

# **GROWING ALIKE OR GROWING APART? INDUSTRIAL SPECIALISATION OF EU COUNTRIES**

by  
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## **Abstract:**

This paper documents specialisation trends in 32 manufacturing industries across 13 European countries over the 1972-1996 period. We find that sectoral employment specialisation measured by locational Gini indices has been generally increasing, and that the dissimilarity of industrial structures among the sample countries has grown. Specialisation is most pronounced in “traditional” resource- and labour-intensive sectors, but there are signs of increasing clustering in technology-intensive industries since the mid-1980s. Specialisation of exports, whilst decreasing on average, is stronger than specialisation of employment. A continuation of the observed specialisation trend might reduce the scope for cyclical convergence of EMU countries and increase the pressure for greater market flexibility in the face of asymmetric fluctuations.

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## 1. INTRODUCTION

The architects of EMU envisaged a strong link between the introduction of a single currency and the convergence of the EU's economies. According to the Maastricht Treaty, monetary union is "to promote throughout the Community a harmonious and balanced development of economic activities (...), a high degree of convergence of economic performance, (...) and economic and social cohesion and solidarity among Member States". Convergence is seen as both a precondition for, and a consequence of, monetary integration.

On the face of it, economic theory supports such insistence on the relationship between EMU and economic convergence. Mundell's (1961) model of an optimal currency area (OCA) suggests that exchange rates should only be fixed among countries that experience similar macroeconomic shocks. The degree of synchronisation of real economic fluctuations, and the effectiveness of non-monetary adjustment mechanisms among participating countries, should be the main criteria by which to judge the desirability of monetary union. Kenen (1969) pointed out that business cycles will be more in step between economies with diversified and similar sectoral structures.

However, the implementation rules of EMU paid scant regard to the real convergence that takes centre stage in OCA theory. They were concerned instead with predominantly nominal and fiscal measures of convergence (Wyplosz, 1997). There are sound theoretical arguments for nominal convergence as a precondition for EMU (e.g. Winkler, 1995), but the neglect of real convergence criteria has attracted criticism (e.g. Buiter, Corsetti and Roubini, 1993). It should be noted, though, that real convergence has not been ignored completely by policy makers. The Maastricht criterion of two years' trouble-free participation in the ERM, for instance, implies an absence of excessive adverse country-specific shocks. Similarly, the "wait-and-see" stance of successive British governments is explicitly predicated on insufficient business cycle synchronisation.

The discussion of real convergence as a desirable condition for EMU might now seem purely "academic", since the single currency has become an irrevocable reality.

However, if we reverse the causal direction of the link between convergence and EMU, the issue remains highly relevant. Whilst the question “how much real convergence should exist for a beneficial monetary union?” has been overtaken by events, the question “how will monetary union affect convergence?” remains crucially important. If EMU were to foster divergence of industrial structures and greater asymmetry of shocks across “euroland” regions, then the need for alternative macroeconomic stabilisers will become acute. On the other hand, if EMU were to turn out as force for structural and cyclical convergence, then the anticipated pressures on fiscal policy and labour-market policy might not materialise.

The theoretical predictions are far from clear-cut. Recent “new economic geography” models resemble neoclassical location theory in that all these approaches emphasise forces of industrial specialisation that relate negatively to spatial transaction costs. If the thrust of these models captures the main determinants of industrial specialisation in Europe, then monetary union will stimulate regional clustering of industries. On the other hand, economic geography models are typically characterised by multiple equilibria and path dependency, and an inherited dispersed industrial structure might reveal itself to be a locally stable equilibrium. In addition, if we take into account that endowment differences across EU countries are relatively small, neoclassical models would seem to favour the industrial dispersion story. Clearly, the theory can accommodate predictions either way, and empirical work is called for to shed light on the question.

In this paper, we focus on the patterns of sectoral specialisation in European manufacturing. Insofar as shocks are sector specific, sectoral specialisation is associated with asymmetry of real shocks. We do not analyse this link explicitly, but the importance of sectoral specialisation for regional macroeconomic convergence is undisputed.<sup>1</sup> Our aim is to document the broad specialisation trends in Western Europe since the 1970s and to distil some conjectures on likely future developments.

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<sup>1</sup> According to Krugman (1997, p. 13), “sophisticated EMU supporters point out with considerable justice that European countries are highly diversified economies with quite similar product mixes, and argue that, as a result, large ‘asymmetric’ shocks requiring major changes in relative wages will be few and far between”. For empirical studies of the relationship between sectoral specialisation and the symmetry of macroeconomic fluctuations, see Bayoumi and Prasad (1997), Clark and van Wincoop (1999) and Imbs (1999). The policy implications of an increase in geographical specialisation in EMU are discussed in Buti and Sapir (1998).

Sectoral specialisation patterns are described in a consistent fashion across 14 European countries for the 1972-1996 period, based on employment and export data for 32 manufacturing sectors.

The paper is organised as follows. Section 2 reviews the theoretical literature on the relationship between industrial specialisation and monetary integration, and it summarises the results of prior empirical work on specialisation patterns in the EU. In Sections 3 and 4, we document specialisation patterns using employment and export data respectively. Section 5 seeks evidence on the determinants of observed specialisation trends, through sector-level grouped analysis. Section 6 concludes.

## **2. THEORETICAL AND EMPIRICAL BACKGROUND**

### *Theory: Is EMU a Force for Specialisation or Dispersion?*

The literature on OCAs establishes an intuitively compelling link between sectoral specialisation and monetary regimes. In essence, it posits that, in the presence of industry-specific shocks, a higher degree of specialisation entails greater asymmetry of macroeconomic fluctuations and therefore a stronger case for monetary decentralisation. In so far as the current eleven euro members are concerned, this type of reasoning might now be considered redundant. The single currency is a fact, and its architects have paid little attention to the criteria implied in OCA theory. Yet, there are good reasons to think that the sectoral specialisation of countries still matters in the EMU context. Now that exchange-rate adjustments can no longer serve to absorb asymmetric shocks within the EU, other adjustment mechanisms will come into sharper focus. The main concern is that unemployment will end up acting as the principal buffer, since labour markets are too inflexible and fiscal transfers too small. Hence, increasing asymmetries could drive up structural unemployment, reinforce pressures to deregulate labour markets and to decentralise labour-market bargaining, and/or fuel demands for greater EU-wide transfer payments. It seems clear that the study of sectoral specialisation patterns has lost none of its policy relevance even now that the euro has been launched.

The key question thus becomes how the adoption of a single currency, combined with the EU's other integration moves, will impact on the sectoral specialisation of member countries. There is a rich body of theoretical work that has examined this type of question. In fact, most theorising in international trade is precisely about this issue, i.e. about the patterns and welfare effects of countries' sectoral specialisation triggered by a reduction in trade barriers. And most models in trade theory predict the same outcome: specialisation. Loosely speaking, neoclassical models associate a reduction in trade costs with increased specialisation of countries in their sectors of comparative advantage, while the "new" theories of trade and geography predict concentration of industries driven by locational scale economies. Hence, specialisation is the prediction of all the theories in contest.<sup>2</sup> Monetary integration can be considered like any other policy change that facilitates cross-border integration of product markets. In addition, however, a single currency is likely to stimulate more integrated and deeper capital markets, which in turn can provide better insurance against heightened production risk in a more specialised economy. If international capital markets are sufficiently developed, countries can hedge against country-specific risks and thus afford to specialise more (Helpman and Razin, 1978; Kalemli-Ozcan, Sorensen and Yosha, 1999). Monetary integration, through the stimulus it provides to capital market integration, would thus seem a particularly effective catalyst of sectoral specialisation.

Based on such theoretical foundations, many economists, including Eichengreen (1992) and Krugman (1993), have predicted that EMU will trigger further sectoral specialisation of participating EU countries. That outcome would have considerable welfare and policy relevance. Locational concentration of industries is the source of virtually all the welfare gains associated with trade liberalisation, but in the context of monetary integration, specialisation is also associated with the complicating effects outlined above. Therefore, the predicted increase in specialisation has been interpreted as increasing the costs of monetary union. In this view, the adoption of a single currency undermines its own desirability in an endogenous process that turns on sectoral specialisation.

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<sup>2</sup> This observational equivalence of competing theories makes it difficult to distinguish them in empirical work. For a useful discussion, see Davis and Weinstein (1998).

Yet, the opposite scenario, whereby monetary integration decreases specialisation, and the formation of an OCA is endogenous, also has its proponents. Perhaps the most prominent formulation of this view is in the European Commission's official *ex ante* assessment of EMU, the "One Market One Money" report, published in 1990. That study does not explicitly consider issues of sectoral specialisation, but it concludes that EMU will reduce the incidence of country-specific shocks. Against a neoclassical background, one can argue that, given the similarity in productive endowments of most EU countries, differences in factor-costs are unlikely to induce very pronounced specialisation. In a "new economic geography" setting, Ricci (1997) has provided a formal underpinning of the view that monetary integration might favour industrial dispersion. He showed in a general-equilibrium model with two identical countries, price rigidities, endogenous exchange-rate determination and exogenous demand or supply shocks, that flexible exchange rates will minimise the variability of sales, and hence maximise profits, of firms located in the country that is more specialised in their sector of activity. Hence, flexible exchange rates promote specialisation and fixed exchange rates favour dispersion of sectors. OCAs form endogenously in a move from flexible to fixed exchange rates. This model hinges on a number of assumptions, probably the most important of which is that sectors are defined sufficiently broadly so that sector-specific exogenous shocks have noticeable effects on exchange rates if countries are unequally specialised.

More generally, one might invoke the "new economic geography" family of models in arguing against a deterministic link between integration and specialisation (Fujita, Krugman and Venables, 1999). These models abstract from comparative advantage and are typically characterised by multiple equilibria and path dependency. In such a setting, it may well be that the inherited pre-integration pattern of sectoral specialisation in the EU is a locally stable equilibrium, unlikely to be dislodged by falling trade costs. When combined with comparative advantage, variants of "new economic geography" models can predict a unique but non-monotonic association between integration and specialisation, whereby industries concentrate in core

countries at early integration stages but re-disperse once integration progresses beyond a certain threshold (Fujita *et al.*, 1999, ch. 16).<sup>3</sup>

In sum, it is difficult to distil a dominant set of theoretical priors about the effect of integration on sectoral specialisation, and empirical work is clearly called for.

### *Empirics 1: Does Manufacturing Specialisation Matter?*

Frankel and Rose (1998) have found empirical evidence that is consistent with the Ricci (1997) scenario. They show a robust positive link between the intensity of trade between two countries and the correlation of their business cycles. Their analysis, however, is univariate, and it does not explicitly consider sectoral specialisation. Imbs (1999) has argued that this suffers from omitted-variables bias and estimated multivariate models of business-cycle correlations. He found that the statistically and economically most significant determinant of GDP co-fluctuations is a measure of sectoral similarity, both in a worldwide country sample and among OECD countries only. In the OECD sample, for example, sectoral specialisation accounts for 9.2% of the variation of co-fluctuations, while none of the other variables considered, including trade intensity, explains more than 2% of variations in the dependent variable.<sup>4</sup> These results are particularly encouraging in the context of this paper, because the Imbs (1999) measure of sectoral specialisation is based on data for 18 sectors in manufacturing, to the exclusion of primary and tertiary activities. Similarly, Clark and van Wincoop (1999) find that sectoral specialisation has a significantly negative effect on international growth correlations; and in Europe this effect is more pronounced when specialisation is computed only for manufacturing than when it is defined across all economic sectors. Manufacturing specialisation patterns thus seem to have a significant impact on the correlation of business cycles, which validates the main motivation of our empirical explorations below.

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<sup>3</sup> Forslid, Haaland and Midelfart Knarvik (1999) provide empirical evidence of such u-shaped evolutions in some industries across four groups of European countries on the basis of a CGE model calibrated on 1992 data.

<sup>4</sup> The full set of explanatory variables contains measures of the similarity of sectoral specialisation, trade openness, the combined income level of the two countries, the difference in income levels between the two countries, geographical distance and a dummy for a common border.

*Empirics 2: Industrial Specialisation in the EU*

Most empirical papers dealing with location at an international level are based on *trade data*. Many of these analyses are concerned with the pattern of trade flows *per se*, but the majority draw on trade data as an indicator of specialisation patterns in production. Trade data are popular because they are widely available, relatively reliable and highly disaggregated. A large number of researchers have analysed patterns of intra-industry trade (IIT), the simultaneous importing and exporting of goods which belong to the same industrial sector. If we assume export propensities that are similar across countries and stable over time, then high and growing shares of IIT are an indicator of sectoral dispersion. Indeed, IIT shares have shown a secular rise throughout the post-war years in most countries. This is true for the EU (Fontagné, Freudenberg and Péridy, 1997; Brülhart and Elliott, 1998) as well as for most industrialised countries world-wide (OECD, 1994). Using a different set of measures on trade data up to 1992, Sapir (1996) also diagnosed an “apparent lack of transformation in the structure of EC manufacturing”.

Trade statistics may be considered a second-best indicator of locational patterns. An uninitiated commentator would likely opt for employment, output or value-added data as the correct gauge of specialisation. Therefore, empirical researchers have recently made efforts to measure specialisation patterns on the basis of *production data*. Krugman (1991) conducted a rough comparison of industrial specialisation indices between the United States (split into four regions) and the four largest EU economies. This exercise suggested that the European Union has a more dispersed, less specialised industrial geography than the United States. Confirmation of comparatively low specialisation in the EU is found in Bini Smaghi and Vori (1993) and in Kalemli-Ozcan *et al.* (1999), who compared specialisation levels based on data for the 1980s. However, Krugman’s (1991) results also indicated that the U.S. economy had become less regionally specialised over the post-war period. Indeed, Kim (1995) found that U.S. industry concentration and regional specialisation had reached its high-water mark in the 1920s. This may explain why some recent studies no longer found a significant difference in specialisation across major EU countries and U.S. census regions at the two-digit level (Peri, 1998; Clark and van Wincoop, 1999).

Looking at data for EU countries and regions alone, Brülhart and Torstensson (1996) and Brülhart (1998) have reported locational Gini indices for 1980 and 1990. An increase in the Gini index calculated from employment data, indicating a rise in industry concentration, was found for 14 of the 18 industries. These 14 industries accounted for 77.3 percent of manufacturing employment in 1990. Similar results were obtained by Amiti (1997). Using several specialisation measures and production data sets, she found evidence of a general increase in manufacturing specialisation among EU countries over the 1968-90 period. The upward trend in specialisation manifested itself with particular consistency in the second half of this time interval, i.e. during the 1980s.

There is an apparent contradiction between the specialisation results based on trade data, which show rising IIT, and those based on production data, which suggest increasing specialisation. Furthermore, some studies using production data (Helg, Manasse, Monocelli and Ravelli, 1995; and De Nardis, Goglio and Malgarini, 1996) suggest that the number of dispersing sectors roughly equalled that of concentrating sectors in the EU during the 1980s. However, we still do not avail of a consistent and comprehensive description of specialisation trends in the EU. On the basis of the existing studies one cannot, therefore, conclusively accept as a stylised empirical fact that EU industry has become more localised in recent years.

### **3. EMPLOYMENT SPECIALISATION IN EUROPE**

#### *Data*

Employment is probably the most directly policy relevant and intuitive measure of the size of an industrial sector. The first part of this analysis therefore draws on payroll data. Traditionally, however, the study of international specialisation patterns has drawn mainly on trade data. Hence, this paper also reports results calculated from export data in order to facilitate comparability with other studies. In particular, the juxtaposition of employment and trade specialisation measures should shed some light on the apparent contradiction between increasing specialisation trends previously

observed in production data and decreasing specialisation trends suggested by the analysis of trade statistics.

The analysis draws on the OECD's STAN database, which provides a balanced panel of annual employment figures for 32 ISIC manufacturing sectors (two- to four-digit) covering the period 1972-1996 and 13 countries.<sup>5</sup> We thereby have a data set that encompasses the most important periods of EU market integration, starting with the 1973 enlargement and culminating in the completion of the Single Market in 1992. The EU-15 countries not included in that database are Belgium, Ireland and Luxembourg. On the other hand, our analysis considers data for Norway, which, albeit not a full member of the EU, has enjoyed effectively free access to the EU market in most manufacturing goods since 1973 (WTO, 1995). Whilst, for a comprehensive analysis of industrial concentration patterns, it would be desirable to use regional data, country-level statistics are more appropriate in the context of this paper, since they coincide geographically with the pre-EMU European currency areas.

#### *The Locational Gini Index*

We have calculated locational Gini indices for each country-year observation. This index reports the share of an area between the Lorenz curve and the 45-degree line in the total area below the 45-degree line. It ranges from zero to one and relates positively to specialisation.

#### **\* FIGURE 1 HERE \***

The construction of the locational Gini index is illustrated in Figure 1 with an example based on Finnish manufacturing exports in 1996.<sup>6</sup> The cumulative shares of exports are measured on the vertical axis, while the cumulative shares of all

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<sup>5</sup> The 1999 edition of the STAN database provides a full set of export data for the period of our investigation. On the employment side, however, some gaps remain. Two changes have been made in order to obtain a balanced panel. First, some sectors with patchy coverage at the disaggregated level were amalgamated. Second, the gaps that remained were filled using extrapolation of trends based on contemporaneous output, value added and/or export data. This was used for a significant part of 1995, and most of 1996, data, as well as for Spain, 1972-77. Note that the filling-in of 1995 and 1996 values likely biases observed specialisation in favour of a continuation of previous trends, so that these results should be interpreted with greater caution than those for earlier years.

<sup>6</sup> Note that the example is based on exports, but the results reported in this section are calculated from employment data.

countries' exports are reported along the horizontal axis. The horizontal ordering of industries is crucial. In terms of Figure 1, industries are lined up so that the slope of the Lorenz curve, which links all industry observations, increases continuously as one moves away from the origin. This ordering can be neatly described with reference to the Hoover-Balassa index of "revealed comparative advantage":

$$BALASSA_{ict} = \left( \frac{\frac{E_{ic}}{\sum_c E_{ic}}}{\frac{\sum_i \sum_c E_{ic}}{\sum_i \sum_c E_{ic}}} \right)_t, \quad (1)$$

where  $E$  stands for exports (or employment, output etc.); and the subscripts  $i$ ,  $c$ ,  $t$  denote industries, countries and years respectively. This measure takes values between zero and infinity and relates positively to a country's specialisation in the particular industry. In a locational Lorenz diagram of specialisation by country, industries are lined up in increasing order of their Balassa index. Hence, Figure 1 shows that, in terms of 1996 exports, Finland was most specialised in paper products, and least in transport equipment. The Gini index, by measuring the area between the 45-degree line and the Lorenz curve, therefore also amounts to a measure of dispersion of Balassa indices. If Finland had exported each product in equal proportion to the average over our country sample, then its Balassa indices would all equal one, the Lorenz curve would coincide with the 45-degree line, and Finnish export specialisation as measured through the locational Gini coefficient would be zero. On the other hand, the greater the deviation of Finnish export shares from the sample means, the greater will be the dispersion of Balassa indices, the stronger will be the curvature of the Lorenz curve, and the higher will be specialisation as measured by the Gini coefficient. A discussion of the properties of the Gini index in the context of international specialisation can be found in Amiti (1997), and Cowell (1999) gives a thorough appraisal of the coefficient's usefulness as a measure of inequality.<sup>7</sup>

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<sup>7</sup> Other studies that have reported locational Gini indices include Krugman (1991), Helg *et al.* (1995) and Brühlhart (1998).

*Locational Gini Indices for EU Countries*

The first step of our analysis was to compute locational Gini indices for the full country sample. Figure 2 graphs the results, reporting three-year averages for the start, mid and end point of the 1972-1996 interval. The first striking feature is that there are marked differences in specialisation levels across the 14 countries, and that these differences vary systematically with country size. The large economies UK, France and Germany are least specialised, whilst the three small countries Greece, Portugal and Norway display the highest average Gini indices. This is not surprising, since large countries are likely to have more heterogeneous economic and natural endowments, and scale economies may be exhausted for a larger number of industries. Second, it becomes immediately apparent from Figure 2 that the long-term specialisation trend in employment terms is upwards. The unweighted average Gini increased from 0.26 in 1972-4 to 0.28 in 1994-6. A clear increasing trend in specialisation is discernible in Figure 2 for seven countries, whilst a continuous downward trend only appears in two cases (Finland, UK).

**\* FIGURE 2 HERE \***

**\* TABLE 1 HERE \***

The same results are reported more formally in Table 1, which lists time-averaged Gini coefficients as well as OLS regressions of annual Ginis (in logs) on a time trend. A statistically significant increasing trend in the Gini index is found for eight countries, whilst a significantly decreasing trend appears for only three (Denmark, Finland, UK). On average, the Gini coefficient increased by 0.3% per year. The strongest increases in specialisation appear for Italy (1.4% annually), Germany (1.2%), Greece (0.9%) and Sweden (0.7%). The fact that this is a rather mixed group of countries sounds a warning signal against sweeping generalisations about the underlying forces that drive the apparent specialisation process. It should also be noted that the observed trends do not appear to be the outcome of some mechanistic mean-reversion process, whereby relatively highly specialised countries would tend to witness decreases in their specialisation measures, and vice versa. The point can be made simply with two illustrative examples: the UK, which had the second lowest base-year Gini, witnessed a significant decrease in specialisation; and Greece, with

the second highest base-year Gini, displayed the most pronounced increase of all sample countries.

### *Structural Dissimilarity Measures*

The finding that manufacturing employment specialisation of EU countries has generally increased is important in its own right. If this trend were to continue, the EU's industrial geography might become more clustered and prone to region- and country-specific shocks. The picture revealed by Gini indices is, however, incomplete, since it says nothing about the similarity of countries. One cannot, for example, infer from the low Ginis of France and Germany and from the high Ginis of Greece and Portugal, that sector-specific shocks will be shared more symmetrically in the former country pair than in the latter. What matters is not only the degree of specialisation, but also the ordering of industries along the specialisation spectrum (i.e. along the horizontal axis of a Lorenz diagram). The similarity of industrial specialisation structures across country pairs can be captured with the following simple index, due to Krugman (1991)<sup>8</sup>:

$$S_{HF} = \sum_i |s_H^i - s_F^i|, \quad (2)$$

where  $H$  and  $F$  denote the two countries,  $i$  refers to sectors, and  $s$  is the share of a particular sector in total manufacturing employment of that country. This measure varies between zero and two; with a value of zero obtaining if the two economies have identical sector compositions, and two indicating perfect dissimilarity of sectoral structures.

**\* TABLE 2 HERE \***

**\* TABLE 3 HERE \***

We have computed similarity indices for all country pairs and sample years in the dataset. A snapshot is presented in Tables 2 and 3, which report base- and end-period results respectively. Again, we find significant dispersion in the indices across observations. In the base period, the index ranges from 0.23 (France-UK) to 0.80 (Portugal-Sweden), the average is at 0.53 and the standard deviation is 0.13. More

strikingly still, the results confirm that EU countries have become more dissimilar over time in terms of the composition of their manufacturing employment. In the end period, the index ranges from 0.22 (France-UK) to 1.02 (Greece-Sweden), and the mean and standard deviation have risen to 0.56 and 0.16 respectively. The rise in the average is evident from Table 3, where all observations which represent increases over the base-period values are in bold print. In 53 out of the 78 country pairs industrial employment structures became more dissimilar between the early 1970s and the mid-1990s. It thus appears that increased specialisation, as apparent from the rise in average Gini coefficients, was such that it also resulted in growing sectoral dissimilarity of EU countries.

In the context of EMU, it is similarity (or “convergence”) with one particular economy, Germany, that has long dominated discussions. We have therefore computed dissimilarity indices with Germany for each sample country. One might object that the European Central Bank now considers a weighted average of the eleven euro countries in its computation of monetary indicators, and that it would for that reason be more appropriate to compute dissimilarity indices with a weighted average of our sample countries. Whilst this is a valid concern, we nevertheless opt for using exclusively German data as the “anchor”, because this allows a more clear-cut interpretation of results. If dissimilarity measures were computed *vis-à-vis* a basket of countries, it would be difficult to distinguish cross-country differences that are due to individual country features from those that are merely driven by the differing weights of countries in the basket. In addition, in its calculation of euro-zone price indices, the ECB accords by far the largest country weight to Germany (35%).<sup>9</sup>

**\* TABLE 4 HERE \***

We report time-averaged dissimilarity indices with Germany, and time trends of those measures, in Table 4. In terms of its industrial composition, the UK, maybe surprisingly, resembles Germany most closely, followed by France, Austria and

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<sup>8</sup> This index has also been applied by Clark and van Wincoop (1999) in an interesting comparison of US and EU data, albeit at a less sectorally disaggregated level than that used here.

<sup>9</sup> The combined weight of Germany and France in the ECB’s calculations is 56%. Since these countries are very similar in industrial structure (Figure 4), our “anchor” could be deemed in fact to represent over half of the economic weight of the Euro-11.

Sweden. Greatest structural dissimilarity with Germany is displayed by Greece, Portugal and Norway. In terms of trends, all countries bar Finland, Norway, Sweden and the Netherlands saw their industrial structures diverge from that of Germany.

In sum, a pretty stark picture emerges from the employment data. The structural composition of manufacturing sectors has become more diverse across EU countries over the last three decades. Most countries have become more specialised, and more dissimilar from Germany. Given that these trends are observed over a period with strong and almost continuous reductions in cross-border transaction costs among EU countries, one might reasonably expect EMU to stimulate a continuation of this pattern. However, for an argument along these lines, one needs some understanding of the underlying forces that shape the observed trends. We will discuss this issue in Section 5. First, however, we replicate the description of specialisation patterns, using data for exports instead of employment.

#### **4. EXPORT SPECIALISATION IN EUROPE**

As outlined in Section 2, there are good practical reasons why most previous studies of international specialisation have been conducted on the basis of trade data. In the context of monetary integration, one can also invoke a more fundamental argument in favour of looking at trade statistics. Namely, in so far as issues of risk and transaction costs are concerned, the introduction of a single currency will impact most strongly on the most open sectors of the economy. One way of taking this point into account is to work with trade data. The replication of the analysis carried out in Section 4 on export data instead of employment data amounts to weighting industries by their export propensity, which in turn can stand as a proxy for openness to trade.

This exercise draws on statistics for the same country, industry and year sample as above, and the same measures are used. Countries' exports to the world as a whole are retained, rather than exports within the sample or to the Euro-11 countries. The principal motivation for this choice is that, over the time period covered by the data, barriers to international transactions have been falling not only within the EU, but

between the sample countries and the overwhelming majority of trade partners worldwide.

### *Gini Indices*

Annual country-level Gini indices are again reported in a bar chart (Figure 3) and in tabular form (Table 5). First, we can note that specialisation levels in terms of exports significantly exceed those calculated with employment data. The overall average Gini of exports is 0.39 (Table 5), whilst that of employment is 0.27 (Table 1). This finding is consistent with incomplete specialisation in a comparative-advantage world and homogeneous products. It could also point to the existence of non-traded goods in heterogeneous sectors, resulting from prohibitive trade costs or from home bias in expenditure. Given the relatively high level of aggregation in our data, the second interpretation looks particularly plausible.

**\* FIGURE 3 HERE \***

**\* TABLE 5 HERE \***

In terms of relative specialisation levels across countries, roughly the same rankings emerge from export data as from employment data. Large countries are relatively less specialised (France, Germany, UK), whilst the highest specialisation measures are found for small countries (Finland, Greece, Norway). This may be explained both by comparative advantage, where large countries are likely to have a richer factor mix, and by increasing returns, through which the size of the economy limits the range of activities that it can efficiently accommodate.

Most importantly, we find confirmation of the pattern that has emerged in prior empirical studies. Whilst specialisation in employment terms has been increasing, export specialisation has tended downwards. Eight of our 13 sample countries show significant negative export specialisation trends, whilst only two show significant positive time trends (Greece and Italy). Hence, countries appear to have become more specialised in the sectoral distribution of their manufacturing *employment*, but at the same time they have diversified their manufacturing *exports*.

### *Structural Dissimilarity Measures*

Tables 6 and 7 report bilateral indices measuring how similar countries are in terms of the sectoral composition of their manufacturing exports. A comparison with the identically constructed results on employment data in Tables 2 and 3 confirms the results we obtained from the comparison of Gini coefficients. On the one hand, most dissimilarity indices are higher in export terms than in employment terms. In other words, countries are more dissimilar from one another in terms of their composition of exports than in terms of their composition of employment in manufacturing sectors. On the other hand, we find more evidence of the “puzzle” that specialisation decreased in export terms even though it increased in employment terms. Over the sample period the bilateral export dissimilarity index rose for a mere 19 out of 78 country pairs.

**\* TABLES 6 AND 7 HERE \***

Table 8 reports export dissimilarity indices *vis-à-vis* Germany. Eight of the 12 sample countries became gradually more similar to Germany in terms of manufacturing export composition, while only three countries became significantly more dissimilar (UK, Greece, Italy).

**\* TABLE 8 HERE \***

For a summarising picture of patterns in dissimilarity indices with Germany, we have constructed Figure 4. This illustrates levels and changes in both export and employment dissimilarity indices. The clustering of data points along the diagonal shows that, in terms of levels, employment and export dissimilarity coefficients are positively correlated, as one would expect. A ranking of countries in terms of their structural similarity to Germany also emerges. Closest to the origin are the proximate and similarly large countries France and the UK, which have the lowest dissimilarity indices. Furthest away from the origin appear the relatively remote and small countries Greece and Portugal, whose composition of manufacturing activity differs most from that of Germany.

**\* FIGURE 4 HERE \***

In half of the sample countries, the arrows also point roughly along the 45-degree line, meaning that export and employment similarity measures have evolved in the same direction. This is the case for the UK, Italy and Greece, who have become more dissimilar from Germany both in employment and in export terms, and for Finland, Norway and Sweden, who have become more similar to Germany on both counts. In the other half of our country sample, the evolution is orthogonal to the 45-degree line, meaning that the changes in employment and export indices have different signs. In all of these cases, the “puzzle” emerges: employment dissimilarity from Germany increased, while export dissimilarity decreased. Note, however, that over the entire period nine of the twelve sample countries have become more dissimilar from Germany in employment terms.

## **5. DETERMINANTS OF SPECIALISATION PATTERNS**

Looking at Figures 1 to 3, some regularities appear. The three large and relatively central economies of Germany, France and the UK have the most diverse, and correspondingly the most similar, composition of manufacturing sectors. Conversely, the three relatively small and peripheral countries Greece, Portugal and Norway have the most specialised manufacturing sectors and differ most from Germany. As mentioned above, this pattern is consistent with predictions of both comparative-advantage and increasing-returns models.

In considering changes rather than levels, one finds that three countries show the most clear-cut dynamics in terms of their structural similarity to Germany. Italy, which moved from being one of the most similar countries to becoming markedly more dissimilar, Greece, which was one of the least similar countries at the start of the period and grew even more dissimilar, and Finland, which became significantly more similar to Germany. These patterns tie in with changes in those countries’ Gini indices: Italy and Greece became more, and Finland less, specialised over time. Such idiosyncrasies in specialisation dynamics across EU countries suggest that simple generalisations are impossible on the basis of country-level measures. Since

differences in locational determinants are more likely to apply across industries than across countries, we turn to the analysis of industry-level Gini coefficients, calculated across the 13 sample countries.

In Section 2, we have outlined the difficulties faced by empirical studies that seek for evidence on competing theoretical approaches. There is no aspiration in this paper to deliver a rigorous quantitative evaluation of the forces that shape observed industrial specialisation.<sup>10</sup> Nevertheless, we want to probe deeper than describing country-level patterns and trends, by considering some salient industry characteristics and examining their impact on specialisation outcomes.

For information on industry characteristics, we draw on three sources. First, the OECD (1987, p. 272ff.) have produced a useful classification of industries “on the basis of the primary factors affecting the competitive process in each activity”. We distinguish four categories:

1. *resource-intensive* industries, where the main competitive factor is “access to abundant natural resources” (9 sectors in our sample),
2. *labour-intensive* industries, where the main competitive factor is labour costs (6 sectors),
3. *scale-intensive* industries, where the main competitive factor is the “length of production runs” (10 sectors), and
4. *technology-intensive* industries, where the main competitive factors are “rapid application of scientific advance” and “tailoring products to highly varied demand characteristics” (7 sectors).<sup>11</sup>

In addition, we consider trade costs in the form of pre-Single-Market non-tariff barriers, drawing on the categorisation by Buigues, Ilzkovitz and Lebrun (1990), which classified industries according to three levels of sensitivity to the Single-Market measures: high, intermediate and low.

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<sup>10</sup> For recent empirical work on testing theoretical paradigms in data on international specialisation, see Davis and Weinstein (1998), Head and Ries (1999) and Brülhart and Trionfetti (1999).

<sup>11</sup> The OECD (1987) report subdivides our “technology intensive” category into “science-based industries” and “differentiated goods”. We have amalgamated the two sectors, because we had to aggregate up from some ISIC 4-digit headings to 3-digit sectors. Aggregation did not pose a problem for the other three industry categories.

The simplest approach is to group industries according to the classifications at hand, and to compute group-wise average Gini coefficients. Such analysis lends itself to graphical representation. We have plotted the evolution of group-level Gini indices over the entire 1972-96 time period (Figures 5-8). Rather than commenting on each graph individually, we can list the most salient findings.

- The strongest specialisation appears in traditional, low-tech industries. In the employment data, the labour-intensive category shows the highest average specialisation levels, while in the export data it is the resource-intensive industries that appear most geographically specialised. In both employment and export statistics, the labour-intensive industries display the most pronounced rate of increase in specialisation.
- In employment as well as export data, it is the technology-intensive industries that appear least geographically concentrated. However, specialisation in those industries has increased since 1986, i.e. during the implementation period of the Single Market programme.
- Specialisation in the scale-intensive industries on average is neither particularly high nor particularly low. There is no evidence of an increase in specialisation in those sectors relative to the manufacturing mean.
- Employment specialisation has consistently been strongest in sectors protected by high non-tariff barriers, but non-tariff barriers do not appear to have significantly affected export specialisation.<sup>12</sup>

**\* FIGURES 5, 6, 7 AND 8 HERE \***

Each of the four stylised findings seems at odds with expectations often associated with “new” models, whereby trade liberalisation unleashes agglomeration forces in increasing-returns industrial sectors. The results reported here suggest instead that the highest degree of specialisation is in traditional, low-tech sectors; and that industries with liberalised intra-EU trade regimes were less rather than more localised than the average.

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<sup>12</sup> Analysis of variance on the group means in Figure 8 shows them not to differ significantly from the overall mean in any of the sample years.

Some results might be driven by data limitations. For instance, the low observed specialisation levels in high-tech sectors might be a result of excessively broad and inadequate product classifications. Another conceivable limitation of this exercise is misspecification through omitted variables. In particular, theory suggests that specialisation outcomes are the effect simultaneously of industry characteristics, such as those that inform the OECD (1987) classification, and of the magnitude of trade costs, such as proxied by our classification by non-tariff barriers. Multivariate analysis is clearly called for.

We have converted the industry classifications into sets of dummy variables, and regressed the specialisation measures on all industry characteristics jointly. Table 9 reports the results. It is apparent that our principal conclusions from Figures 5-8 survive in the regressions. Labour- and resource-intensive industries are significantly more geographically concentrated than the average, technology-intensive industries are less concentrated, and the scale-sensitivity of industries has only a weak impact on specialisation. Furthermore, when we control for other locational determinants, the degree of both employment and export specialisation increases in the level of intra-EU non-tariff barriers. The magnitudes of these effects are important. For instance, employment specialisation in technology-intensive sectors is 30% lower, and in high-NTB sectors it is 45% higher, *ceteris paribus*.

**\* TABLE 9 HERE \***

## **6. CONCLUSIONS AND CONJECTURES**

This paper documents specialisation trends in 32 manufacturing industries across 13 European countries over the 1972-1996 period. Employment and export data are used concurrently to compute specialisation measures. In line with the existing literature, we find that specialisation has been generally increasing in employment terms, whilst export data point towards a slight decrease in average specialisation. These opposing overall trends appear irrespective of the specialisation measure used.

Whilst it is clearly impossible to give a simple and general answer to the “growing alike or growing apart” question, we are not left in complete confusion. First, for a number of countries, employment and trade data tell the same story. The structural composition of manufacturing in two countries, Italy and Greece, has consistently become more specialised as well as more dissimilar from most fellow EU countries. The opposite is true for Denmark, Finland and the Netherlands. These countries have diversified their manufacturing bases and become more similar to most EU countries, in particular Germany. Sweden, whilst specialising in employment terms, has also become more similar over time to Germany.

Have there been two converging groups of countries, a northern and a southern “club”? Our results do not permit such a simple generalisation. Data for Spain and Portugal, as well as for Austria, produce the picture that emerges also for the overall average: increasing specialisation and structural dissimilarity of employment but decreasing specialisation and dissimilarity of exports. The explanation of this apparent puzzle probably lies in the different speeds of two processes that are triggered by the fall in trade barriers. One process is an increase in the export propensity across industries, including ones that were previously “non-traded”. The other process is that of sectoral specialisation in an evolving international division of labour. If economic integration triggers the first process more quickly than the second (which seems plausible), then contradicting specialisation trends in employment and trade patterns may well emerge. And if this is the explanation for our apparently contradictory specialisation results for some countries, then employment data should probably be interpreted as a more reliable indicator of long-term trends than trade data.

We have also produced some evidence that “traditional” labour-intensive and natural resource-intensive sectors represent the most concentrated activities among EU countries. This might be in line with the growing specialisation, at least in employment terms, observed for Greece, Italy, Spain and Portugal. On the other hand, an acceleration of geographical concentration in technology-intensive sectors since the mid-1980s cautions against the interpretation that increased specialisation is merely the result of low-tech industries disappearing faster in the northern than in the southern member countries. Considering the fact that obsolete statistical

classifications probably lead to a downward bias in the estimated specialisation levels of high-tech sectors, the observed increase might well reflect strong clustering tendencies in those industries.

In conclusion, an answer to the question posed in the title of this paper clearly must be subject to some qualifications. Nonetheless, given that employment data are probably a more reliable gauge of long-term specialisation trends than trade data, we can state that our results for the last three decades by and large favour the “growing apart” hypothesis. The average country-level Gini index on sectoral employment has risen from 0.26 in the early 1970s to 0.28 in the mid-1990s, and there are no discernible signs of a trend reversal. Is this a bad omen for EMU? In the strict context of OCA theory, the implication is that the incidence of asymmetric fluctuations and the corresponding adjustment costs must be rising. Yet, two reasons caution against pessimism. First, extrapolation of historical trends is particularly hazardous when facing as large a change in policy regime as the introduction of a single currency. For example, the strong divergent tendencies of industrial sectors in Italy and Greece may well have been influenced by those countries’ particular inflation records and exchange-rate movements. The Lucas critique must be borne in mind. Second, the efficiency gains from adopting the single currency are positively correlated with a country’s openness, and thus, small countries are likely to benefit most. On balance, this may well make up for the fact that we find the smaller countries to be the most specialised, and hence most prone to asymmetric shocks.

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**Table 1: Country-Level Gini Indices of Manufacturing *Employment*, 1972-1996**

Country	Mean Gini	<i>OLS Regression on Time Trend:</i> $\ln(GINI)_t = \beta_1 + \beta_2 * YEAR_t + \varepsilon_t, YEAR = \{72, \dots, 96\}$		
		$\beta_2$	<i>t</i> statistic*	R <sup>2</sup>
Austria	0.20	0.0061	8.24	0.73
Denmark	0.32	-0.0015	-3.57	0.36
Finland	0.32	-0.0053	-9.95	0.79
France	0.13	0.0093	7.82	0.77
Germany	0.18	0.0119	11.58	0.84
Greece	0.42	0.0091	23.91	0.97
Italy	0.23	0.0136	15.46	0.92
Netherlands	0.33	-0.0023	-1.76	0.12
Norway	0.38	-0.0002	-0.53	0.00
Portugal	0.40	0.0026	2.91	0.29
Spain	0.20	0.0047	4.85	0.55
Sweden	0.28	0.0073	14.64	0.92
UK	0.13	-0.0032	-5.86	0.43
PANEL <sup>#</sup>	0.27	0.0033	16.12	0.38

\* calculated from White-adjusted standard errors.

# OLS with country fixed-effects. R<sup>2</sup> only for “within” variation.



**Table 4: Structural Dissimilarity of *Employment* Compared to Germany, 1972-96**

Country	Time-Averaged Dissimil. Index w.r.t. Germany	OLS Regression on Time Trend: $\ln(S)_t = \beta_1 + \beta_2 * YEAR_t + \varepsilon_t$ , $YEAR = \{72, \dots, 96\}$		
		$\beta_2$	<i>t</i> statistic*	R <sup>2</sup>
Austria	0.39	0.0095	8.53	0.78
Denmark	0.54	0.0018	3.81	0.49
Finland	0.62	-0.0068	-3.80	0.52
France	0.32	0.0047	3.43	0.28
Greece	0.81	0.0113	13.57	0.92
Italy	0.48	0.0164	17.10	0.92
Netherlands	0.53	-0.0007	-0.47	0.01
Norway	0.62	-0.0025	-3.62	0.35
Portugal	0.80	0.0035	4.38	0.40
Spain	0.51	0.0086	6.70	0.77
Sweden	0.41	0.0004	0.59	0.02
UK	0.30	0.0109	8.39	0.74

\* calculated from White-adjusted standard errors.

**Table 5: Country-Level Gini Indices of Manufacturing *Exports*, 1972-1996**

Country	Mean Gini	OLS Regression on Time Trend: $\ln(GINI)_t = \beta_1 + \beta_2 * YEAR_t + \varepsilon_t$ , $YEAR = \{72, \dots, 96\}$		
		$\beta_2$	<i>t</i> statistic*	R <sup>2</sup>
Austria	0.31	-0.0202	-18.11	0.95
Denmark	0.45	-0.0033	-4.96	0.53
Finland	0.57	-0.0088	-10.12	0.81
France	0.16	0.0003	0.16	0.00
Germany	0.19	-0.0064	-5.21	0.51
Greece	0.65	0.0034	2.79	0.26
Italy	0.28	0.0064	5.99	0.60
Netherlands	0.38	-0.0082	-6.53	0.59
Norway	0.55	-0.0017	-1.56	0.08
Portugal	0.56	-0.0037	-3.96	0.31
Spain	0.30	-0.0068	-2.41	0.27
Sweden	0.38	-0.0057	-6.97	0.71
UK	0.23	0.0033	1.79	0.11
PANEL	0.39	-0.0040	-6.59	0.15

\* calculated from White-adjusted standard errors.

# OLS with country fixed-effects. R<sup>2</sup> only for “within” variation.



**Table 8: Structural Dissimilarity of Exports Compared to Germany, 1972-1996**

Country	Time-Averaged Dissimil. Index w.r.t. Germany	OLS Regression on Time Trend: $\ln(S)_t = \beta_1 + \beta_2 * YEAR_t + \varepsilon_t$ , $YEAR = \{72, \dots, 96\}$		
		$\beta_2$	<i>t</i> statistic*	R <sup>2</sup>
Austria	0.51	-0.0218	-26.58	0.96
Denmark	0.76	-0.0045	-6.65	0.69
Finland	0.99	-0.0157	-16.29	0.91
France	0.33	-0.0008	-0.23	0.00
Greece	1.24	0.0034	2.49	0.21
Italy	0.49	0.0032	2.10	0.15
Netherlands	0.68	-0.0095	-7.50	0.66
Norway	0.95	-0.0035	-3.27	0.28
Portugal	1.04	-0.0085	-4.93	0.64
Spain	0.56	-0.0221	-8.65	0.80
Sweden	0.52	-0.0044	-2.80	0.26
UK	0.39	0.0107	5.79	0.60

\* calculated from White-adjusted standard errors.

**Table 9: Determinants of Specialisation**

(OLS with year fixed effects; dependent variable = log of Gini; 775 observations)

	<i>Employment data</i>		<i>Export data</i>	
	(1)	(2)	(4)	(5)
Labour intensity dummy (OECD, 1987)	0.151 (2.10)**	0.149 (2.12)**	0.217 (3.13)***	0.196 (3.12)***
Technology intensity dummy (OECD, 1987)	-0.106 (-2.67)***	-0.295 (-8.08)***	-0.224 (-6.97)***	-0.374 (-8.60)***
Resource intensity dummy (OECD, 1987)	0.087 (2.03)**	0.101 (2.09)**	0.571 (14.2)***	0.655 (17.5)***
Scale intensity (Pratten, 1988)	-0.002 (-0.52)	0.001 (0.26)	0.008 (1.75)*	0.011 (2.74)***
Intermed. NTB dummy (Buigues <i>et al.</i> , 1990)		0.088 (2.17)**		0.222 (5.80)***
High NTB dummy (Buigues <i>et al.</i> , 1990)		0.449 (9.63)***		0.426 (9.14)***
Adj. R <sup>2</sup>	0.084	0.204	0.432	0.512

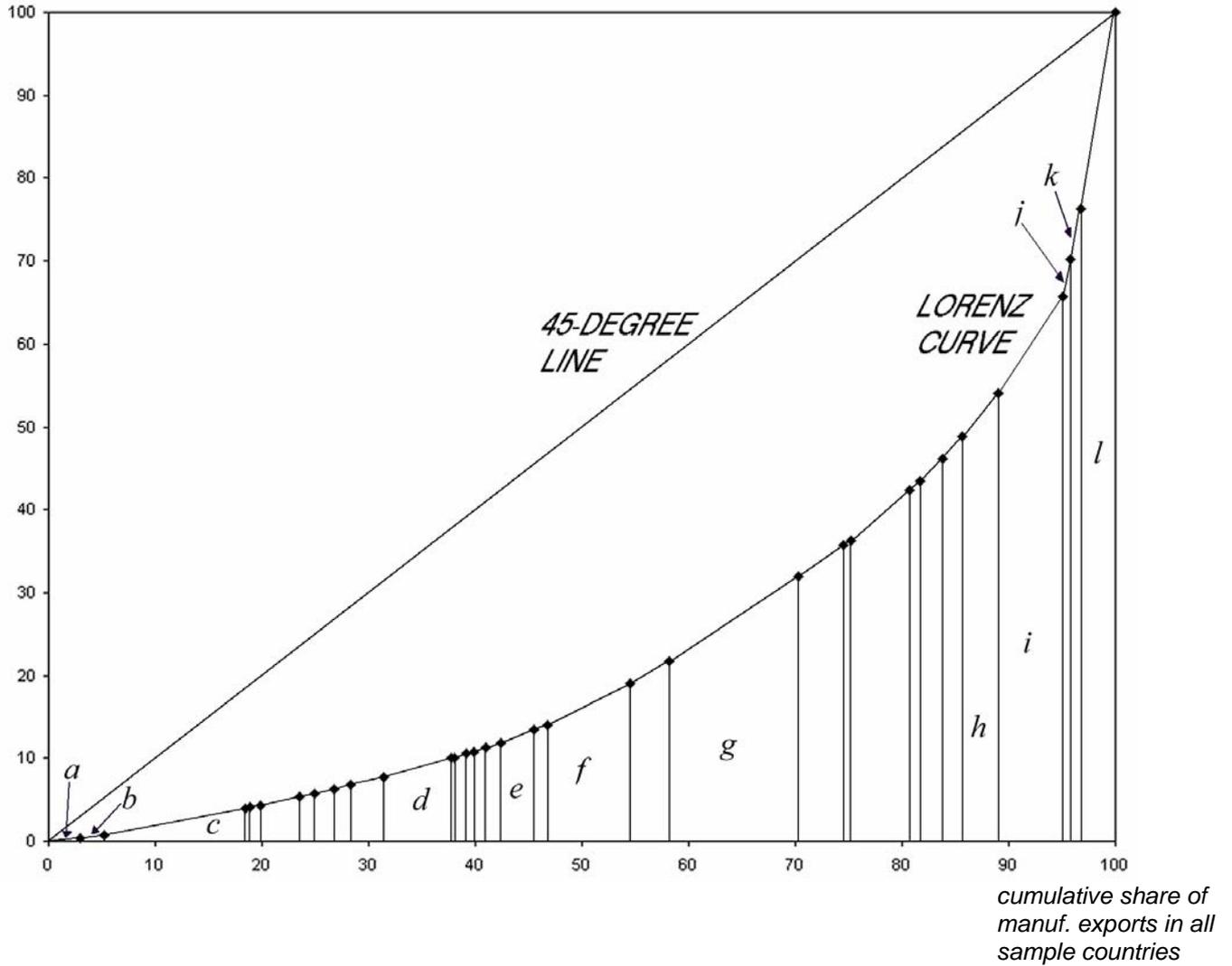
Notes:

- *t*-values from White-adjusted standard errors; confidence levels: \*\*\* 99%, \*\* 95%, \* 90%.
- In order to avoid perfect multicollinearity, we dropped the OECD (1987) dummy for scale-intensive industries and replaced it by the classification of Pratten (1988) who ranked industries in descending order by their estimated minimum efficient plant scales.

### Figure 1: A Locational Lorenz Curve

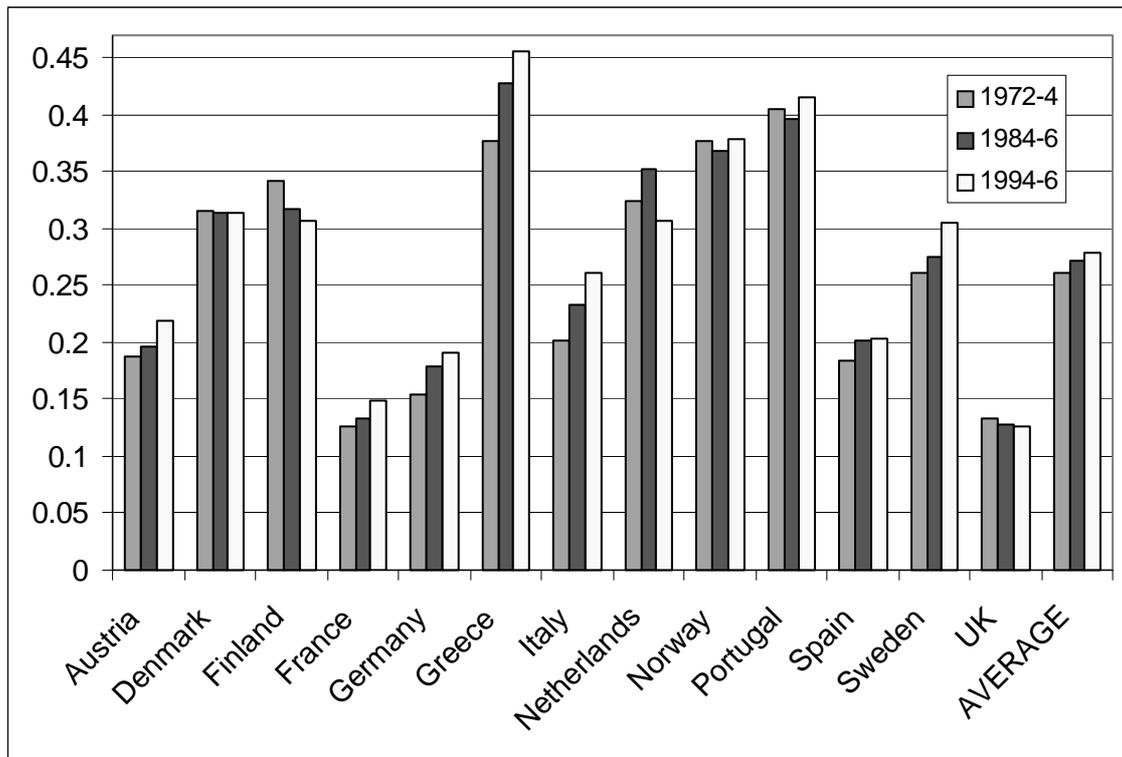
(Manufacturing specialisation of Finland, 1996)

*cumulative share of  
Finnish manufacturing exports*

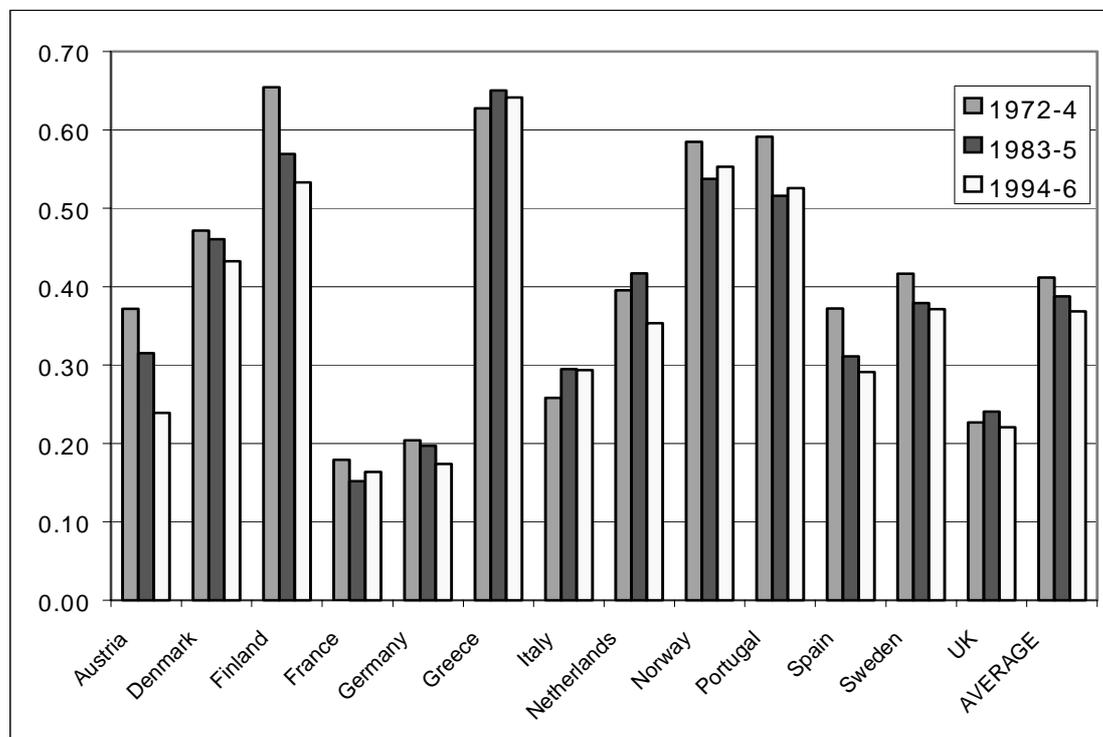


- a...* Transport equipment n.e.c.
- b...* Pharmaceuticals
- c...* Motor vehicles
- d...* Food products
- e...* Professional and scientific equipment
- f...* Industrial chemicals
- g...* Machinery n.e.c.
- h...* Iron and steel
- i...* Radio, TV and telecom equipment
- j...* Shipbuilding
- k...* Wood products
- l...* Paper products

**Figure 2: Country Specialisation in Manufacturing Employment, 1972-1996**  
(Gini indices, unweighted averages)

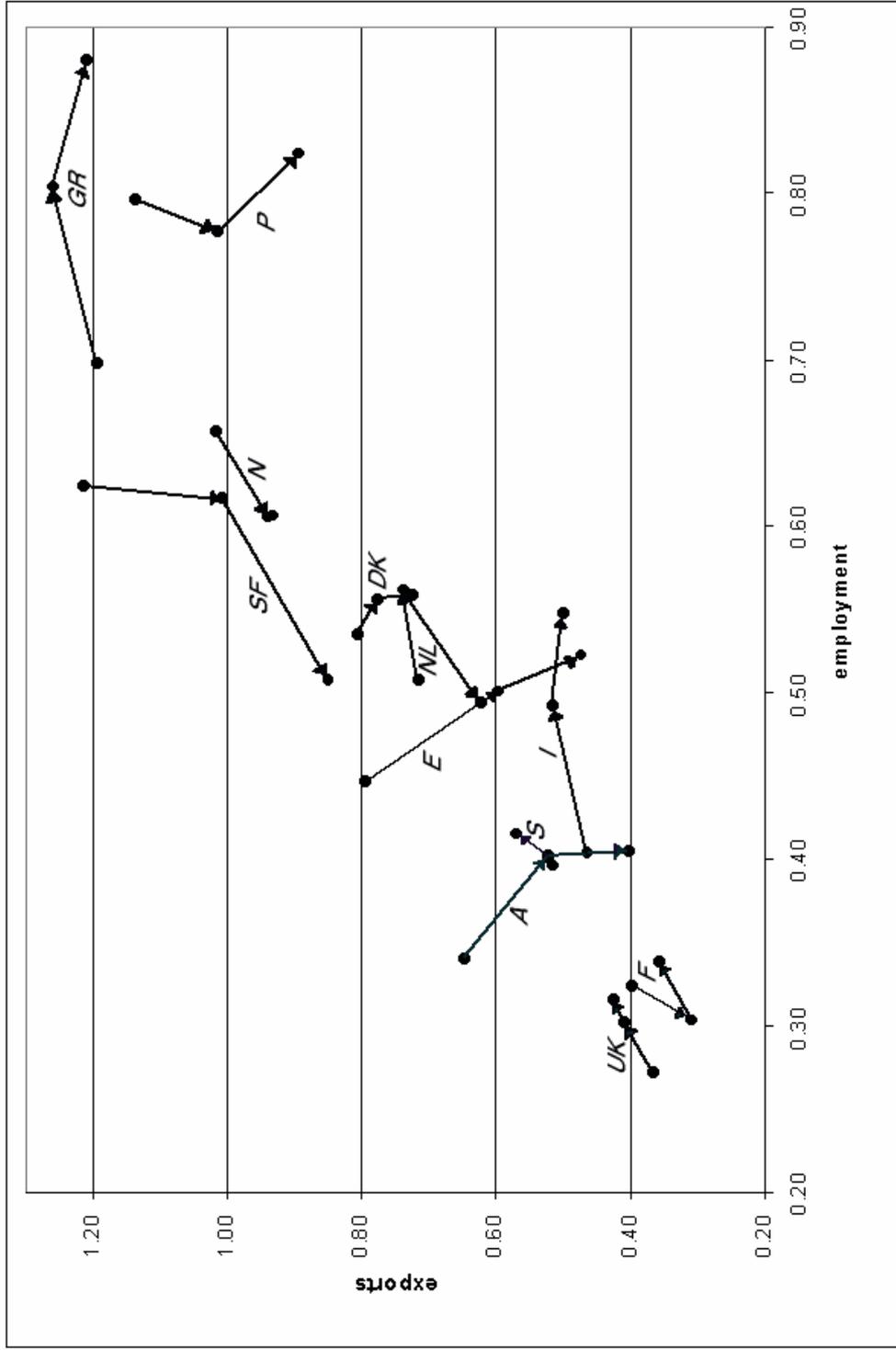


**Figure 3: Country Specialisation in Manufacturing Exports, 1972-1996**  
(Gini indices, unweighted averages)

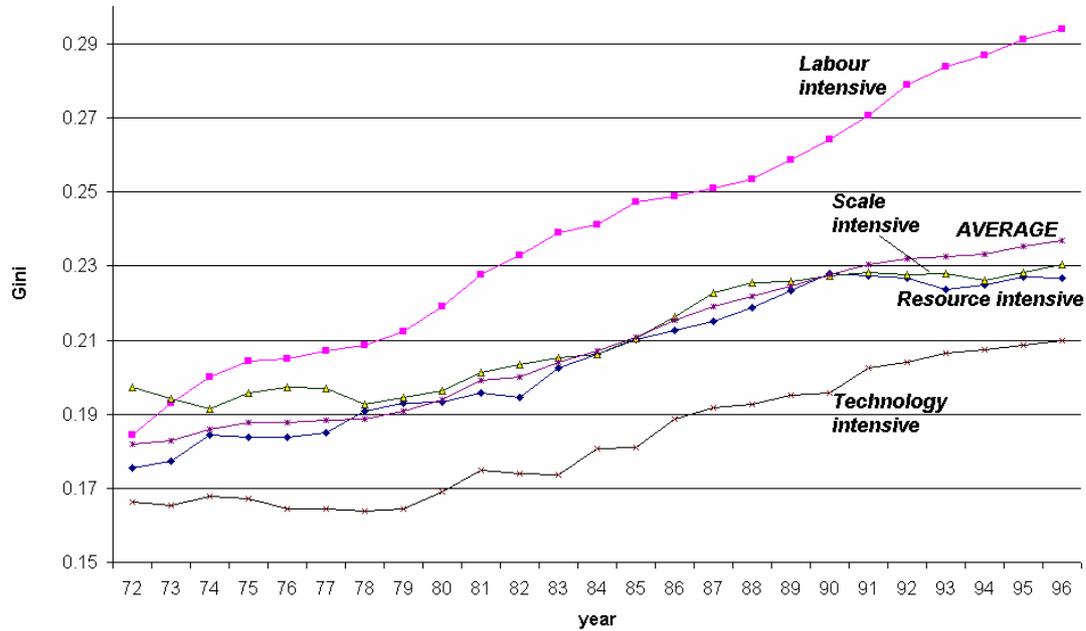


**Figure 4: Structural Dissimilarity From Germany in Employment and Export Terms, 1972-1996**

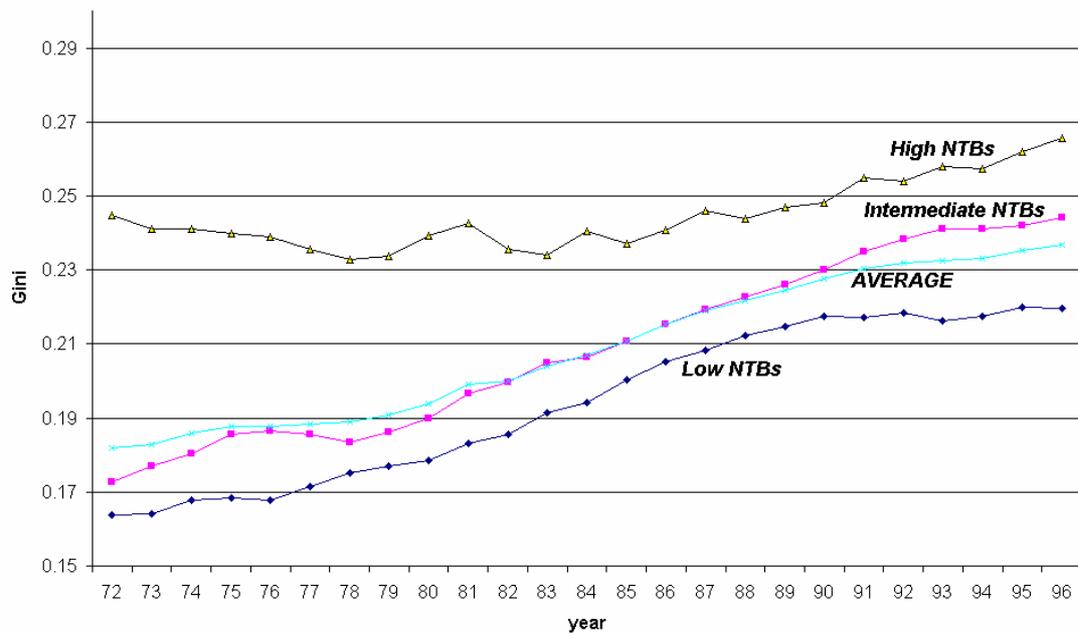
(data points: 1972-4, 1983-5, 1994-6)



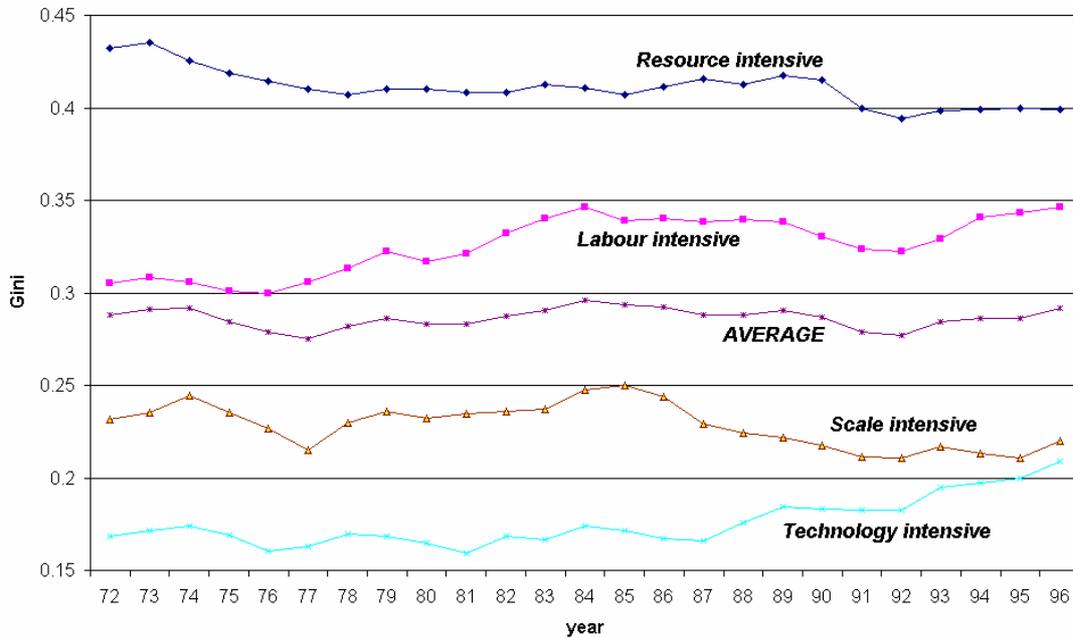
**Figure 5: Employment Specialisation Patterns in Five Industry Categories**  
(categorisation based on OECD, 1987)



**Figure 6: Employment Specialisation Patterns and Sensitivity to the Single Market**  
(categorisation based on Buigues, Ilzkovitz and Lebrun, 1990)



**Figure 7: Export Specialisation Patterns in Five Industry Categories**  
(categorisation based on OECD, 1987)



**Figure 8: Export Specialisation Patterns and Sensitivity to the Single Market**  
(categorisation based on Buigues, Ilzkovitz and Lebrun, 1990)

