369            | .263            |
| GER | <b>.213</b>    | .334            | .320            | <b>.177</b>    | .365            | .290            |
| GRC | .449           | <b>.371</b>     | .514            | .473           | <b>.314</b>     | .582            |
| IRL | .386           | .355            | <b>.329</b>     | <b>.289</b>    | .390            | .397            |
| IT  | .306           | <b>.262</b>     | .393            | .361           | <b>.250</b>     | .430            |
| NL  | .298           | .401            | <b>.284</b>     | <b>.202</b>    | .452            | .304            |
| PRT | .508           | <b>.304</b>     | .482            | .565           | <b>.333</b>     | .627            |
| ESP | .389           | <b>.277</b>     | .402            | .390           | <b>.220</b>     | .434            |
| SWE | .336           | .505            | <b>.319</b>     | .351           | .516            | <b>.224</b>     |
| UK  | <b>.165</b>    | .380            | .323            | <b>.202</b>    | .398            | .363            |

Source: EU KLEMS database, March 2008.

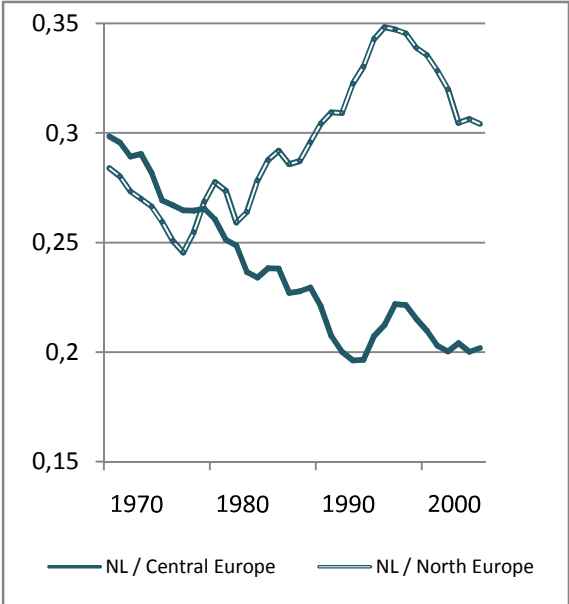
In some cases the assignment is difficult: Austria, Ireland and the Netherlands, which we have all assigned to the Central European club, are more similar to Scandinavia or - in the case of Austria - to Southern Europe, in 1970. Yet, as can be seen from Figures 1 through 4, these countries' switch to Central Europe occurred at an early stage of the observation period. For the sake of simplicity, we therefore decided to add these three countries to Central Europe for the whole observation period. More difficult is the classification of Finland, which is similar

to both Northern and Southern Europe, or to put it differently: which does not fit into any of the clubs very well. We added Finland to the Northern European club due to its notable structural similarities to Sweden.



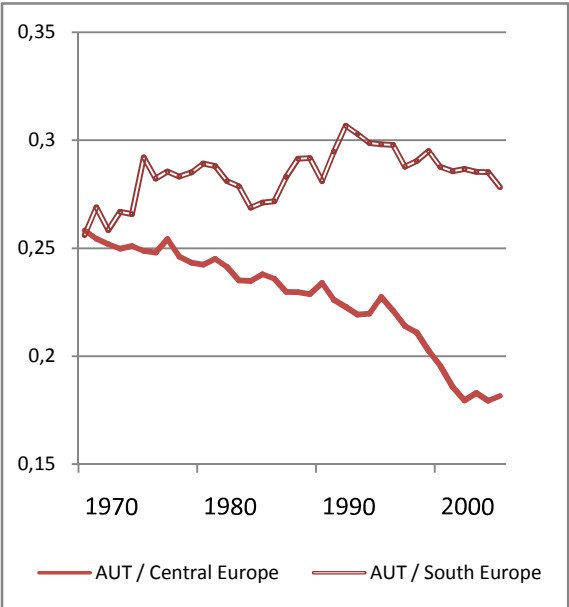
**Figure 1: Club Deviation of Ireland**

Source: EU KLEMS database, March 2008.



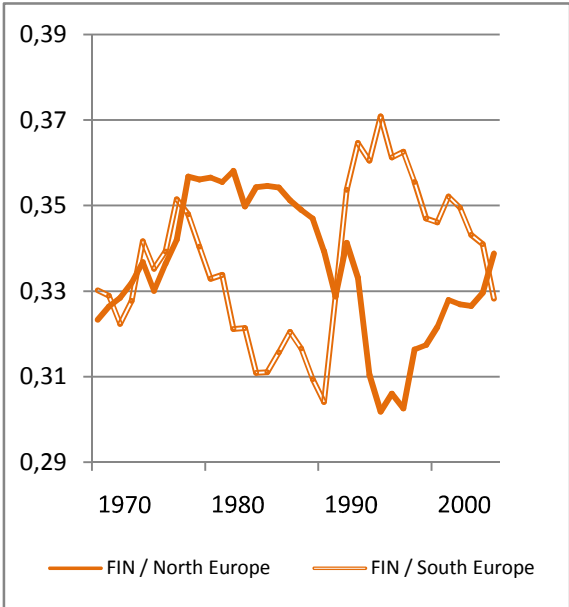
**Figure 2: Club Deviation of the Netherlands**

Source: EU KLEMS Database, March 2008.



**Figure 3: Club Deviation of Austria**

Source: EU KLEMS database, March 2008.



**Figure 4: Club Deviation of Finland**

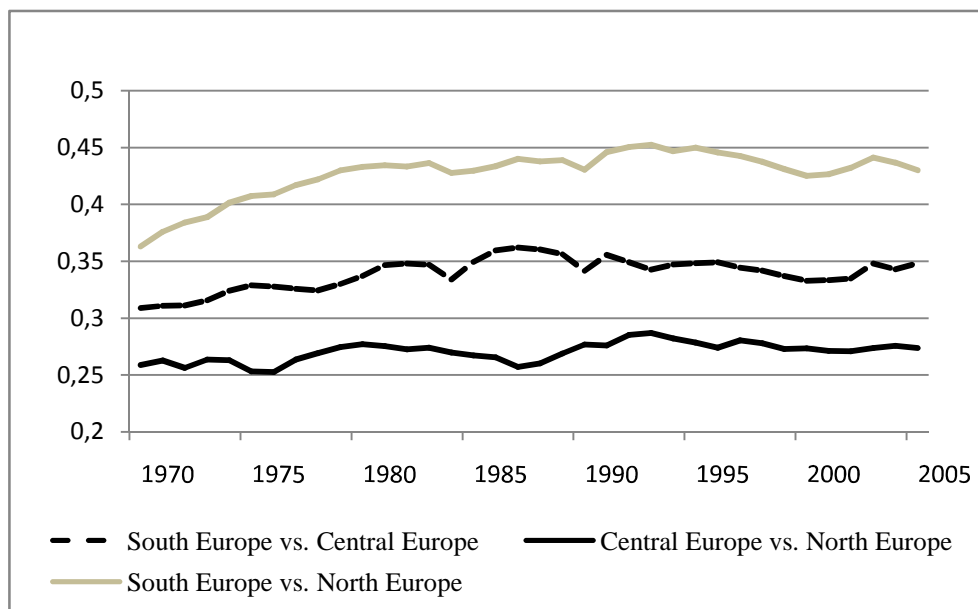
Source: EU KLEMS Database, March 2008.

## 4. Results

In a first step, we analyze the development of specialization patterns for the three country clubs and compare the differences across clubs as well as within clubs. In order to find out why the clubs developed as they did and which countries and industries were the driving forces of economic development within the clubs, we then focus on the country and industry levels for each club separately.

### Heterogeneity between and within Country Clubs

Comparing the employment structures of three country clubs to each other, we do not find pan-European convergence. Quite the contrary, the differences between North, Central, and South Europe even rise slightly over the investigation period. Not surprisingly, the economic structures of the Southern Countries compared to the Northern Countries are the



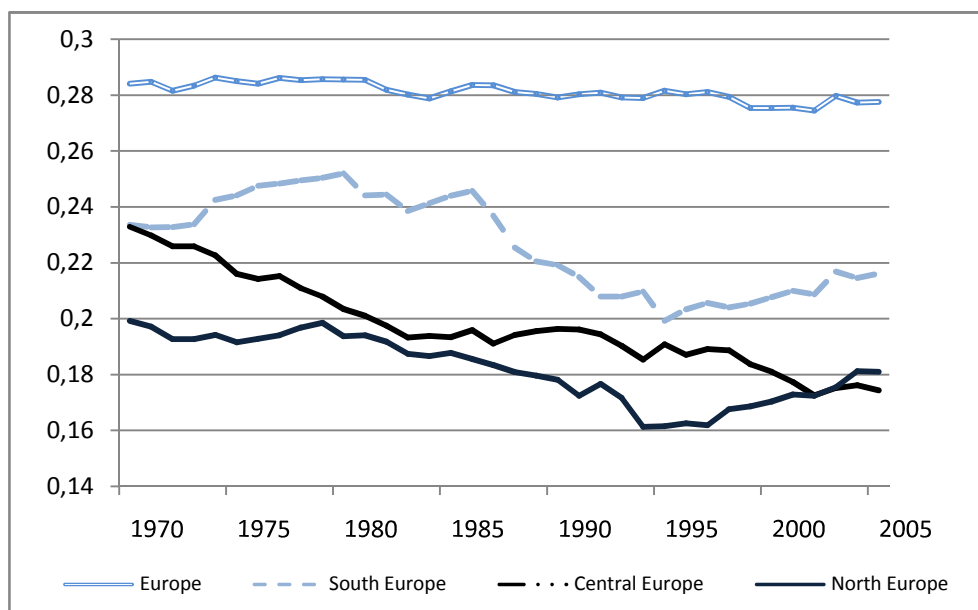
**Figure 5: Heterogeneity between Clubs 1970 – 2005**

Source: EU KLEMS database, March 2008.

most diverse, starting from a level of 0.363 and peaking at 0.450 in the mid-nineties, before slight convergence trends set in, which might be a sign of catching-up processes in lagging Southern European Countries. A similar picture arises from comparing the development between the Central and Southern European clubs. Central and Northern Europe remain the two most similar clubs over the investigation period; divergence processes prevail since the mid-1980s however. The club consisting of Central European Countries seems to be characterized by an average economic structure that lies somewhere between the Northern

and the Southern club, although the countries are more similar to their Northern neighbors – despite the fact that a divergence trend set in between the two clubs after 1986.

Focusing on the heterogeneity of the countries *within* individual clubs instead of the differences between clubs, the picture is quite different: In all clubs the countries became more homogenous over time, as Figure 6 shows. Yet, as the clubs are drifting apart, overall heterogeneity in Europe has hardly declined since 1970 (see the upper line “Europe” in Figure 6). The lowest initial level of heterogeneity is found for North Europe, while the convergence path is steepest for Central Europe which is the most homogenous club at the end of the observation period. Interestingly, both the Northern and the Southern club exhibit diverging trends from the 1990s onwards.



**Figure 6: Heterogeneity within Clubs 1970-2005**

Source: EU KLEMS database, March 2008.

### Specialization Patterns and Structural Change of Country Clubs

How the three country clubs differ from each other can be seen in detail from Table 3, which displays the employment shares per industry and club, both in 1970 and 2005. In order to have a reference level, we also show the EU average employment shares.

The largest industries in all clubs - both in 1970 and 2005 - are traditional industries. For the manufacturing sector these are Food, Textiles, Machinery and Metal Fabrication; the service sector is dominated on the one hand by trade/logistics industries (Retail Trade, Transport, and Wholesale Trade), and on the other hand by social branches (Education and Health & /Social Work). Besides, from Table 3 patterns of structural change become evident, which can be

found in all clubs to a certain degree: Employment has decreased in all manufacturing industries, in particular in low-technology industries, giving rise to tertiarization processes; the fastest growing industry by far has been Business-related Activities, while employment in textile production has drastically diminished in all clubs.

**Table 3: Employment Shares of Industries in 1970 and Development 1970-2005**

|                                    | 1970 |         |       |       | Differences 1970-2005 |         |       |       |
|------------------------------------|------|---------|-------|-------|-----------------------|---------|-------|-------|
|                                    | EU   | Central | South | North | EU                    | Central | South | North |
| FBT                                | .048 | .047    | .052  | .048  | -.019                 | -.018   | -.021 | -.024 |
| Textiles                           | .060 | .054    | .085  | .036  | -.047                 | -.047   | -.056 | -.032 |
| Leather                            | .011 | .008    | .018  | .005  | -.008                 | -.007   | -.010 | -.004 |
| Wood                               | .014 | .011    | .022  | .025  | -.007                 | -.005   | -.012 | -.013 |
| Pulp & Paper                       | .011 | .012    | .007  | .022  | -.006                 | -.007   | -.003 | -.011 |
| Printing & Publishing              | .019 | .020    | .014  | .027  | -.006                 | -.006   | -.003 | -.012 |
| Coke                               | .003 | .003    | .003  | .001  | -.002                 | -.002   | -.002 | .000  |
| Chemicals                          | .023 | .025    | .021  | .014  | -.012                 | -.013   | -.011 | -.002 |
| Rubber & Plastics                  | .013 | .014    | .010  | .012  | -.003                 | -.003   | -.001 | -.003 |
| Mineral Products                   | .023 | .021    | .028  | .018  | -.013                 | -.013   | -.014 | -.011 |
| Basic Metals                       | .022 | .025    | .015  | .019  | -.015                 | -.018   | -.008 | -.010 |
| Fabricated Metal                   | .042 | .043    | .042  | .027  | -.016                 | -.020   | -.011 | -.002 |
| Machinery                          | .045 | .051    | .030  | .044  | -.022                 | -.028   | -.007 | -.011 |
| Accounting & Computing<br>Machines | .002 | .002    | .002  | .002  | -.001                 | .000    | -.001 | -.001 |
| Electrical Engineering             | .018 | .020    | .014  | .012  | -.009                 | -.010   | -.006 | -.004 |
| Communication Equipment            | .011 | .012    | .008  | .009  | -.006                 | -.007   | -.004 | .001  |
| Precision Instruments              | .012 | .015    | .006  | .007  | -.005                 | -.007   | -.002 | .000  |
| Motor Vehicles                     | .022 | .025    | .016  | .016  | -.009                 | -.010   | -.007 | -.002 |
| Transport Equipment                | .013 | .013    | .012  | .013  | -.007                 | -.007   | -.007 | -.007 |
| Recycling                          | .020 | .019    | .024  | .017  | -.008                 | -.008   | -.007 | -.005 |
| Motor Vehicles & Fuel              | .033 | .033    | .034  | .036  | -.001                 | -.001   | .000  | -.009 |
| Wholesale Trade                    | .062 | .063    | .059  | .072  | .001                  | -.001   | .005  | -.001 |
| Retail Trade                       | .114 | .106    | .140  | .107  | -.006                 | -.004   | -.015 | -.027 |
| Hotels & Restaurants               | .048 | .041    | .070  | .040  | .021                  | .017    | .024  | -.001 |
| Transport                          | .069 | .068    | .072  | .077  | -.004                 | -.005   | -.004 | -.005 |
| Post & Telecommunication           | .022 | .024    | .018  | .022  | -.004                 | -.005   | -.002 | -.001 |
| Financial Intermediation           | .029 | .032    | .021  | .024  | .009                  | .013    | .007  | .003  |
| Real Estate                        | .007 | .007    | .005  | .012  | .007                  | .009    | .003  | .009  |
| Renting of Machinery               | .002 | .003    | .001  | .001  | .002                  | .002    | .002  | .003  |
| IT-related Activities              | .004 | .005    | .003  | .004  | .019                  | .019    | 0.02  | .022  |

|                      |      |      |      |      |      |      |       |      |
|----------------------|------|------|------|------|------|------|-------|------|
| R&D                  | .003 | .004 | .001 | .003 | .002 | .003 | 0.001 | .007 |
| Business Activities  | .042 | .050 | .024 | .032 | .085 | .097 | 0.072 | .058 |
| Education            | .053 | .051 | .052 | .077 | .024 | .025 | 0.020 | .028 |
| Health & Social Work | .065 | .067 | .049 | .103 | .048 | .064 | 0.019 | .066 |
| Domestic Services    | .012 | .007 | .023 | .014 | .017 | .006 | 0.038 | .004 |

Source: EU KLEMS database, March 2008.

The employment structures of the clubs, as shown in Table 3, show interesting patterns: Compared to the European average, Southern European countries are characterized by strong specialization in low-tech and low-skill industries, like Textiles, Leather, Retail Trade, Transport or Hotels & Restaurants. At the same time, the low employment level of Southern Europe in the health & social work industry is notable.

In contrast, Scandinavian countries exhibit a strong social sector (i.e. high employment shares in Education and Health & Social Work) from 1970 onwards and even increase their lead in these industries over time. Notable as well is the specialization in the wood and paper industries at the beginning of the observation period due to comparative advantages in natural resources. In line with the technological upgrade of Northern European Countries, the specialization in these industries has not been kept up, which can be seen from the dropping employment shares, not only in wood and paper production, but in all major low-tech and low-wage industries. The employment shares in medium-high and high-tech industries, in contrast, remained largely stable. In the service sector a similar picture arises: Whereas Northern Europe once was heavily specialized in Retail Trade, it managed to upgrade economic structures that are now characterized by high employment shares in high-skill industries such as Education or IT-related Activities.

In contrast to the two clubs described above, specialization of the Central European club is less pronounced: In general, employment levels in low-tech industries were already low in 1970 and have decreased further since then. It seems that Central European Countries have had competitive advantages in traditional medium- and high-tech industries such as Electrical Engineering and Machinery, instead, as employment in these industries was high at the beginning of the investigation period. Remarkably, the structural change from manufacturing towards the service sector is the strongest for this club: while in 1970 the manufacturing sector was largest in Central Europe with the service sector being the smallest, specialization patterns changed so much that in 2005 Central Europe has the smallest manufacturing and the largest service sector of all three clubs. This is above all driven by increasing specialization in

IT-related and Business-related Services like renting of Machinery or R&D, as well as by a higher level of specialization in Financial Intermediation. As we will show below, the developments in this club are mainly driven by the economic structures of the big countries belonging to it, i.e. Germany, France and the UK.

Caused by terziation as well as by catch-up processes, the differences between the clubs are diminishing over time in most manufacturing industries - above all in low-tech industries such as the textile industry. Exceptions to this tendency are found in two emerging industries: Divergence occurs in the office and accounting industry due to the strong specialization of Ireland, and in the communication equipment industry due to the specialization of Finland (see Figure 9 and Figure 25 below). An interesting development is also found for the chemical industry, where employment drops by more than fifty per cent both in Central and Southern Europe, but with different consequences: whereas in Central Europe the high employment share shifts towards EU average levels, employment in Southern Europe was already below average in 1970 and declines even further. Similarly, employment in Machinery and Motor Vehicles decreases significantly, with the strongest decline in Central Europe which might be giving up its specialization in these industries. However, caution is advised when interpreting these shifts, as the developments may be caused also by automation and rationalization processes or by outsourcing trends (leading to a shift from e.g. Machinery to engineering services). In this respect, the rise of Chinese exports to the rest of the world – has had an enormous impact on the textile industry in Western Europe, where Portugal and Italy have trouble in keeping up with the increasing low-wage competition (Commission of European Communities 1993).

Regarding the service industries, the three clubs drifted apart from one another in particular in the social sector (i.e. with regard to Education, Health & Social Work) as well as in Hotels & Restaurants. The former has been growing in all clubs, but at different speeds. Remarkably, the growth rate in Northern European Countries which were already characterized by a large social sector was the highest, implying structural divergence across the clubs. This is not surprising since the goals of public policy are heterogeneous across the clubs. A similar picture arises in Hotels & Restaurants, where Southern European Countries, which already had a high share of employment in this industry in 1970, grew most quickly, whereas Central Europe proved unable to catch up to the leading countries. Remarkably, in Southern Europe employment levels of domestic workers are high from 1970 on, growing steadily over time. This trend seems to parallel the Central and Northern European growth in the social sector, so

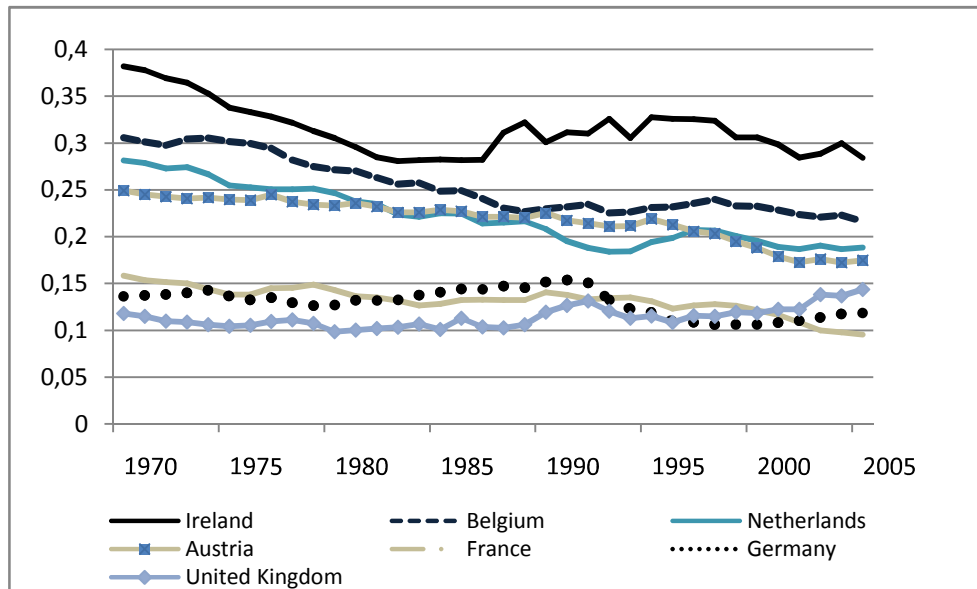


that it might be due to institutional differences in the sense that in Southern Europe social services are taken over by domestic workers.

### **1.1.1. Convergence and Divergence within Central Europe**

As has been described above, the Central European club is characterized by a strong trend of within-club convergence over the investigation period (see Figure 6), contradicting the results of pairwise comparisons in Midelfart-Knarvik et al. (2002). The reason for the differences in results could be in the fact that the authors only report pairwise Krugman Specialization Indices for two periods in time (i.e. 1980-1983 and 1994-1997) and report the heterogeneity of individual countries in comparison to the large economies of Germany, France and the UK only, thus suppressing important information regarding the development of economic structures. We present the development of the pairwise Krugman Specialization Indices calculating the differences between the employment shares of a given country and the average employment shares of the club (see Figure 7). As can be seen there, nearly all Central European countries in fact converged towards the average over the course of time. An exception is the UK which was close to the Central European average from the beginning, though.

Taking a closer look, we identify two sub-clubs for 1970: on the one hand, there are the big players France, Germany and the UK, which tend to be little specialized, and on the other hand the smaller, more specialized countries Austria, Belgium and the Netherlands. This higher degree of specialization of smaller countries compared to larger countries might be typical, but it could also be a result of a mere calculation effect, as the influence of larger countries to the club-average is larger.



**Figure 7: Heterogeneity of Central European Countries**

Source: EU KLEMS database, March 2008.

We find a convergence trend between these two sub-clubs starting at the beginning of the 1990s such that until 2005 the differences between the small and big countries have largely vanished. This suggests that economic integration may have different effects on the two groups: While relative specialization levels of small countries were reduced, heterogeneity of the larger countries was low and remained roughly unchanged. Obviously, Ireland deviates from both sub-clubs. However, it is found to be the most converging country – which is in line with the literature about the Irish catch-up process (Midelfart-Knarvik et al. 2003) – followed by strong relative de-specialization patterns in Belgium and the Netherlands.

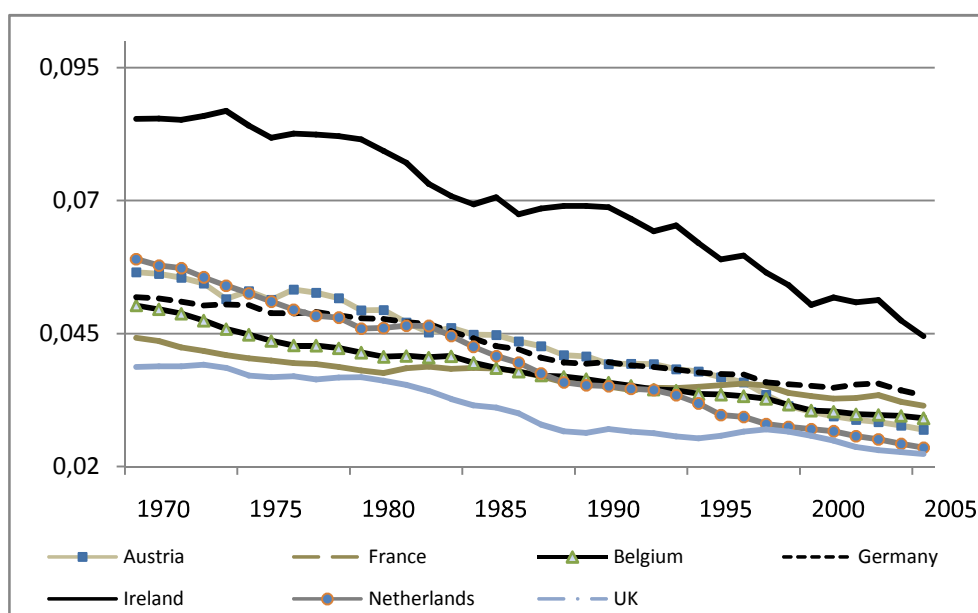
Turning to the question of which industries were the drivers of convergence, we focus on heterogeneity within the Central European club for each industry separately. From Table 4 it can be seen that the main drivers of convergence are the low-tech industries, in particular the production of food, textiles and basic metals. Interestingly, Machinery also exhibits a high degree of convergence, which is a remarkably parallel with our finding that Central Europe has de-specialized in this industry. In contrast, divergence occurs only in service industries, mainly in high-skill areas like Business-related Services. Interestingly, employment in Hotels & Restaurants also diverges, which could be due to the fact that people tend to undertake more international journeys today than in 1970. Countries such as Austria benefit from this trend and specialize in tourism (Janger and Wagner 2004).

**Table 4: Industry-specific Heterogeneity in Central Europe ( $\hat{K}_i$ )**

|                                 | 1970 | 2005 | $\Delta\hat{K}_i$ | Development<br>relative to 1970 |
|---------------------------------|------|------|-------------------|---------------------------------|
| Food, Beverages, Tobacco        | .078 | .037 | -.041             | -.530                           |
| Textiles                        | .068 | .013 | -.055             | -.812                           |
| Leather/Footwear                | .022 | .003 | -.019             | -.848                           |
| Wood                            | .022 | .015 | -.007             | -.310                           |
| Pulp & Paper                    | .013 | .007 | -.006             | -.465                           |
| Printing & Publishing           | .026 | .017 | -.010             | -.365                           |
| Coke                            | .009 | .003 | -.006             | -.670                           |
| Chemicals                       | .034 | .037 | .003              | .084                            |
| Rubber & Plastics               | .019 | .015 | -.004             | -.199                           |
| Mineral Products                | .030 | .015 | -.016             | -.518                           |
| Basic Metals                    | .087 | .024 | -.063             | -.720                           |
| Fabricated Metal                | .049 | .026 | -.023             | -.464                           |
| Machinery                       | .128 | .058 | -.071             | -.551                           |
| Accounting & Computing Machines | .021 | .016 | -.005             | -.232                           |
| Electrical Engineering          | .048 | .025 | -.023             | -.475                           |
| Communication Equipment         | .021 | .011 | -.010             | -.462                           |
| Precision Instruments           | .027 | .027 | .000              | -.014                           |
| Motor Vehicles                  | .064 | .048 | -.016             | -.249                           |
| Transport Equipment             | .037 | .010 | -.027             | -.736                           |
| Recycling                       | .034 | .015 | -.019             | -.551                           |
| Motor Vehicles & Fuel           | .021 | .024 | .003              | .163                            |
| Wholesale Trade                 | .066 | .071 | .005              | .069                            |
| Retail Trade                    | .087 | .049 | -.038             | -.437                           |
| Hotels & Restaurants            | .100 | .117 | .017              | .170                            |
| Transport                       | .030 | .031 | .001              | .019                            |
| Post & Telecommunication        | .033 | .033 | .000              | -.004                           |
| Financial Intermediation        | .030 | .038 | .008              | .272                            |
| Real Estate                     | .018 | .019 | .002              | .093                            |
| Renting of Machinery            | .011 | .012 | .001              | .053                            |
| IT-related Activities           | .015 | .027 | .012              | .825                            |
| R&D                             | .017 | .021 | .004              | .224                            |
| Business Activities             | .103 | .182 | .078              | .759                            |
| Education                       | .065 | .053 | -.012             | -.187                           |
| Health & Social Work            | .114 | .069 | -.045             | -.396                           |
| Domestic Services               | .082 | .053 | -.029             | -.354                           |

Source: EU KLEMS database, March 2008.

For some industries with remarkable changes in specialization patterns, the developments of the employment shares of the Central European countries over time are depicted in the following figures. We highlight two groups of developments: In the first group the development is driven mainly by Ireland, in the second by the largest economy in this club, i.e. Germany. Regarding the first group, the catch-up and structural upgrade of the Irish economy over the whole investigation period has strongly shaped major developments. Whereas in 1970 Ireland was a country characterized by low productivity of labor and a strong relative specialization in low-tech and low-wage industries such as the food industry, by 2005 it had profited dramatically from European Integration, which attracted large amounts of foreign direct investment by multinationals. Even though Ireland remained the single most specialized country in Food, a strong trend of de-specialization is notable (see Figure 8). Concentrating on Central European Countries only, the effect is even larger than reported for the whole sample that contains Greece and Italy; two countries that were far more relatively specialized in Food than any other Central European Country.



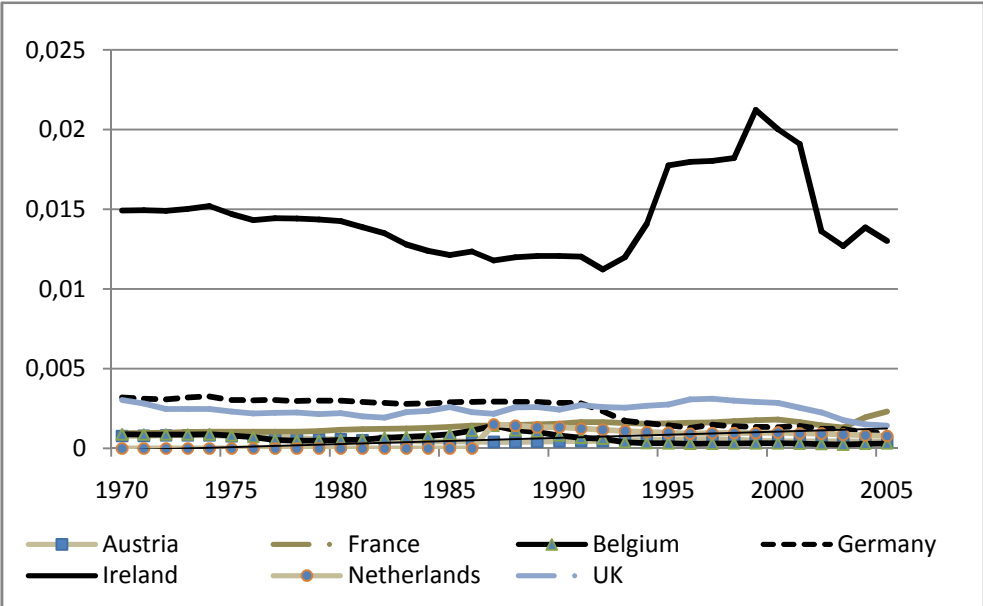
**Figure 8: Employment in Food in Central Europe**

Source: EU KLEMS database, March 2008.

At the same time, Ireland exhibits rising employment shares in fast growing, high-tech industries such as Accounting & Computing Machines (see Figure 9) or Communications Equipment (see Figure 10). Interestingly, Ireland's specialization in Accounting and Computing Machines has started already in the 1970s and persisted until the end of the investigation period, with a peak around the year 2000. This continuing strength can be attributed to a large part to Ireland's success in attracting foreign firms in these fields, a

development which was strongly influenced by Ireland’s industrial policy, which promoted the location of many (US-American) subsidiary firms of international headquarters in these industries such as Intel, Yahoo, Microsoft, HP, Apple, Google, or Amazon.com.

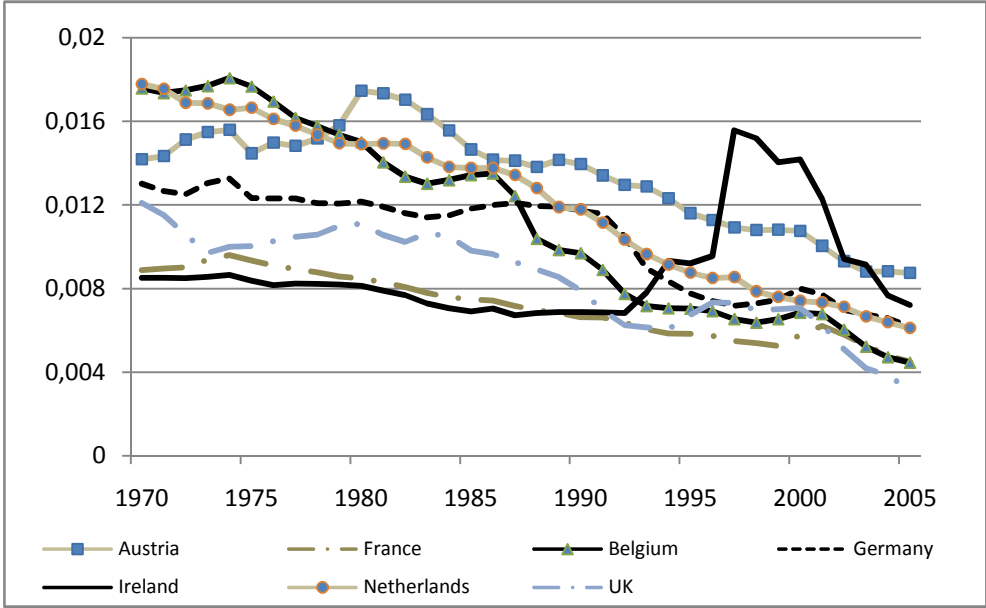
From Figure 9 we learn that Ireland was characterized by a strong specialization in Accounting and Computing Machines already in the 1970s. Since other countries could not catch-up, the one-country specialization of Ireland remained a fairly stable pattern in that industry until Ireland lost considerable employment beginning in the late 1990s, leading to one-country convergence. It is notable, that there is no other industry in which heterogeneity is as large and in which no other country had the chance to catch-up. As has already been laid out, we have to be careful in interpreting this result, since it is not merely the competitiveness of Irish workers or Irish firms that are responsible for that development. It is mainly foreign firms driving the process, which invested in Ireland due to a favorable tax regime.



**Figure 9: Employment in Accounting & Computing Machines in Central Europe**  
 Source: EU KLEMS database, March 2008.

The development in Communications Equipment is different from the former industries since Ireland’s one-country specialization only set in at a very late stage of the observation period, i.e. in the mid-1990s. Earlier than that, Ireland had for a long time been the country characterized by the lowest employment shares in Communications Equipment of all Central European countries. Thus, it is not initial advantages that lead to this result; on the contrary, Belgium and the Netherlands, which were the relatively most specialized countries in the beginning of the observation period, experienced massive losses in employment shares over the course of time. It should be again the strategy of Ireland’s industrial policy to attract

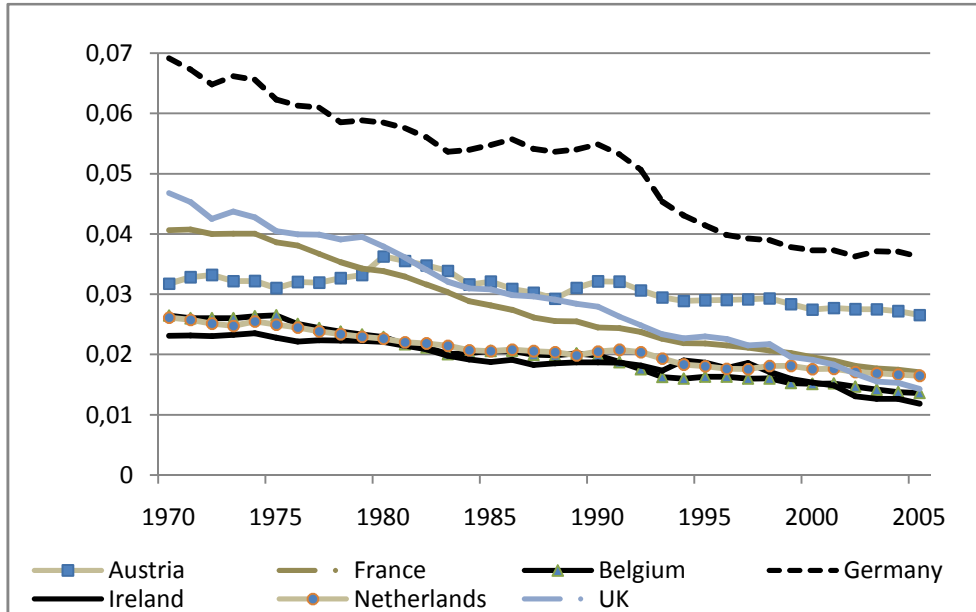
foreign firms – and it seems that Ireland was the most successful of the Central European countries in attracting foreign capital in this particular industry (Koski et al. 2002).



**Figure 10: Employment in Communications Equipment in Central Europe**  
 Source: EU KLEMS database, March 2008.

The second group of industries we present is characterized by the persisting strong position of Germany. This is the case for Machinery, Electrical Engineering and Motor Vehicles, which all belong to the group of medium-high or high tech industries. In both the machinery and electrical engineering industry, Germany had a strong lead in the 1970s. Even though we have to recognize a steady decline of the employment shares since the 1970s leading to a remarkable convergence trend, Germany remains the single most important country in both industries in Central Europe (see

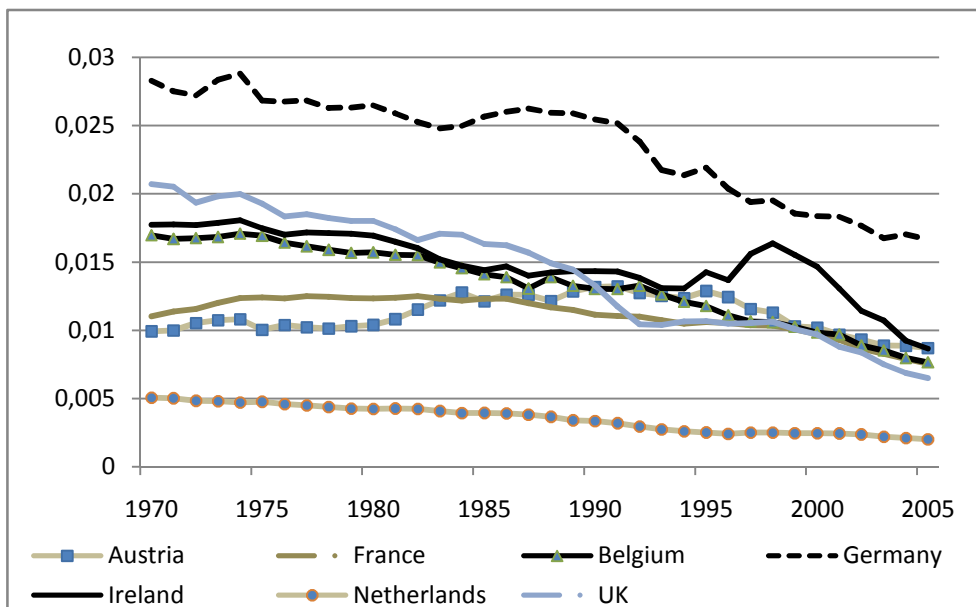
Figure 11 and Figure 12).



**Figure 11: Employment shares of Machinery in Central Europe**

Source: EU KLEMS database, March 2008.

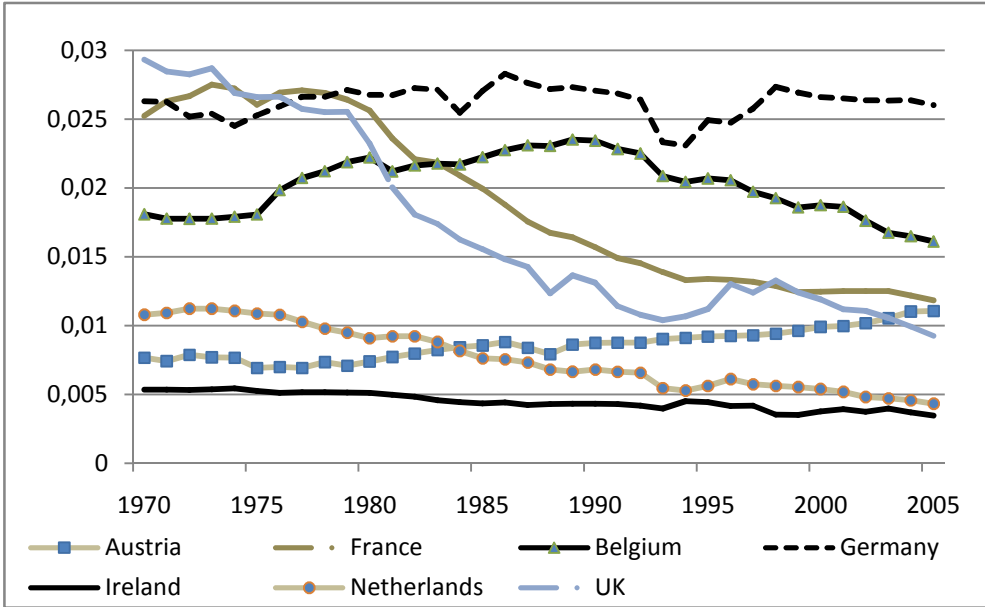
As such, this is not only a sign of a dissipating competitive advantage of Germany but a sign of structural change. Apart from Austria all countries in the sample have moved out of Machinery, which comes as no surprise due to the shift from an industrial to a service society occurring in all advanced economies. Similar, but less pronounced is the picture for the electrical engineering industry.



**Figure 12: Employment in Electrical Engineering in Central Europe**

Source: EU KLEMS database, March 2008.

Regarding the motor vehicles industry, the development is less clear, but also exhibits the strong position of Germany. The production of motor vehicles is scale-intensive (Pratten 1988), thus employment share should be found mainly in large and central places. This is true for the beginning of the observation period, when France, Germany and the UK had the largest employment shares. At the same time, small, non-integrated countries such as Austria and Ireland had small employment shares in line with the results of Brühlhart (1998b) (see Figure 13). From the 1980s onwards, a different picture arises, since employment levels in France and the UK decrease dramatically, leading to an almost complete collapse in the UK. Germany has always had a strong tradition in the production of Motor Vehicles. Thus, while other countries already specialized out of Motor Vehicles, employment kept constant in Germany (Aiginger 2000). Tylecote and Vertova (2007) attribute this to the superior production systems in Germany and the US that were much more inspired by the fordist production than the UK model. The development of Austria is also noteworthy, since the need of economies of scale would imply that small countries have competitive disadvantages compared to larger countries. However, the employment share in Motor Vehicles increased remarkably in Austria, especially from the early 1990s onwards, which might be a result of Austrian's proactive cluster policy for car component suppliers.

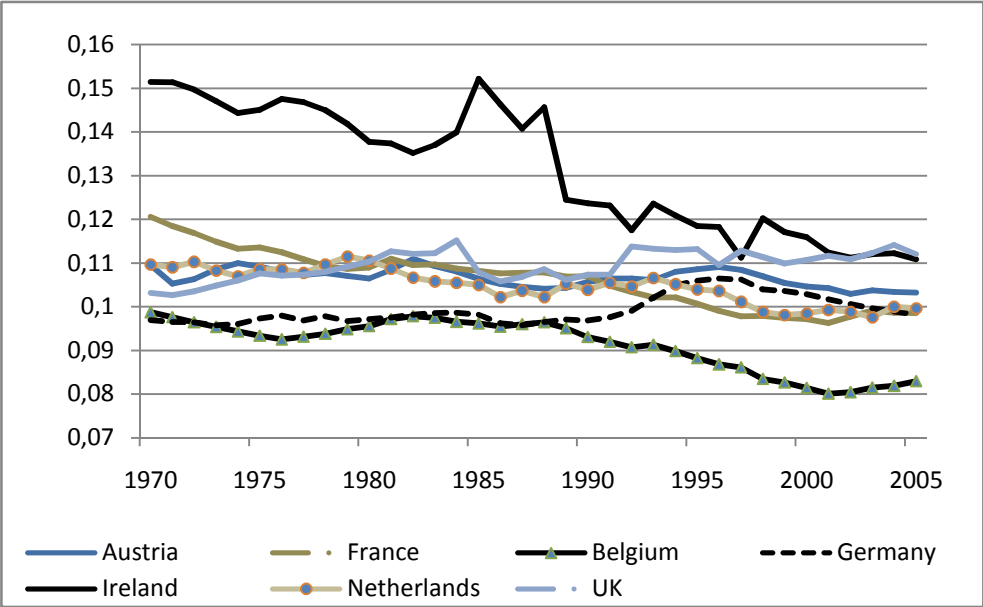


**Figure 13: Employment in Motor Vehicles in Central Europe**  
 Source: EU KLEMS database, March 2008.

Regarding the service sector, remarkable patterns are found for Retail Trade, Hotels & Restaurants and Financial Intermediation. In many cases, Ireland is also found to be the single most important country driving convergence within the Central European service industries.

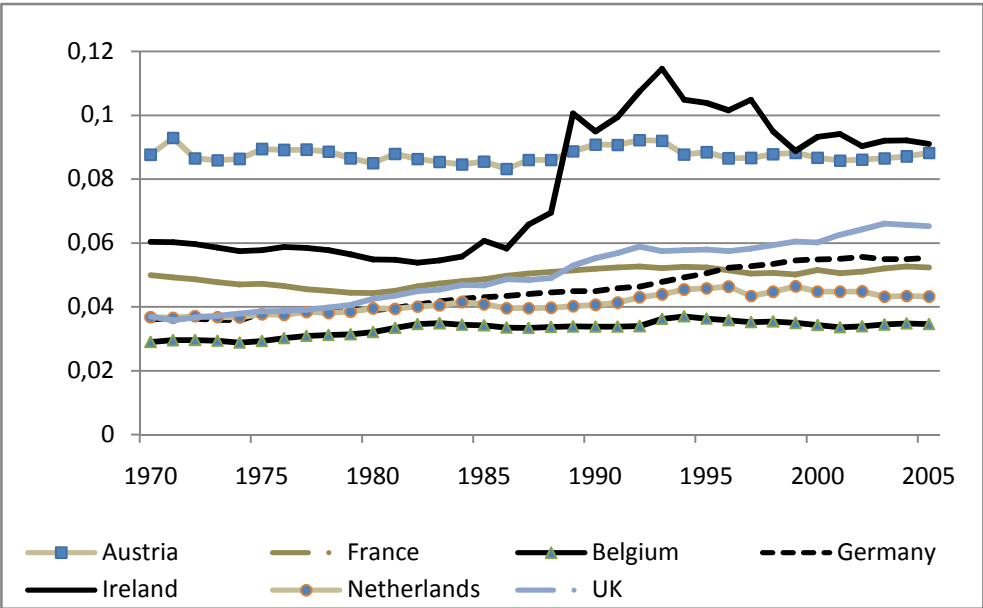


This is the case for instance for Retail Trade, where the change in employment patterns in Ireland is the main driver of convergence, with Belgium being the only country to remarkably deviate from the average from the late 1980s onwards (see Figure 14).



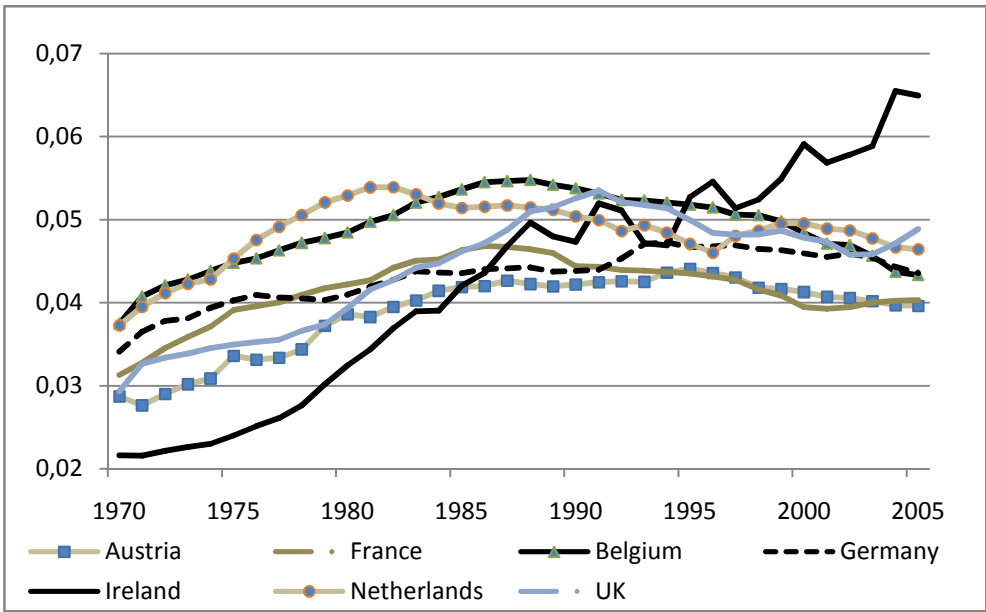
**Figure 14: Employment in Retail Trade in Central Europe**  
 Source: EU KLEMS database, March 2008.

Regarding employment in Hotels and Restaurants, in particular the strong and persisting specialization of Austria is remarkable. The only country catching up with Austria is Ireland, thanks to a steep rise of employment since the 1980s (see Figure 15).



**Figure 15: Employment in Hotels & Restaurants in Central Europe**  
 Source: EU KLEMS database, March 2008.

In contrast to this, the Financial Intermediation industry is marked by a dynamic development, in particular changing the Irish economic structure. The low degree of financial regulation combined with a favorable tax system for international investors and multinational firms attracted many foreign banks and made employment rise from the lowest to the highest figures in the Central European club. In the other countries in this group employment shares rose similarly to the Irish case in the first decade of the investigation period, but then stagnated or even shrunk slightly. Nevertheless, in all countries the employment level is higher in 2005 than in 1970, hinting the growing importance of financial intermediation services.

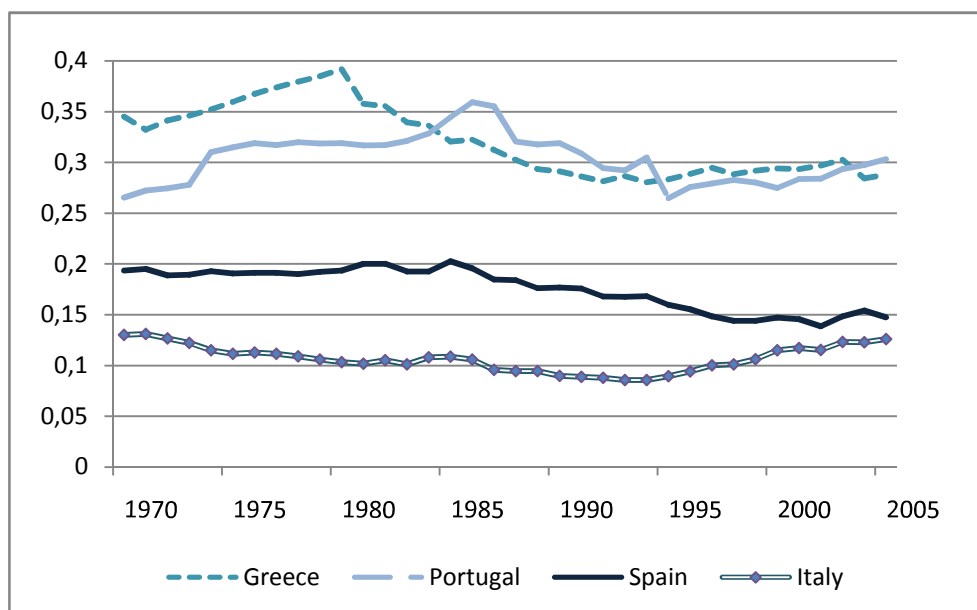


**Figure 16: Employment in Financial Intermediation in Central Europe**  
 Source: EU KLEMS database, March 2008.

**Convergence and Divergence within Southern Europe**

In contrast to the clear convergence within the Central European club, among the Southern European countries only the indices of Greece and Spain diminish steadily over time, while Portugal seems to diverge even more from the average, in particular in the first half of the observation period, before a period of convergence sets in 1987. From the mid-1990s the picture changes again: the convergence trends of Greece, Spain and Portugal vanish, while Italy even starts diverging from the South European average. As a result, the Club-Krugman is growing from the mid-1990s on (see Figure 5). We will argue below that these patterns can be understood as catch-up processes of Portugal and Greece, while Italy is taking the technological lead. Italy and Spain are specialized in medium-technology and more skill-

intensive industries than Greece and Portugal, which supports the results obtained by Midelfart-Knarvik et al. (2002).



**Figure 17: Heterogeneity of Southern European Countries**

Source: EU KLEMS database, March 2008.

As in the Central European club, the manufacturing industries are converging, but with two exceptions: Heterogeneity in the leather industry remains constant over time and it even grows slightly in rubber & plastics production.

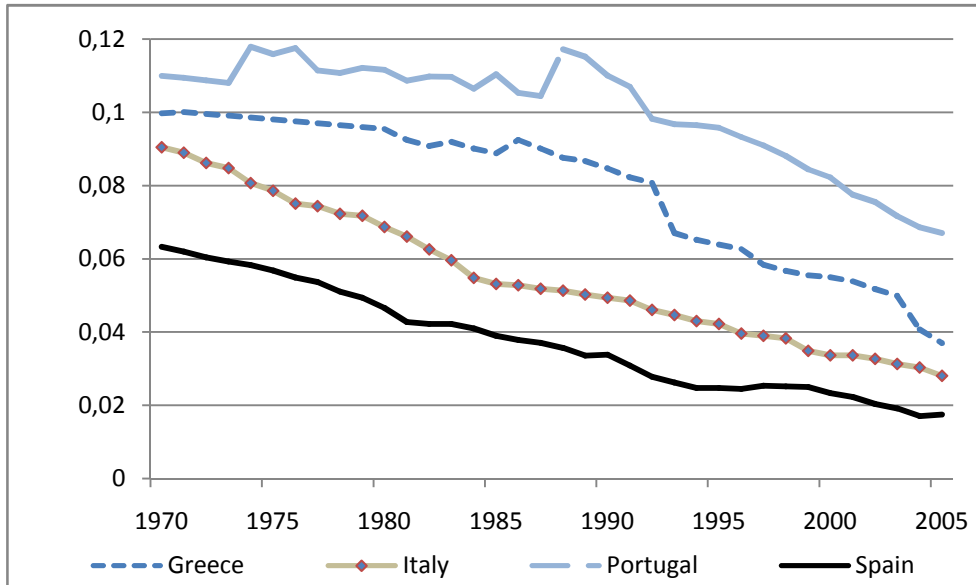
**Table 5: Industry-Specific Heterogeneity in Southern Europe ( $\hat{K}_i$ )**

|                                 | 1970 | 2005 | $\Delta\hat{K}_i$ | Development relative to 1970 |
|---------------------------------|------|------|-------------------|------------------------------|
| FBT                             | .066 | .029 | -.037             | -.566                        |
| Textiles                        | .066 | .058 | -.007             | -.113                        |
| Leather/Footwear                | .016 | .016 | .000              | .004                         |
| Wood                            | .013 | .012 | -.002             | -.144                        |
| Pulp & Paper                    | .003 | .002 | -.001             | -.455                        |
| Printing & Publishing           | .009 | .003 | -.005             | -.611                        |
| Coke                            | .006 | .004 | -.002             | -.374                        |
| Chemicals                       | .017 | .007 | -.010             | -.575                        |
| Rubber & Plastics               | .006 | .007 | .001              | .214                         |
| Mineral Products                | .013 | .011 | -.002             | -.129                        |
| Basic Metals                    | .022 | .006 | -.016             | -.726                        |
| Fabricated Metal                | .049 | .028 | -.020             | -.417                        |
| Machinery                       | .038 | .036 | -.002             | -.051                        |
| Accounting & Computing Machines | .004 | .002 | -.002             | -.560                        |

|                          |      |      |       |       |
|--------------------------|------|------|-------|-------|
| Electrical Engineering   | .021 | .012 | -.009 | -.414 |
| Communication Equipment  | .014 | .006 | -.008 | -.603 |
| Precision Instruments    | .014 | .008 | -.006 | -.442 |
| Motor Vehicles           | .024 | .017 | -.006 | -.263 |
| Transport Equipment      | .011 | .005 | -.006 | -.561 |
| Recycling                | .013 | .005 | -.008 | -.617 |
| Motor Vehicles & Fuel    | .019 | .023 | .004  | .228  |
| Wholesale Trade          | .094 | .070 | -.024 | -.254 |
| Retail Trade             | .057 | .087 | .031  | .541  |
| Hotels & Restaurants     | .053 | .050 | -.003 | -.063 |
| Transport                | .091 | .050 | -.041 | -.453 |
| Post & Telecommunication | .009 | .013 | .004  | .482  |
| Financial Intermediation | .010 | .016 | .006  | .618  |
| Real Estate              | .016 | .021 | .005  | .314  |
| Renting of Machinery     | .002 | .003 | .001  | .736  |
| IT-related Activities    | .010 | .056 | .046  | .596  |
| R&D                      | .001 | .002 | .001  | 2.864 |
| Business Activities      | .043 | .051 | .008  | .178  |
| Education                | .037 | .049 | .012  | .317  |
| Health & Social Work     | .029 | .023 | -.006 | -.219 |
| Domestic Services        | .036 | .074 | .038  | 1.039 |

Source: EU KLEMS database, March 2008.

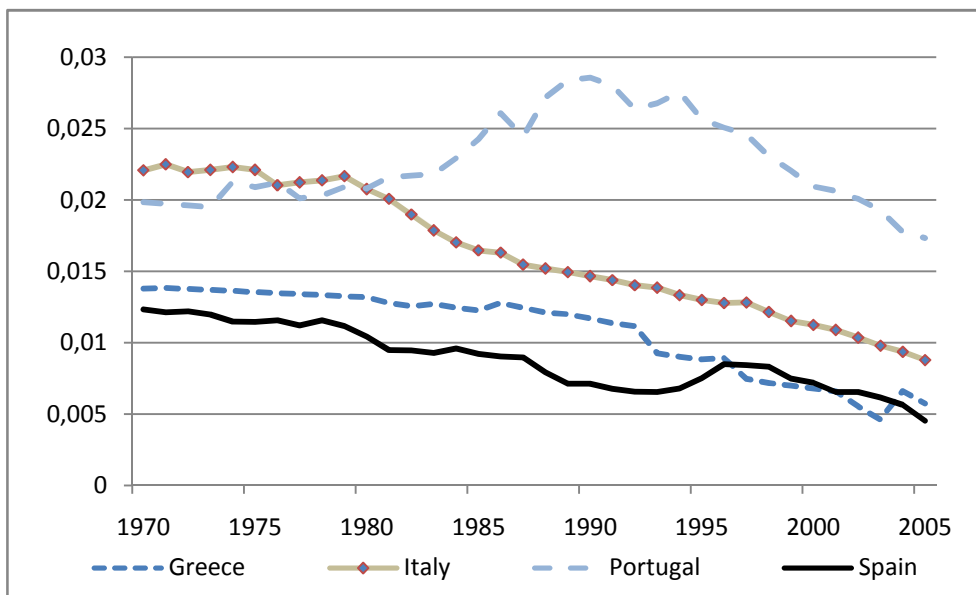
The convergence in the textile industry (as the largest industry in this club) is relatively low. This is contrary to the result for Central Europe, where a high degree of convergence was detected. It should be noted however, that even though employment in Textiles fell in all Southern European countries, the levels remain quite heterogeneous. As Figure 18 shows, the main reason for the low degree of convergence seems to be the delayed structural change of Portugal, which holds high employment levels in low-tech industries such as the textile production until the mid-1990s (when protectionism was set to end by the WTO). Besides, there should be differences between the countries with regard to the employment structures within the textile industry: the textile industry in Italy is far more high-skilled than in the other countries, since Italy focuses on the quality segment of this industry and has high-value added segments where design, research and development (R&D) are important competitive factors (Aiginger 2000). The other Southern European countries, in contrast, are in more direct rivalry with Asian countries, since they tend to produce standardized mass products of lower quality.



**Figure 18: Employment in Textiles in Southern Europe**

Source: EU KLEMS database, March 2008.

A similar development can be observed in the leather industry, where Portugal even built up employment in the first half of the investigation period, before it started reducing it in line with the other countries (see Figure 19).



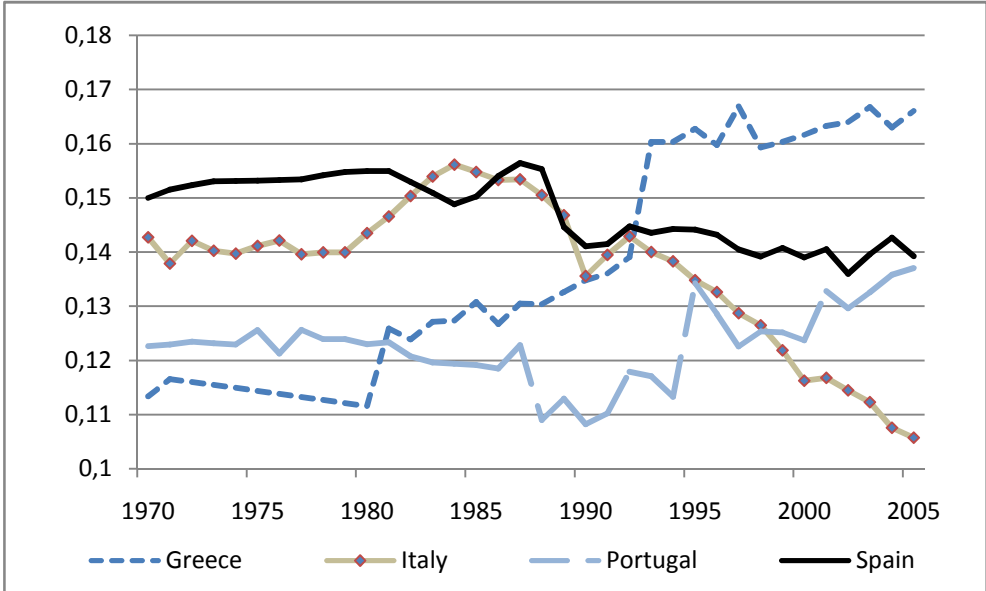
**Figure 19: Employment in Leather in Southern Europe**

Source: EU KLEMS database, March 2008.

In the service sector, the most strongly converging industry is Transport, which is mainly caused by employment reduction in Greece (see Figure 20), while in the other three countries employment remained constant. The one-country de-specialization of Greece in Transport might be interpreted as a sign of technological catch-up by Greece, leading to rationalization

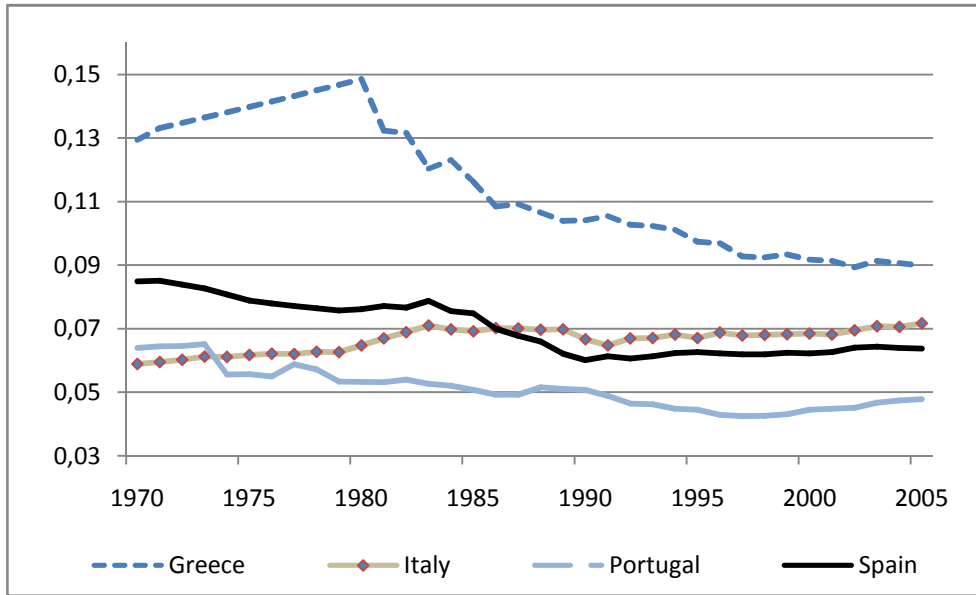
and automation and reducing employment from the 1980s onwards (see Figure 21). Thus, Greece did not lose competitiveness, but rather increased competitiveness while reducing employment.

In Retail Trade, computer services and employment in Private Households, heterogeneity strongly increases at the same time. The developments in Retail Trade and Computer Services can be interpreted as a hint regarding the special role Italy plays within the Southern European club: While at the beginning of the 1970s, employment levels were highest in Spain and Italy, Retail Trade was of minor importance in Greece and Portugal. Since the early 1980s, however, employment has dropped by almost 40 per cent in Italy, and remained roughly unchanged in Spain, whereas in Greece and Portugal the industry has even risen. At the same time, employment in the skill-intensive computer services industry has been growing more strongly in the Italian economy than in the other three countries, where the development sets in later and remains less dynamic until 2005 (see Figure 22). Taken together, it seems that Italy is the structurally (technologically/economically) leading country within South Europe, and our results lead to the conclusion that the development of Italy continues, increasing the lead to the other South European countries. Nevertheless, a dynamic development comparable to the rise of Ireland, has not taken place in Italy, so that the country was not able to catch-up to the Central European club.



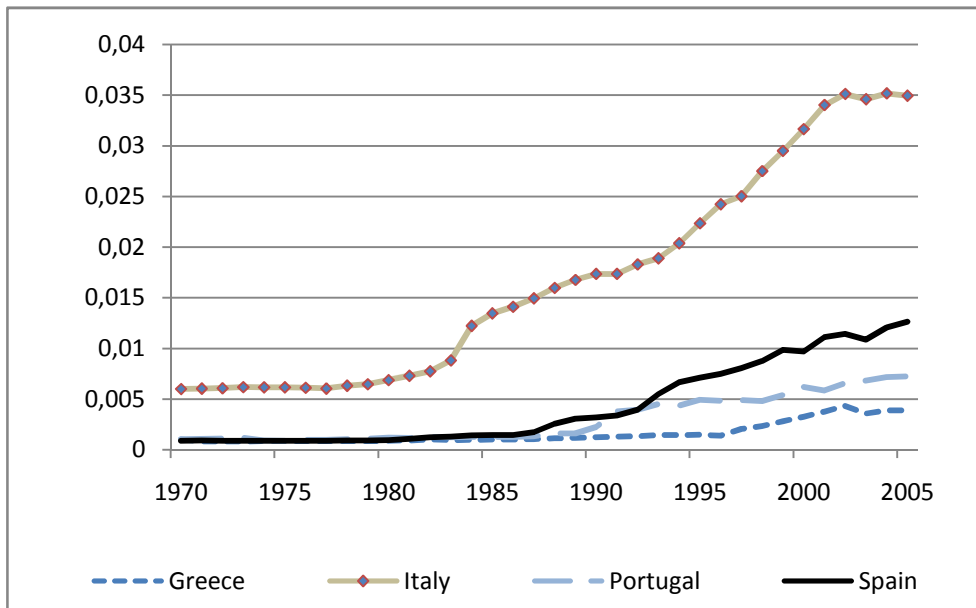
**Figure 20: Employment in Retail Trade in Southern Europe**

Source: EU KLEMS database, March 2008.



**Figure 21: Employment in Transport in Southern Europe**

Source: EU KLEMS database, March 2008.



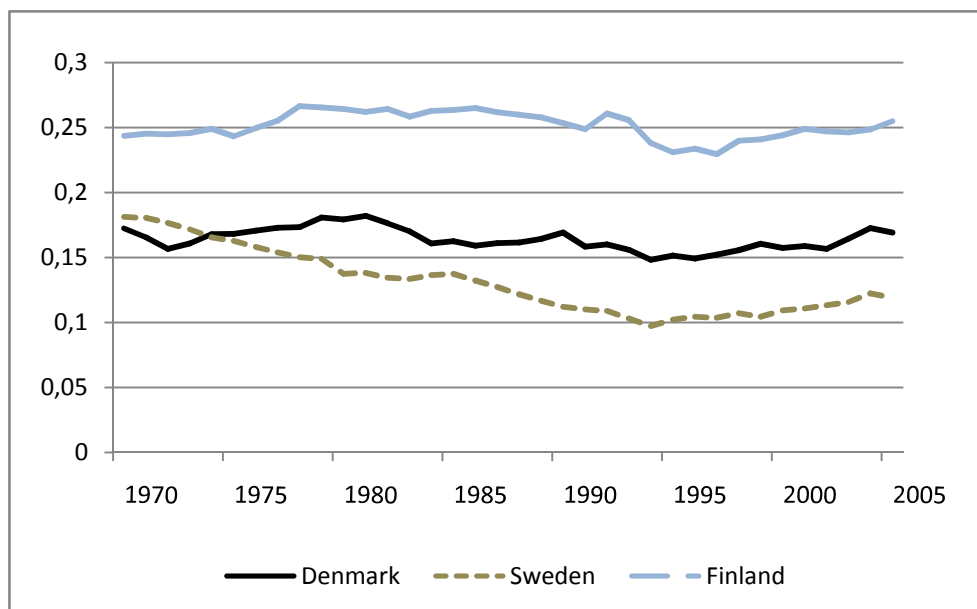
**Figure 22: Employment in IT-related Services in Southern Europe**

Source: EU KLEMS database, March 2008.

### Convergence and Divergence within Northern Europe

In our third country group, Scandinavia, we find only slight convergence, caused by the fact that Denmark and Sweden were already similar in economic structures at the beginning of the investigation period – thus the potential for further convergence was rather low. On the other

hand, the fit of Finland with the club is poor over the whole investigation period, as has been mentioned above (see Figure 4 and Figure 23). Whereas Denmark did not converge further to the club-average over the period of time however, the economic structure of Sweden becomes more similar to the average, implying that the (slight) within-club convergence of Northern European countries is only due to the development of the Swedish economy.



**Figure 23: Heterogeneity of Northern European Countries**

Source: EU KLEMS database, March 2008.

Investigating the patterns of structural convergence on the industry level, we see that the countries converged in all industries of the manufacturing sector apart from Communications Equipment and Precision Instruments (see Table 6). In contrast, there are both convergence and divergence trends occurring in the service sector.

**Table 6: Industry-specific Heterogeneity in Northern Europe ( $\hat{K}_i$ )**

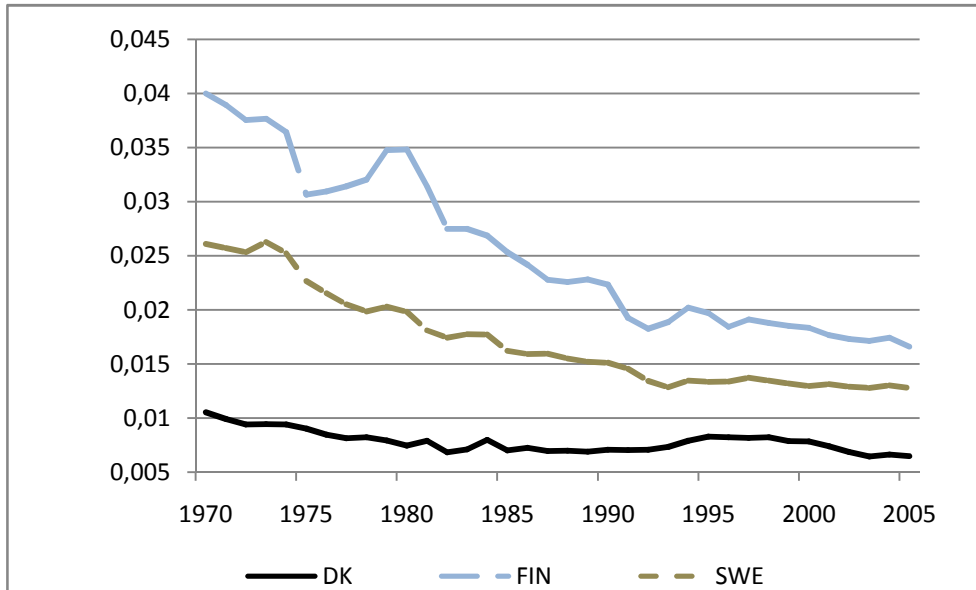
|                       | 1970 | 2005 | $\Delta\hat{K}_i$ | Development relative to 1970 |
|-----------------------|------|------|-------------------|------------------------------|
| FBT                   | .048 | .024 | -.024             | -.509                        |
| Textiles              | .036 | .004 | -.031             | -.875                        |
| Leather               | .005 | .001 | -.005             | -.892                        |
| Wood                  | .025 | .012 | -.013             | -.514                        |
| Pulp & Paper          | .022 | .011 | -.011             | -.486                        |
| Printing & Publishing | .027 | .015 | -.012             | -.453                        |
| Coke                  | .001 | .001 | .000              | -.161                        |
| Chemicals             | .014 | .012 | -.002             | -.127                        |
| Rubber & Plastics     | .012 | .009 | -.003             | -.280                        |



|                                 |      |      |       |       |
|---------------------------------|------|------|-------|-------|
| Mineral Products                | .018 | .007 | -.011 | -.598 |
| Basic Metals                    | .019 | .009 | -.011 | -.551 |
| Fabricated Metal                | .027 | .025 | -.002 | -.081 |
| Machinery                       | .044 | .033 | -.011 | -.257 |
| Accounting & Computing Machines | .002 | .001 | -.001 | -.528 |
| Electrical Engineering          | .012 | .008 | -.003 | -.283 |
| Communication Equipment         | .009 | .010 | .001  | .121  |
| Precision Instruments           | .007 | .007 | .000  | .014  |
| Motor Vehicles                  | .016 | .014 | -.002 | -.142 |
| Transport Equipment             | .013 | .006 | -.007 | -.525 |
| Recycling                       | .017 | .012 | -.006 | -.318 |
| Motor Vehicles & Fuel           | .036 | .027 | -.009 | -.238 |
| Wholesale Trade                 | .072 | .071 | -.002 | -.022 |
| Retail Trade                    | .107 | .080 | -.027 | -.251 |
| Hotels & Restaurants            | .040 | .039 | -.001 | -.025 |
| Transport                       | .077 | .072 | -.005 | -.069 |
| Post & Telecommunication        | .022 | .021 | -.001 | -.053 |
| Financial Intermediation        | .024 | .027 | .004  | .148  |
| Real Estate                     | .012 | .021 | .009  | .705  |
| Renting of Machinery            | .001 | .004 | .002  | 1.680 |
| IT-related Activities           | .004 | .026 | .021  | 4.985 |
| R&D                             | .003 | .010 | .006  | 1.859 |
| Business Activities             | .032 | .090 | .058  | 1.788 |
| Education                       | .077 | .105 | .029  | .376  |
| Health & Social Work            | .103 | .169 | .066  | .637  |
| Domestic Services               | .014 | .018 | .004  | .266  |

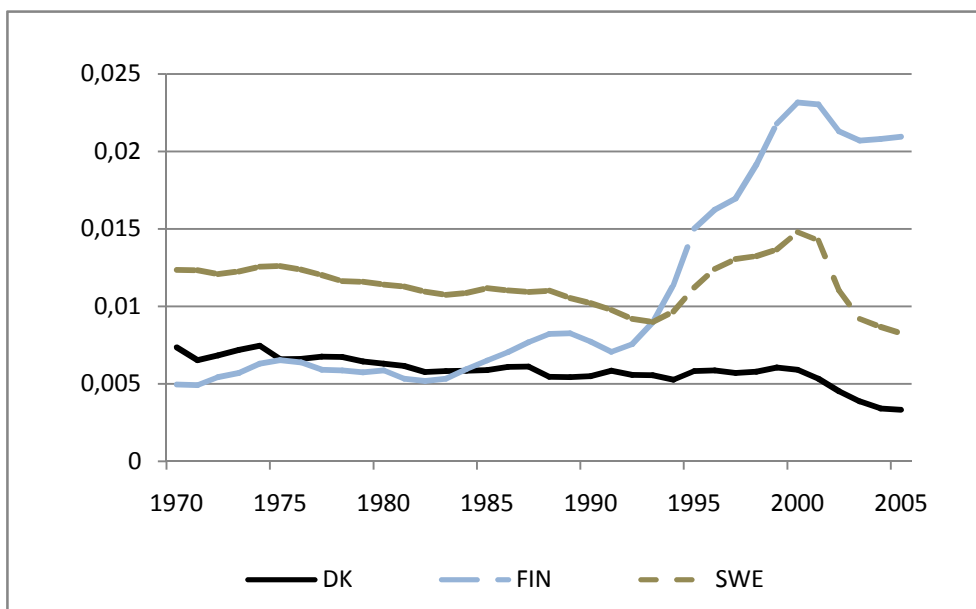
Source: EU KLEMS database, March 2008.

Turning to the most significant developments, the convergence in low-tech industries is noteworthy. All three countries soon began to de-specialize in Textiles and Leather, i.e. in industries the Northern European countries have no competitive advantage in. Even more remarkable is the sharp drop in employment shares in Wood as well as in Pulp & Paper; industries in which Finland and Sweden were characterized by comparative advantages due to an abundance of natural resources (see Figure 24). Comparing the three countries, a catch-up process of Finland is visible: It shows the steepest decline of the low-tech forestry based industries, where the country was leading in the 1970s, while at the same time it specializes in (both traditional and emerging) high-tech industries like Machinery and Communication Equipment (see Figure 25). In 2005 employment in these industries is far above the European average.



**Figure 24: Employment in Wood in Northern European Countries**  
 Source: EU KLEMS database, March 2008.

Note that despite the dynamic growth from the 1990s onwards, the countries' employment shares in emerging high-technology industries are still relatively small, so that these specialization (and on the club level divergence) patterns do not strongly affect overall heterogeneity.

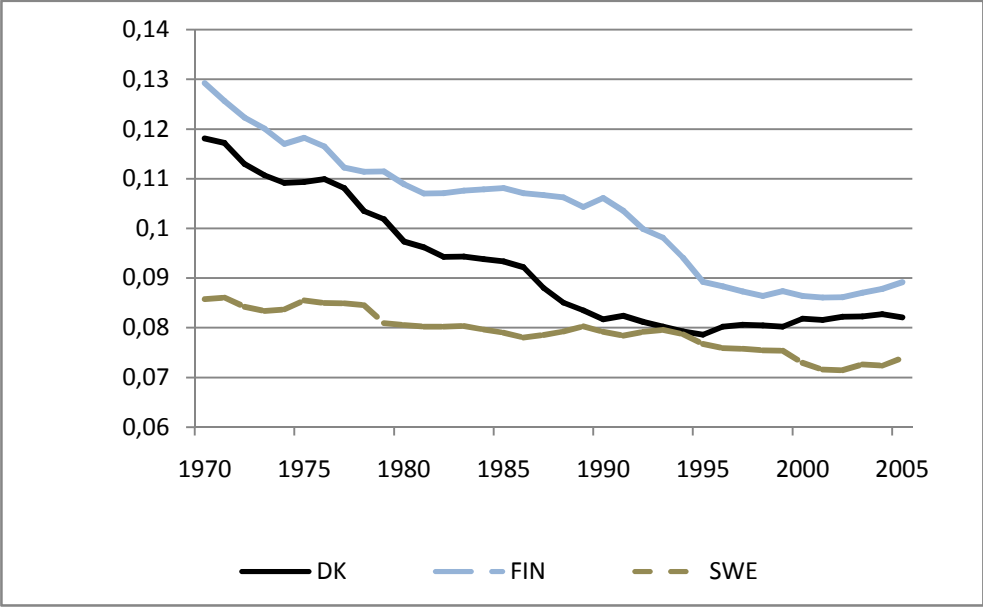


**Figure 25: Employment in Communications Equipment in Northern European Countries**

Source: EU KLEMS database, March 2008.

In the service sector, again the employment structure of Finland and its differences to the club average is the main cause for any divergence trends, whereas developments in the Danish

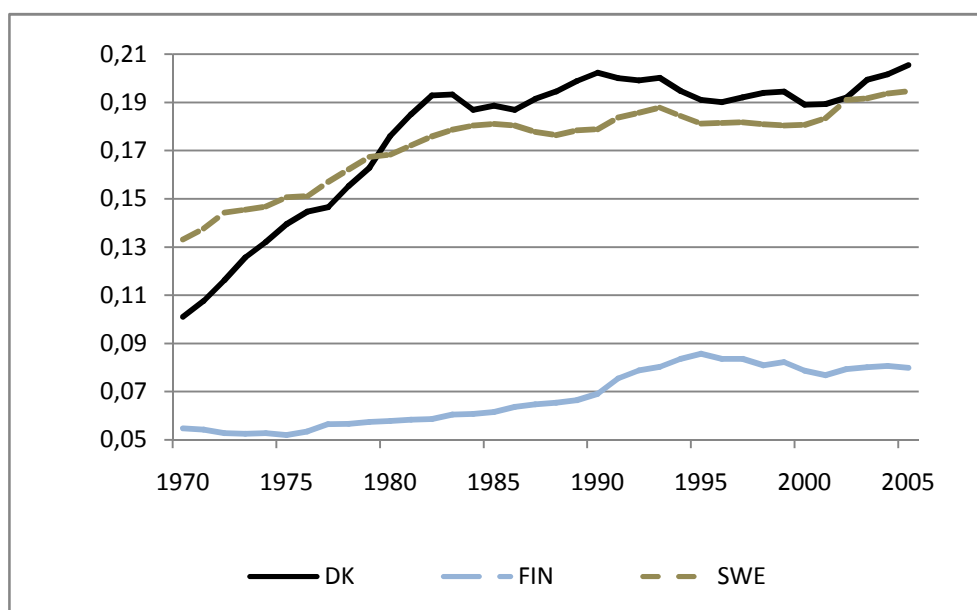
economy are drivers of convergence: At the beginning of the observation period the Finnish service sector was similar to the structure of the lagging South European countries, being dominated by in industries with low knowledge intensity like retail trade and transport. In contrast, Denmark and even more so Sweden were characterized by a strong social sector with large employment shares in Health/Social Work and Education. Over time, employment shares in low-skill industries like Retail Trade (Figure 26) have been shrinking both in Denmark and in Finland, causing convergence.



**Figure 26: Employment in Retail in Northern European Countries**

Source: EU KLEMS database, March 2008.

On the other hand, the differences in Health & Social Work between Finland and the other two Scandinavian countries, which were already large in the 1970s, have been growing over time (see Figure 27). Although employment in this industry has increased also in Finland, both Denmark and Sweden exhibit much higher growth rates. Interestingly, we find a growing share of employment in private households in Finland which cannot be observed for Denmark and Sweden. This could be interpreted as a hint that social services are partly being taken over by privately employed caretakers in Finland instead of social institutions, as might be common in Sweden and Denmark. However, to verify this hypothesis a more disaggregated data set would be required.



**Figure 27: Employment in Health & Social Work in Northern European Countries**

Source: EU KLEMS database, March 2008.

From this perspective, the poor fit of Finland to any of our convergence clubs gets clear: On the one hand, specialization patterns in the manufacturing sector with strong forestry based industries in the 1970s and specialization in medium-high and high tech industries from the 1990s on are similar to the North European club. On the other hand, the service sector with its specialization on Retail Trade and Transport instead of Education and Health and Social Work seems to be less developed and shifts the country close to the South European countries in our analysis.

## 1.2. Conclusion

In this contribution, we focus on structural change and convergence of European countries, analyzing specialization patterns in the period 1970-2005. We compare employment shares of 20 manufacturing and 15 service industries of 14 Western European countries over time, applying variations of the Krugman Specialization index.

To summarize our findings, all Western European Countries are characterized by significant changes in their economic structures due to the decline of traditional low-tech and low-skill industries opposed to the rise of more skill and technology intensive industries. Nevertheless, and despite some dynamic catch-up trends in particular of Ireland and Finland, the economic structures persist to be quite heterogeneous across Europe.

While employment structures among the Central European countries have converged over time, the differences between the three clubs, i.e. between North, Central, and South Europe, persist. In particular Portugal and Greece, although both countries exhibit structural shifts away from low-tech and low-skill industries like textiles and transport, seem to be delayed in their development and have not been able to catch-up even to the other South European countries.

We find that specialization patterns in Europe are sticky: The abundance of natural resources leads to a long-lasting specialization pattern of Northern European countries in the pulp & paper and wood industries, the abundance of knowledge in the steel and chemical industries to a specialization of Germany in the respective industries. Also the large employment shares of South European countries in the declining textile and leather industries as well as the lagged structural shift away from these industries are a sign for the path-dependency and stickiness of specialization patterns.

The degree of structural change is slower than postulated by economic theory and thus also the degree to which specialization patterns of countries have changed has remained low. We attribute this to the low degree of labour mobility on the one hand and the

With regards to the free movement of goods and capital, full market integration has been realized, whereas the free movement of services and workers has not yet been realized even though a free internal labour market has been achieved by the harmonization of social security, residence permits, diploma recognition, work conditions, health and safety conditions (Commission of European Communities 1997). Thus the level of both permanent and temporary migration has remained at three percent of the European labour force since the 1970s and remained behind expectations (Molle 2001). This low level of mobility<sup>4</sup> implies that workers have not yet taken full advantage of the benefits of free movement – i.e. better opportunities to capitalize special qualifications via higher wages –nor have employers been

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<sup>4</sup> In the early 1970s, only three percent of the labour force within Europe migrated to one of the neighbor Western European countries. On the one hand, this is due to of non-coordinated labour policy (recognition of diplomas), but on the other hand is caused by the economic downturn in the aftermath of the oil crisis. As a consequence governments applied more restrictive measures to prevent increasing pressure of migrants from non-European countries on home labour markets and even fostered programs aimed at return migration to home countries (Böhning 1979 or Hammar 1985). Back then, it was above all Irish citizens migrating to the UK and Italians moving to Germany and other more favorable countries. Intra-EU migration as a share of the total work force even fell between three and two percent from the 1980s onwards. This could be due to the fact that the push- and pull-factors lost importance for this country group, i.e. differences in wages, job opportunities, education systems, capital accumulation. The share of extra-EU 15 migrants remained constant over time and even rose slightly in the aftermath of the single market program can be traced to the increasing activities of multinational firms in foreign countries (Molle 2001).

able to optimize the factor input mix since nationally segmented labour markets still support a mis-match between the skills required by expanding industries and the skills obtained by employees in declining industries.

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