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SPECIALISATION AND (GEOGRAPHIC) CONCENTRATION OF EUROPEAN MANUFACTURING

BACKGROUND PAPER FOR “THE COMPETITIVENESS OF EUROPEAN INDUSTRY: 1999 REPORT”

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1. New challenges and opportunities

European manufacturing has been and is currently facing dramatic changes in its business environment. The process of integration has abolished trade barriers, created a single market and finally a single currency. Globalisation has widened the horizon for production, consumption and competition and accelerated the dissipation of knowledge, information and technology. Nevertheless, it has also increased the world-wide impact of national and regional economic and political shocks. The consequence has been not only new challenges, but also new opportunities for firms, people and institutions.

New technologies, like telecom, electronics and biotechnology, are changing production patterns and consumer choices. Services have become the largest macroeconomic sector, although they are often value enhancing and complementary to manufactured goods. The United States is facing an unprecedentedly long period of economic growth without inflation and fiscal deficit. Asian countries, as well as Russia and South America, were hit by a crises and forced to reform their financial and economic institutions. At varying paces, former transition countries in Central and Eastern Europe are slowly catching up and have started the process of negotiating access to the European Union.

The focus of the analysis

The last Competitiveness Report (CR 1998) evaluated competition within the triad. It was shown that in comparison to the US, Europe is at a deficit when it comes to creating income and employment. The productivity of the economy as a whole, and of the manufacturing sector specifically, is still significantly lower in Europe than in the US. Furthermore, in Europe, the share of population employed is lower and unemployment is higher. Positive aspects of the European situation are its large and increasing trade surplus in manufacturing, stable world market shares of exports, a quality premium for European manufacturing, and a strong position in skill intensive industries. Deficits in fast moving industries (which are driven by research or marketing) and in industries with high product differentiation, as well as the ongoing presence of a comparatively high share of labour intensive industries, characterise the structure of European manufacturing and underline the need for more structural change.

This report (Competitiveness Report 1999) is about structural change within Europe. The specific focus is on whether integration and global competition are making European countries more similar or more specialised and whether industries are becoming more concentrated in individual member countries or more dispersed over all regions. Looking at the specialisation of countries (i.e. the structure of production and exports), examining the concentration of industries (i.e. how production or exports of an industry is distributed across sectors) and finally studying the growth patterns of industries in countries, there are three perspectives from which we can view the empirical data of production in industries and countries and how it has changed over time[1].

Specialisation and concentration as policy issues

The issues of specialisation and concentration are important to economic policy and to the competitiveness of the European Union for at least three reasons. Firstly, the main channel by which integration enhances efficiency and competitiveness, are decisions of firms regarding their optimal size and location, without the former national boundaries. The utilisation of scale economies and a deeper division of labour were expected to become the driving horses of Europe’s increased competitiveness in the Single Market Program. On a more theoretical level, integration is modelled as a decrease in "transport costs", a notion incorporating transport costs proper, as well as the costs of distribution, complying with different business rules, national regulations, transaction costs etc. The deepening of integration needs and works via structural change. If endowments and factor inputs are different across countries, the change goes in the direction of increasing specialisation. High wage countries have to move into high productivity and research intensive industries in order to ensure further growth in production and employment. Low wage countries specialise in labour intensive activities.

The second policy issue is the concern that the specialisation of countries in narrow product groups may increase demand risk for individual countries. This is discussed as a problem which could result from a common European currency, possibly making countries and regions more vulnerable to "asymmetric shocks". These are disturbances that effect countries differently, and would therefore endanger stability within a common currency area. An optimal integration area should minimise the probability of shocks. Since the instrument of currency devaluation is no longer available, new flexible institutions should cushion against this danger. The preconditions necessary when countries within the European Monetary Union are to protect themselves from asymmetric shocks were assessed as critical in some studies. The heterogeneity of countries within the European Union is still large; the mobility of labour rather low. Productivity increases were expected to come from increasing economies of scale, and globalisation was expected to effect low-income countries specifically. The contribution of industry structure and its change allow a more detailed assessment of the probable impact of these stylised facts.

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[1] For the exact definition of specialisation and concentration see Box 3.1.

A third issue of high policy concern is raised in regional economics. Integration may lead to an agglomeration of activities in attractive regions. The regions that potentially could be preferred are called the core. These are regions with high demand or better market access. Poor regions, may they be either at the periphery or disadvantaged by a lack of endowments, their history, or their structure, may fall behind. The concentration of activities in the preferred region is driven by the motive to use spillovers, to economise on inputs and to make use of high skills. It is driven by economic motives and enhances productivity and competitiveness. However, such concentration could be asymmetric, and politically and socially not viable in the long run. It is important to know whether such a process is currently active, and if it is, then in which industries and regions.

Comparing the regional structure in European manufacturing with that in the US invites a prediction for dramatic change in Europe. Regions are far more specialised in the US. Some economists used this difference to forecast regional concentration in Europe as a consequence of the creation of a single European Market. A restructuring process in which entire industries shift their locations implies higher costs of structural adjustment, followed by a process of upgrading quality, vertical and horizontal differentiation of products and increasing *intra*-industry trade.

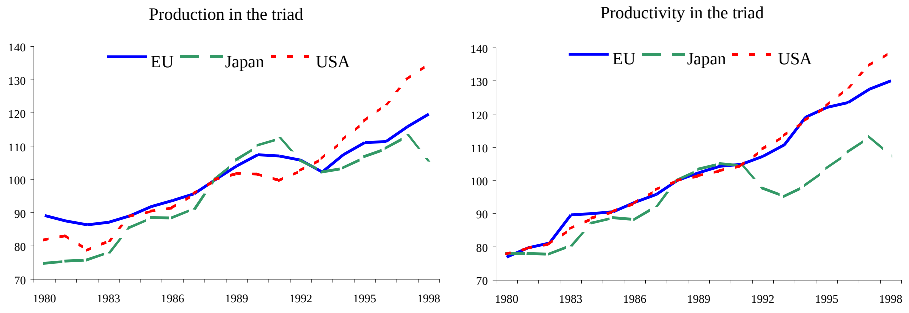
Monitoring the specialisation and concentration of industries is therefore necessary for an assessment of European competitiveness and the risks Europe faces. Information about ongoing processes is an important input to economic policy. It is of crucial importance to know on the one hand whether the structural change needed for catching up relative to the US and promoting competitiveness is taking place; and on the other hand, whether it is leading to balanced or unbalanced structures, to more efficiency, or to specialisation patterns prone to asymmetric shocks.

While monitoring specialisation is important to evaluate risks and chances, and as an important input in creating the optimal policy framework, a specific degree of specialisation or concentration is no economic goals as such. The objective of firms is optimally to adjust to the changing environment, the objective of countries is to increase value added and employment (and other goals summarised by the definition of competitiveness, see Competitiveness Report 1998). We measure this on the macro level by looking at growth of value added, employment and productivity, on the sector level by calculating the speed of structural change. The speed of structural change is defined as difference in the structure in the beginning and in the end of the period. It can be expected to be related to competitiveness and growth. It is also related to changes of specialisation and concentration, however if countervailing tendencies co- exist which partly work in the direction of specialisation, partly in that of dispersion, the changes in specialisation will underestimate structural change. A survey on theoretical models show that this is the case, and the data show that the speed of change is larger than net changes in specialisation and that they are closer related to performance (chapter 7).

Slow growth stops productivity catch up

The data sets we use are in general available for the period 1988 to 1998. European manufacturing increased its nominal value added in this period by 2.9% p.a. (see Table 1.1) Seen from a long-term perspective, this was a period of slow growth. Industry growth was less in Europe than in the USA, but higher than in Japan. Employment in manufacturing decreased in Europe by 8% for the total period (-0.8% p.a.), and was approximately stable in the US. The unfavourable development in Europe, as compared to the US, was due to the crisis of 1993/94, which did not hit the US, and to the impact of the Asian crisis and its repercussions in Eastern Europe (Russia) at the end of the period. Europe’s long and gradual process of catching up in productivity versus the US is therefore not evident during this period (Fig 1.1). The temporary delay in Europe’s efforts to close the gap in productivity is expected to end, when the growth rates of European industry catch up. The in depth analysis in the Competitiveness Report 1998 shows that in the long run, industry growth is less employment intensive in Europe. This implies that the productivity increase should be higher. However the data provided illustrate that the productivity gap is still large for Europe.

Fig 1.1: Growth of production and productivity



Source: WIFO calculations using Main Economic Indicators (OECD) and SBS; production in real terms.

Table 1.1: Annual growth of production and exports: 1988 to 1998

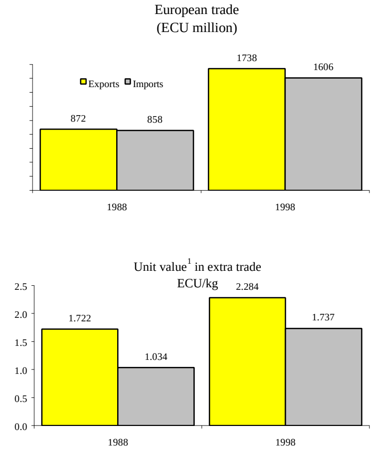
	Value added	Exports		
		Total	Extra	Intra
Belgium	4.4	7.8	7.6	7.9
Denmark	3.7	6.8	2.3	10.2
Germany	3.0	5.5	5.3	5.7
Greece	3.5	8.0	12.1	5.0
Spain	3.6	10.1	6.9	11.9
France	2.4	7.6	7.2	7.8
Italy	2.5	7.1	7.4	7.0
Ireland	8.9	13.8	15.8	13.0
Netherlands	3.7	5.9	5.4	6.0
Austria	6.4	7.3	9.9	6.0
Portugal	7.8	8.9	4.6	10.2
Finland	1.7	7.9	8.8	7.2
Sweden	-0.3	6.4	7.4	5.8
United Kingdom	1.9	8.4	6.6	9.9
EU	2.9	7.1	6.6	7.5

Source: WIFO calculations using SBS and COMEXT, nominal values.

Quality premium and high *intra*-export growth

Exports have grown faster than imports, so that Europe now has a surplus of 132 bn ECU in its trade of manufacturing products (see Fig 1.2). Its exports are more higher valued than its imports, reflecting a positive "quality premium" for its exports to non members. This premium comes primarily from countries outside the US and Japan, e.g. from Central and Eastern European countries. Exports as well as imports are rising faster than production, *intra*-exports are increasing faster than *extra*-exports, reflecting the deepening of integration in Europe (see Fig 1.3).

Fig 1.2: Trade surplus and quality premium in European trade



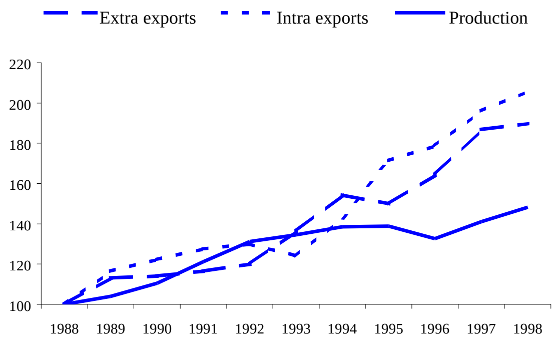
[1] EU12.

Source: WIFO calculations using COMEXT.

Questions not addressed

This report will not address the question of convergence of incomes. Literature is available on this question and certain stylised facts are emerging. There seems to be convergence of per capita income, but it is slow. And it may be a conditional convergence, which means that different countries converge at different levels, depending on their ability to accumulate knowledge and to engage in research. Convergence between regions in Europe has been the dominant trend of the last 40 years. However, this trend may have levelled off, and it may not hold within all countries. Regional convergence is less pronounced for incomes than for productivity, since the ratio of employment to population is persistently different. The topics of convergence of incomes and of dispersion or specialisation of the production structure (convergence or divergence of structures) are partly connected via demand forces and the supply of resources. Rising incomes that converge at a common per capita value would tend to make demand patterns as well as skills more similar. However, this report addresses – with the exception of a chapter on convergence of endowments – mainly the specialisation of production and trade.

Fig 1.3: European exports grow faster than production



Source: WIFO calculations using COMEXT and SBS.

The report focuses on European industry. Manufacturing is an important macro-sector in any economy and it is larger in Europe than in the US. Manufacturing provides the majority of traded goods, and determines the contribution of external sources to the creation of value added and employment (external balance). The service sector is increasing its share in all developed countries. In the future, it will become even more important to income and employment. A complete investigation of the specialisation pattern should eventually try to incorporate services, specifically the interface of production related and value enhancing services. Until now, such an analysis has not been possible due to data limitations. The main results are for manufacturing.[2]

Table 1.2: Shares of *intra* trade rises for imports, exports and total flows

	Imports				Exports				Total trade			
	Share of *intra*		Share of *extra*		Share of *intra*		Share of *extra*		Share of *intra*		Share of *extra*	
	1988	1998	1988	1998	1988	1998	1988	1998	1988	1998	1988	1998
Belgium	72.8	73.7	27.2	26.3	77.5	78.0	22.5	22.0	75.2	76.0	24.8	24.0
Denmark	56.4	73.4	43.6	26.6	48.3	66.4	51.7	33.6	52.4	69.9	47.6	30.1
Germany	55.0	56.3	45.0	43.7	54.6	55.3	45.4	44.7	54.7	55.8	45.3	44.2
Greece	66.9	68.6	33.1	31.4	64.3	48.3	35.7	51.7	66.2	63.0	33.8	37.0
Spain	65.2	75.0	34.8	25.0	59.4	69.9	40.6	30.1	62.6	72.6	37.4	27.4
France	69.5	70.3	30.5	29.7	60.3	61.6	39.7	38.4	65.1	65.8	34.9	34.2
Italy	63.1	66.3	36.9	33.7	57.1	56.1	42.9	43.9	60.0	60.6	40.0	39.4
Ireland	72.1	60.0	27.9	40.0	73.8	68.8	26.2	31.2	73.0	65.3	27.0	34.7
Netherlands	67.5	53.8	32.5	46.2	74.9	75.9	25.1	24.1	71.2	65.0	28.8	35.0
Austria	79.5	75.1	20.5	24.9	70.2	62.3	29.8	37.7	75.2	69.1	24.8	30.9
Portugal	75.8	81.9	24.2	18.1	72.5	81.6	27.5	18.4	74.4	81.8	25.6	18.2
Finland	68.8	69.9	31.2	30.1	59.4	55.8	40.6	44.2	63.8	61.4	36.2	38.6
Sweden	65.0	70.3	35.0	29.7	60.6	56.8	39.4	43.2	62.8	62.7	37.2	37.3
United Kingdom	53.2	56.1	46.8	43.9	50.6	58.2	49.4	41.8	52.1	57.1	47.9	42.9
EU	72.8	73.7	27.2	26.3	77.5	78.0	22.5	22.0	75.2	76.0	24.8	24.0

Total trade: Exports plus imports.

Source: WIFO calculations using COMEXT.

The period and units of analysis

The report analyses the development of industries and sectors of manufacturing in the member countries of the European Union. The patterns of specialisation and concentration do not necessarily follow along these lines. Specialisation processes sometimes develop at more disaggregated levels, may they be sub-industries or even firms or may they be regions within countries. Data problems do not allow further disaggregation for all industries and all countries. Any deeper disaggregation would force a reduction in the generality of the analysis: within industry analyses reduce the comparability between industries, since industry specific information has to be used; within country information would allow only the use of highly aggregated sector information.

The period analysed is 1988 to 1998. For some data, longer series are available, but this time period is the common ground for the bulk of data. Even for this time span, many data were missing and had to be estimated by WIFO. Fortunately, the beginning and the end of this period are not particularly extreme points in the business cycle. In the middle of the period, Europe faced a severe recession with devaluations in some member countries. Additional country specific shocks during these years were the unification of Germany, the transition of the Central and Eastern European Countries, the loss of the Russian market and the political turmoil in the Balkan region. Each of these shocks affected member countries differently and technically speaking increased the noise in the data set.

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[2] Manufacturing is defined by EUROSTAT as NACE sectors 15–36. We call 2 digit units "sectors" and 3 digit units

The report uses aggregate data, not firm data. The term "concentration" is used to indicate the position of the countries with the largest output shares in a sector or in an industry. The notion of concentration in industrial economics and in competition policy is different from this interpretation and refers to the importance of a few large firms and their market power. Industries can be concentrated in a small number of countries, but firm structure can be fragmented. The opposite can also be true: an industry can be dispersed across countries, but ownership is concentrated in a few multinational firms.

The main variables used are production and exports. Depending on the question, data on imports, employment, demand and direct investment are used. Production is defined as nominal value added. The creation of value added is the final goal of economic activity, and is defined as one of the components of competitiveness. Taking the nominal value added is not optimal for all questions, but problems of price adjustment and holding quality constant for 100 industries in each member country are nearly unsolvable. Exports are also at current prices. We most often used total exports to maximise comparability with production data (which are not available for domestic, *intra*-EU and *extra*-EU destinations), but additionally checked the main tendencies for *intra* only. The European Union is defined according to its members in 1998. The activity of the countries, which joined in 1995, is included for the whole period.

Structure of the report

We start each major chapter with a survey of previous empirical studies and predictions from economic theory. First, we review the expected consequences of integration on specialisation and regional concentration, report on previous studies and provide an assessment of how the endowments of member countries have changed. The probability that specialisation has increased and the lines along which this has occurred depends on the question whether endowments are different and whether they converge. Later, this structural change is investigated from three perspectives. The first

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"industries". Data sources are EUROSTAT, European Commission, UN and WIFO.

perspective is the ***specialisation of countries***, i.e. the structure of production and exports of countries. We define specialisation according to whether a country specialises in a few industries or production is dispersed across industries. The second perspective is the ***concentration of industries***. We define concentration according to whether an industry is concentrated in a few countries, or dispersed across all countries. The third perspective is the ***growth of industries*** in specific countries. The methodological approach of the report is to look what we expect to happen according to the theory, and then to look at what actually happened. The analysis of the dynamics of industries is done by means of an econometric approach, which indicates what determines the medium term growth of industries. The country effects, which emerge, are discussed against the background of policy variables. Finally, we look at how trends in specialisation and concentration, and structural change in general, are related to competitiveness, and its main components: growth of value added and employment.[3]

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[3] WIFO thanks the members of the Scientific Committee Pierre Buigues, Pierre Defraigne, Ioannis Ganoulis, Paul Geroski, Steve Davies, Andre Sapier and Leo Sleuwaegen and also Adriaan Dierx and Fabienne Ilzkowitz from DGII. For critical comments and discussions on workshops WIFO is grateful to: Paul Baker, Fritz Breuss, Marius Bruelhart, Annalisa Ferrando, Wilhelm Kohler, Michael Landesmann, Bruce Lyons, Peter Mayerhofer, Marianne Paasi, Michael Peneder, Alexander Sembenelli, Gunther Tichy, Gabriele Tondl, Stefano Vannini and Rudolf Winter-Ebmer. Research assistence by Dagmar Guttmann, Traude Novak, Gerhard Schwarz, Eva Sokoll and Dominik Walch is acknowledged. For computer programming the authors thank Wolfgang Klameth and Marianne Schöberl. The authors for WIFO were: Karl Aiginger, Michael Boeheim, Klaus Gugler, Michael Pfaffermayr and Yvonne Wolfmayr-Schnitzer.

2. Theoretical predictions, previous evidence, endowments

In this chapter we review the predictions of the theoretical literature about the specialisation of countries and the location of industries. Afterwards we give a very short overview on empirical studies on specialisation of countries and concentration of industries. A factor central to the division of labour is the abundance and scarcity of endowments of countries. We therefore present evidence on the endowment profiles of countries, and whether they converged in Europe over the past ten years.

2.1 The determinants of specialisation patterns: theory[4]

The purpose of this chapter is to outline the theoretical background behind the question of how integration/globalisation can influence a country’s specialisation patterns. The chapter starts with a review of traditional comparative advantage models for trade, as well as models from the new trade theory literature, predicting potential specialisation patterns across countries in inter- and *intra*-industry trade. The bow is then bent further towards economic geography models, which provide insights on the spatial distribution of economic activity, in particular on how core-periphery patterns can arise endogenously in equilibrium.

Traditional trade theory

Traditional trade theory explains trade specialisation patterns by concentrating on the unique characteristics of each country, which in turn give rise to relative cost differences, called "comparative advantages". Ricardian models focus on international differences in the productivity of labour as a source of cost differences, while the Heckscher-Ohlin model stresses endowment differences or the relative abundance of factors of production[5]. Countries are forecast to export goods with which they are abundantly endowed. In addition to capital and labour inputs, human capital and other knowledge related factors such as labour skills, R&D expenditures, and the employment of scientists and engineers (variables closely linked to technological capabilities) are included in the so-called "generalised factor proportions theory". This has brought traditional theory much closer to reality, although the model is still static.

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[4] For a full survey of predictions of trade theory, economic geography models and the literature on multinational firms on the effects of integration and globalisation on specialisation patterns in production and trade, see: Wolfmayr-Schnitzer 1999: Globalization, Integration and Specialisation of Countries: A Survey of Literature, WIFO Working Paper, 1999.

[5] Or, in other words, countries are abundant in different factor-inputs; this model assumes that all countries have access to the same technology (production function); (Ricardo, 1817; Heckscher, 1919; Ohlin, 1933).

Technological opportunities

Posner (1961) added technological change as an independent determinant of specialisation. Innovation continuously alters the list of products and processes; "technology gap models" depend on the speed of innovation and imitation. Here technology is not an endowment, but rather the outcome of innovation, learning and discovery. The technology-gap model was an important precursor of the product-cycle theories, which incorporate the idea that products go through a life-cycle of systematic changes in technology, so that the various competitive advantages of a country are decisive at different stages in the product life cycle: skilled labour for production and the development of new products; capital intensive production techniques during a product's "growing stage"; low wage, less skilled labour when the product has matured and been standardised.[6] Krugman (1979a) formalises the product cycle idea. The ability of the more advanced "North" to develop and produce new goods becomes a source of comparative advantage. The "South" adopts new production technologies with a lag. This technology transfer to the South forces the North to "continually innovate, not just to grow, but even to maintain real income" (Krugman, 1990, pp. 150).

In the next step, the concept of innovation is presented as an endogenous activity. Product and process innovation are interpreted as deliberate, purposeful R&D, carried out with profit seeking intentions (Romer, 1990, Aghion, Howitt, 1990), which depend on expectations for monopoly profits - at least temporarily - until the new technology is of general knowledge to the public. Sustainable growth is made feasible by the assumption that the creation of knowledge through private R&D yields positive external effects. The new knowledge thus adds to the public stock of technological knowledge and is accessible to all firms doing R&D themselves. Without the assumption of technological externalities, innovators would be able to establish permanent monopolies without any further efforts at R&D. If innovations are equated with new products, the model is similar to Krugman´s, describing a process of ongoing product upgrading and imitation, in which the North and South are consecutively climbing up the quality ladder.

Traditional trade theory uses differences in endowments and in relative costs to explain specialisation. For given differences in costs and endowments, decreasing transport costs or trade barriers (integration) leads to higher specialisation. This point of view can best explain how countries at different stages of development engage in trade, trade that is characterised by an exchange of goods from different industries (inter-industry trade). The traditional assumptions of constant returns to scale and perfect competition guarantee that in the absence of endowment differences, economic activity will be evenly dispersed across regions.

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[6] Hirsch (1967) stresses that factor endowments determine the location of production over the life cycle (allocating new products to developed countries, due to their strength in skilled labor), while Vernon (1966) emphasises that innovations

New Trade Theory

However, most trade occurs between countries in similar stages of development and is an exchange of differentiated products that fall into the same product category (*intra*-industry trade). This situation is explained by the new trade theory, which stress scale economies, product differentiation and imperfect competition. The first class of new trade theory models assumes that a firm’s costs decrease with the size of the local industry, while also time maintaining the assumption of perfect competition and constant internal costs. Economies of scale external to the firm build the basis for regional concentration[7]. The second class of models is based on internal economies of scale and monopolistic competition. Consumers derive utility from product variety and each variety is produced with increasing returns to scale. The direction of trade in these kinds of models can be explained only if the model is augmented by endowment differences or if transport costs make it more profitable to relocate activities to larger markets, thereby increasing returns to scale. The latter constitutes the home market effect, which means that countries are likely to export goods that are in greater demand at home (Krugman, 1980, Helpman, Krugman, 1985, Linder, 1961). Ethier (1982) shifts the interest to the input side. Inputs are produced with economies of scale, and a larger variety of components yield economies of specialisation. Trade provides each country with access to the components of the others, giving rise to "international economies of scale", leading to *intra*-industry trade for inputs.

Intra-industry trade is in general predicted to rise as countries become more similar. However, *intra*-industry trade may also involve an exchange of vertically differentiated products, with the rich or capital abundant countries producing goods of higher quality. Income and endowment differences can thus also form the basis for vertical IIT, which is an exchange of different varieties that are of different qualities (Falvey, 1981, Falvey, Kierzkowski, 1985).

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are demand driven, following the main arguments of Linder (1961), who sees innovations as a function of proximity to the market and ease of communication.

[4] Some of the more recent contributions to this literature include Panagarija (1980, 1981, 1986), Markusen and Melvin (1981) and Ethier (1982a).

New Economic Geography

Economic geography models focus on the forces of agglomeration and dispersion. Economies of scale are as essential to these models as are transport costs. It is not countries which are of central interest, but regions or locations; not trade, but the structure and share of production; and finally, not comparative advantages determine specialisation, but rather differences in market size and the concentration of demand. The larger country is predicted to have higher wages, to produce a larger variety of IRS goods and to be a net exporter of that good, when trade opens (Krugman, 1980). History may also play a role, since cumulative and circular causation can maintain and magnify past specialisation patterns The combination of transport costs and economies of scale leads to the prediction that countries become the net exporters of a specific product when it is subject to increasing returns to scale (not net importers, as traditional theory with constant returns to scale would predict). More recent advances in economic geography have combined this home market effect with forward and backward linkage mechanisms, which give rise to agglomeration economies: firms want to have good access not only to a large market (demand), but also to the inputs they need. However, if economic activity is already concentrated to a certain extent in one place, a favourable economic environment is created, which in turn supports further concentration. Regional concentration then becomes a self-reinforcing process. Migration is attracted by higher wages in the core, increases the market size and works as an additional centripetal force.

On the other hand, the forces of dispersion are essential to any model of economic geography. Various sources of dispersion have been sited in the literature: the geographic dispersion of demand from immobile agricultural workers (Krugman, 1991a, 1991b); from immobile consumers (Krugman, Venables, 1995, 1996); non-traded goods (Helpman, 1999); congestion externalities (Ricci, 1999), land rent (Elizondo, Krugman, 1996) and local public expenditure (Trifonetti, 1997).

Political concerns

The political question raised by these models is whether integration and a lowering of transport costs leads to an imbalance between a rich core and a poor periphery. One recurring feature is that there may be two phases: a first one in which agglomeration increases as trade costs decrease and a second one in which diseconomies of agglomeration (such as increasing wages) combined with ever lower transport costs lead to dispersion. See Krugman, 1991(a,b) for the effect of transport costs on the competition effect (which drives production to the periphery) and the home market or linkage effect (which attracts production). As Krugman, Venables, (1990) point out, the critical assumption for the u-shaped relationship between transportation costs and the geographic concentration of industry is that relative factor prices diverge. Anything that impedes the emergence of such differences (for example: internationally mobile labour or capital), will reinforce the centripetal tendencies. Puga (1998a) augments the model with inter-industry mobility. Finally, while within the basic framework of the new economic geography models given in Krugman (1991a,b), labour mobility is the driving force for agglomeration, another set of models stresses vertical linkages between firms, which in turn give rise to agglomeration forces (Venables, 1996, Krugman, Venables, 1995, Puga, 1998b).

As it comes to specialisation, economic geography models predict that due to agglomeration forces, the core region specialises in activities subject to increasing returns to scale, while activities related to constant returns to scale move to the periphery. This tendency can be counteracted or enforced by endowment differences. Amiti (1997) directly examines how, under otherwise equal circumstances, the size of a country can influence specialisation patterns when industries are allowed to differ in terms of factor intensities, trade costs and demand elasticities. She specifies conditions under which the larger country could specialise in labour intensive goods subject to high transportation costs at high levels of trade costs and become net exporters of capital intensive goods at low levels of trade costs. Krugman-Venables (1996) show how specialisation can be induced by sector specific agglomeration forces, when input-output linkages are stronger within industries, than between industries. Venables (1998) investigates whether industry agglomerations (one in each country) are unique and in line with comparative advantage, if countries and industries differ in productivity. Ricci (1998) presents a model in which an increase in country size, inducing the agglomeration of increasing returns activities, reduces the specialisation of that country in the comparative advantage sector within the IRS sector. He also shows that lowering trade costs can move industries into the smaller country, when the smaller country enjoys higher productivity. Bruelhart (1995) investigates the relation between liberalisation, increasing returns and *intra*-industry trade. He concludes that *intra*-industry trade will decline with progressing integration. Furthermore, if there is a time lag between the liberalisation of trade and the re-location of production there, will be an initial surge of IIT followed by a decline.

Summary

For given endowment differences across member countries, intensified integration is predicted to increase specialisation. Countries with higher incomes will specialise in capital intensive, skill intensive and research intensive industries. If endowments converge – as they should eventually in a single market with factor mobility - and industries have constant returns to scale, specialisation is forecast to decrease. In the presence of both forces - lower trade costs and converging endowments - the result is indeterminate.

High-income countries will concentrate on industries with high levels of product and process innovations, driven by forces on the demand side (new products and greater variety are demanded) and supply side (innovation rents and the capacity to make use of technological opportunities). In industries where product differentiation is important, countries specialise in products on the upper quality segment. Countries with similar incomes engage in *intra*-industry trade.

Economic geography highlights the possibility that locations and countries with optimal market access (defined by size, income level, and centrality) may profit first and stronger from integration. Industries focusing on increasing returns to scale should locate near the largest market; spillovers enforce the advantages of large markets, as do forward and backward linkages. The periphery specialises in low wage industries, in industries with less product differentiation and limited spillovers. Eventually this process is forecast to reverse, if wages rise faster in the centre, if diseconomies of agglomeration emerge and if lower transport costs make a given cost difference between the core and periphery more decisive. *Intra*-country labour mobility, inter-industry mobility, national wage policy and international migration of labour tend to enforce this view. The spatial concentration of economic activity could become a self-reinforcing process. The mobility of firms, as well as the up-grading of skills and productivity in the periphery, diminish the danger of uneven development. Industries with economies of scale, with spillovers, strong linkages and home market effects in general will locate in large countries.

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2.2 Previous empirical results on the convergence of country and industry structures

In contrast to the large amount of literature on the convergence of per capita income, literature on the concentration and specialisation of economic activities is not abundant. There is no consensus on conceptual issues and evidence appears partly contradictory. The results are summarised in Table 2.1, showing which data, variable and time period were used, which question was raised and what conclusions were reported.[8]

USA: Higher albeit declining regional concentration

Krugman 1991 shows that manufacturing is more regionally concentrated in the US than in Europe by comparing four regions in the US with four large countries in the EU. The most highly concentrated industries are not cutting edge, high technology sectors. Specifically, textiles industries are highly concentrated. The higher concentration in the US relative to Europe was confirmed in later studies. It became a stylised fact, as well as a phenomenon, which was expected to occur in Europe, once the single market took hold. Karsten (1996) cautioned that Europe was not fully comparable, insofar as skills were more dispersed, and the single market in Europe had evolved from a more fragmented structure, while in the US, the fundamental decisions regarding location were made at the start of the industrial revolution, in a market that was already integrated. Concentration declined in the US between 1947 and 1985, which combined with the additional evidence of Kim 1995, 1997 lead to the second stylised fact that regional concentration has been declining in the US with the "high water mark of manufacturing location ....reached probably in the 1920´s" (Krugman, 1991, pp. 80).

Different evidence for Europe

Dollar, Wolff (1995) found in an investigation on eight countries (including the US) that an equal number of industries were concentrating and deconcentrating between 1970 and 1986, although their main focus was on catching up and not on concentration. Bruelhart (1995) reported that 14 out of 18 industries were concentrating in Europe between 1980 and 1990; labour intensive industries exhibited the most dispersion, but also showed significant potential for future concentration, while industries with high returns to scale were already concentrated. Amiti (1998) found that production concentration increased in the majority of industries between 1976 and 1989, and that specialisation rised in six of ten European countries. The contrary was reported by Dalum et al. (1998) and Laursen (1998) for exports. Haaland et al. (1999) make the point that it is important to distinguish between absolute measures of concentration (such as concentration ratio) and relative ones (which relate concentration to country size), a topic intensively studied in Knarvik et al. 1999.

Table 2.1: Empirical literature about specialisation resp. concentration trends

Author, Year	Variable	Indicator	spec/conc	Time	Country/region	Data source	Aggregate	Result
Krugman, 1991	Employment	Sum of AD	Specialisation	1947-1985	USA	US census	3 digits SIC	In 4 regions decreasing
Bruelhart, 1995	Employment	GINI	Concentration	1980-1990	EU	EU	2 digits NACE	In 14 out of 18 sectors increasing
Dollar, Wolff, 1995	Exports	CV of RCA's	Concentration	1970-1986	9 countries	OECD	2 digits SITC	Increasing in 6, decreasing in 6 sectors
Molle, 1997	Employment	Sum of AD Locational coefficient	Concentration, specialisation	1950-1990	EU, NUTS2	EU	17 sectors	Deconcentration up to 80s, despecialisation
Amiti, 1998	Production	GINI	Concentration, specialisation	1976-1989	EU (10 countries)	EU, UNIDO	27 industries	Concentration increases in 6 of of 10 countries, in 17 of 27 industries
Dalum et al., 1998	Exports	SD of RCA's	Specialisation	1956-1992	20 countries	OECD	20 countries	In 16 out of 20 countries decreasing
	Exports	SD of RCA's	Concentration	1956-1992	20 countries	OECD	60 industries	In 55 out of 60 industries decreasing
Laursen, 1998	Exports, R&D	See above + beta	Concentration, specialisation	1971-1991	19 countries	OECD	19 sectors	Stronger decreasing in exports than in patents
Haaland et al., 1999	Production	Absolute, relative shares	Concentration	1985-1993	EU (13 countries)	OECD	35 sectors	11.4% increase in average industry
Knarvik et al., 1999	Production, trade	Absolute, relative, locational	Concentration	1970-1992	EU	OECD, UNIDO	22/27 sectors 104 industries	Tentative result: Europe tends to concentrate

Sectoral specialisation: industry structure of a country, absolutely or relative to other counties
Regional concentration: country structure ("market shares" of countries) of an industry, absolutely or relative to total manufacturing
CV: coefficient of variation
SD: standard deviation
RCA: export specialisation rates (Balassa)
AD: absolute differences

Molle (1999) found that on the regional level (NUTS 2, units smaller than countries), concentration as well as specialisation has decreased rather robustly over the last 40 years, using employment as an indicator. The robust trend did not however continue between 1980 and 1990, which is in line with studies showing convergence in productivity (but less for per capita income) in Europe. Although this trend was robust over decades, it has become less clear during more recent periods. In general, from the two strands of thought – the convergence and the divergence schools – evidence is according to Molle in favour of the first and convergence is predicted to continue: "The 40 year trend is not likely to halt ... The trend towards convergence of regional wealth may be expected to continue" (Molle, pp. 75).[9]

Technology, multinationality and quality ranges

Archibugi, Pianta (1992, 1994) find there is a convergence of aggregate Science &Technology indicators (R&D, patent intensity and bibliographic indicators). However, at the sector level, they found increasing technological specialisation. Similar results by Cantwell (1989, 1991) and Laursen (1998, using patent data) raise the question whether technological specialisation and sector

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[8] For a more extensive survey see Aiginger (1999).

[9] In a recent study (OECD, 1999), a specialisation index for NUTS 1 regions is calculated on the level of 3 broad sectors (agriculture, industry and services). The index compares the regional structure of employment with that in the EU (sum of absolute differences), and declines from 1986 to 1996. A similar index on the country level using 8 broad categories for 10 countries shows an increase in 7 countries. For trends within the service sector, see Landesmann, Petit, 1995.

specialisation might go in different directions (with specialisation in the former and de–specialization in the latter). Technological specialisation may arise from cumulative innovation and may be very persistent. See Laursen (1998) for evidence that technological content (patents) tends to diverge.

Davies, Rondi, Sembenelli (1998) report that neither concentration (now defined in the context of industrial organisation as the share of the largest *firms* in each industry) nor geographic concentration changed in Europe between 1987 and 1993. In terms of the location of production, it appears that the leading firms have dispersed their operations across more, rather than fewer, member States However, multinationality (the number of countries in which the leading firms operate) has increased, which could signify a concentration of ownership. Diversification (the number of industries in which firms operate) is larger in Europe than in the US, but the return to the core is not yet very strong. Trade increased fastest in industries seen as sensitive to the SEM (catching up from low values). Multinationality did not increase specifically in sensitive sectors (it had been high here before), but rather grew fastest where it had been low: in advertising intensive industries and in industries with low trade intensity. This could be interpreted as a convergence of the degree of multinationality.

The European Commission (1997; the study was conducted by CEPII) disentangled one-way trade from *intra*-industry trade and further disaggregated the latter into horizontal and vertical components. Again, the vertical components have different quality segments. *Intra*-industry trade is increasing; although the most recent data indicates that the increase has flattened out. Portugal and Greece have the highest shares of one-way trade. Denmark is an exception, as a high-income country with a one-way trade share of 60 %. France, Germany and Belgium have the lowest shares of one-way trade, and have the largest shares in both categories of two-way trade. The two-way differentiated category can be split again into the markets in which exports are more highly valued (upper quality segment) and in which they are lower valued. Some countries are specialised in certain industries over the entire price/quality spectrum (Denmark in agriculture, Greece in textiles). Most countries are specialised in different quality segments, with Germany being the outlier, supplying all its important industries in the higher quality segment. The conclusion is that countries may not be specialised "in industries, but rather in quality ranges in industries". This hints at the importance of productivity differences and/or of skills, and possibly indicates that specialisation according to factor intensities may not be all important.

Summary

The results appear contradictory. They urge us (i) to use a broad scale of indicators to measure trends, specifically some which stress relative positions and others which stress absolute positions; (ii) to distinguish carefully between the country dimension (whether country structure changes = specialisation) and the industry dimension (whether industries concentrate or de-concentrate = concentration); and (iii) to remember that trends can differ for different regional units (regions, countries), for different aggregates (sectors, industries) and for different indicators (production, trade, employment, technology). There are some hints that trends which once were strong in the long run (like income convergence in regions and structural convergence) at least temporarily levelled off in the eighties. And there is some evidence that trade specialisation could move in the direction of decrease, while technological specialisation and geographic concentration might go in the other direction.

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2.3 Convergence of endowments

The main purpose of this chapter is to analyse, whether there has been a tendency for endowments of European countries to become more similar over the course of time. Theory predicts that for given endowment differences, integration should lead to more specialisation. On the other hand, integration should itself decrease endowment differences. Endowment is treated here in the perspective of traditional trade theory, that is as given before production decisions are made. We have to acknowledge that endowments for some factors are not supplied by "first nature" that is exogenously given once for all, but created, adjusted and updated over time. Dynamic analysis, economic geography and strategic management literature stress this very important fact.

Table 2.2: Country and time coverage of endowment variables

	R&D capital stock	Physical capital stock	Labour
Belgium		*	*
Denmark	*	*	*
Germany	*	*	*
Greece		*	*
Spain	*	*	*
France	*	*	*
Italy	*	*	*
Ireland	*		*
Netherlands	*	*	*
Austria		*	*
Portugal		*	*
Finland	*	*	*
Sweden	*	*	*
United Kingdom	*	*	*
	EU 10	EU 13	EU 14
Years analysed	1980-1996	1980-1995	1980-1996

Source: WIFO calculations using OECD.

Resource abundance and concentration

A factor is defined to be abundant in a country, if its supply is large relative to other factors. From theory, what matters for specialisation in terms of endowments is their relative concentration. Countries which have much capital (relative to its supply of labour and research capacity) is predicted to specialise and export capital-intensive goods. We measure endowments not only in the relative way, but report also how much of the total supply is available in the largest countries (absolute concentration) and how concentrated the supply is relative to economic activity (relative concentration). This and the choice of similar indicators are done to maximise comparability with the following analysis of specialisation and concentration of production and trade. Note that resource abundance[10] in the present analysis is defined relative to EU factor endowments and GDP. In a strict sense the comparison should be with world endowments and world GDP. Thus it could be that countries which in our sample appear to have an abundance in labour would actually be measured to have a scarcity if the major suppliers of labour intensive goods outside Europe were included.

Box 2.1: Data sources and measurement methods

The variables that have been selected to represent endowment profiles of the EU countries include measures of labour, physical capital and the R&D capital stock. The intermittent nature of the data makes the collection of resource data quite difficult and involves compromises. Thus, besides their presumed economic importance, resource data for EU countries were selected primarily on the basis of data availability and international comparability. It is especially difficult to get internationally comparable figures on physical capital stocks or R&D capital stocks due to different underlying estimation procedures and assumptions on the retirement patterns of fixed assets.[11] To improve international comparisons of figures and especially to improve coverage, the data set includes own estimates for the physical capital stock and the R&D capital stocks. The endowment data set was intended to cover the period from 1980 to 1996, but due to the incompleteness of the primary data sources the country coverage as well as the time series are different across the variables used.

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[10] These resource abundance ratios in turn are indicators of factor abundance on the assumption that GDP is a linear function of the endowments (weighted shares of endowments with weights equal to (world) factor earnings). Then, if the share of an endowment i in country j (V_{ij}/V_{iEU}) exceeds the country's GDP share (Y_j/Y_{EU}), the country is said to be abundantly supplied in factor i compared with other resources on the average. If GDP is a non-linear function of the endowments (if scale economies are important or if factor prices are not equalised) a comparison of a resource share with the GDP share will not reveal the abundance of the factor compared with other factors on the average. However, comparisons of the absolute abundance ratios are nonetheless appropriate, since they will reveal the relative abundance of the two resources considered.

[11] For more details see: OECD (1993).

To be able to compare between variables and abundance profiles of countries more directly we have chosen to first constrain the data set to nine EU countries and the 15 years from 1980 to1995 for which all variables were available. We then calculated indicators for each of the variables individually covering the longest time period and highest country coverage possible. Table 2.2 lists the variables as well as the time and country coverage for each of the variables, which will be described in more detail in the following.

Physical Capital Stock: Estimates of the stock of (physical) capital (CS) for each country were derived by the Perpetual Inventory Method which adds gross domestic investment (I) to an initial estimate of the capital stock, applying depreciation factors based on an assumed average asset live:

$$CS_t = (1- d)CS_{t-1} + I_{t-1},$$

where ? ? is the depreciation rate. The benchmark for CS, or initial estimate of the capital stock was calculated by the following formula:[12]

$$CS_0 = I_o /(g + d),$$

where g is the average annual growth of gross investments over the period for which data was available.

The basic data for the estimates of the stock of (physical) capital for each country were taken from the OECD STAN Database for Industrial Analysis. This source provides figures in domestic currency on gross fixed capital formation for the industrial sector and include investments in machinery and equipment, buildings and land (improvements). Most countries follow the recommendations of the United Nations System of National Accounts (SNA) in deciding which types of good to include in gross fixed capital formation.[13] Data were given for 1970 to 1995 for all of the EU countries with the exception of Ireland and Luxembourg. Data for Spain commence in 1978. Implicit gross domestic investment deflators with base year 1990 were used to obtain real investment expenditures.

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[12] This procedure was suggested by Griliches (1980) and used in Coe-Helpman (1995) to estimate benchmarks for R&D capital stocks.

[13] For more details see: OECD(1993).

Ideally, disaggregated investment series with the appropriate depreciation factors should be used to arrive at estimates of the capital stock. However, data limitations make such an approach impossible in this study. Thus, aggregate gross investment flows are taken, along with the assumption of an average life of assets, also ignoring the fact that countries may concentrate their investments on either short- or long-lived assets.

Our estimates of the capital stocks are based on a supposed average asset life of 15 years corresponding to a depreciation rate of 6.7% if one assumes a linear depreciation pattern. Finally, the domestic capital stocks were converted into US dollars using 1990 purchasing power parity exchange rates for investments from the Penn World Table.

R&D capital stock: The variable R&D stock measures the business sector research and development capital stock. The estimation procedure is the same as for the physical capital stock and is based on R&D expenditure data from the OECD's Main Science and Technology Indicators (the BERD series). These data are very incomplete with unavailable or incomplete observations for some of the years under study. For part of the countries the gaps could be filled using the ANBERD series which include OECD estimates for some of the missing years. The result is then a time series from 1974 to 1996 for ten EU countries. R&D capital stocks were then calculated using a depreciation rate 15%.[14]

Labour: Finally, labour is measured by the economically active population taken from the OECD labour force survey.

The main results for a nine-country data set

We focus on three types of endowments: labour, the stock of physical capital and the stock of R&D capital (see Box 2.1 for the data and the calculation). The relation between the three factor inputs can be best demonstrated in a triangle (called endowment simplex) in which the factors are represented by the vertices of the triangle and the abundance in a factor is indicated if a country approaches the vertex for this factor. Figure 2.1 represents the endowment simplex for nine EU countries for which data on all the variables were available for the given years. The figure has two points and nine arrows.

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[14] Coe, Helpman (1995) used depreciation rates of 5% in their estimates of R&D capital stock. However, depreciation rates for R&D-expenditures are typically estimated to be considerably higher and a number of studies have assumed depreciation rates of 15% (Griliches, 1990). We have done our calculations of the R&D stock for a depreciation rate of 5% also but report results for a 15% depreciation rate only, in part because to us it seemed to be the more realistic assumption, but also because depreciation rates did not seem to make any strong difference to empirical results on the changes of the geographic concentration of the R&D capital stock.

Roughly in the middle of the endowment triangle is the point representing the total endowments for the nine EU countries in 1995, the second point represents endowments in 1980 (plotted on 1995 scales)[15]. The nine arrows show the starting position of the individual countries and their movement between 1980 and 1995. Thus, relative endowments of all countries can be compared to that of the whole group, as well as their change over time. Two results emerge from this figure. The first is the movement of all countries toward the R&D-vertex of the triangle suggesting relatively strong R&D capital accumulation in all of the considered countries. Specifically, the strong movements of Finland, Denmark and Spain, which were at the low end indicates rather strong convergence for the R&D capital stocks. Sweden is moving fast, too and is now the country with the relatively largest R&D-stock. Secondly, for most countries the arrows move towards the EU average, which suggests that the pack of countries has grown a little tighter over the time period considered, and greater similarity in factor endowments of the countries.

Table 2.3: Geographic concentration of factor endowments

	R&D capital stock (EU 9)			Physical capital stock (EU 9)			Labour (EU 9)		
	1980	1995	Change[1]	1980	1995	Change[1]	1980	1995	Change[1]
Sample A:									
Absolute concentration									
CR3	80.2	76.2	-4.0	69.2	68.8	-0.4	61.4	64.3	2.9
CR5	92.9	90.1	-2.8	90.1	88.4	-1.7	88.2	88.9	0.7
Herfindahl Index	0.23	0.22	-0.01	0.20	0.19	-0.01	0.17	0.18	0.01
Standard deviation of shares	12.38	11.70	-0.68	10.52	10.06	-0.45	8.52	9.12	0.60
Relative concentration									
Standard deviation of resource abundance ratios 1)	0.48	0.42	-0.06	0.26	0.23	-0.03	0.16	0.09	-0.07

	R&D capital stock (EU 10)			Physical capital stock (EU 13)			Labour (EU 14)		
	1980	1995	Change 1)	1980	1995	Change 1)	1980	1995	Change 1)
Sample B:									
Absolute concentration									
CR3	80.1	75.9	-4.2	62.4	61.5	-0.9	54.4	56.5	2.1
CR5	92.8	89.7	-3.1	81.3	79.0	-2.3	78.2	78.1	-0.1
Herfindahl Index	0.23	0.22	-0.01	16.51	15.66	-0.86	0.14	0.14	0.01
Standard deviation of shares	12.2	11.5	-0.7	8.6	8.1	-0.4	7.0	7.4	0.3
Relative concentration									
Standard deviation of resource abundance ratios 2)	0.50	0.44	-0.06	0.40	0.32	-0.08	0.23	0.21	-0.02

1 Change in % points.
2 Resource abundance ratio: relation of endowment (R&D capital stock, physical capital stock, labour) relative to GDP
Sample A: Maximum of compatibility: indicators for 9 countries: DK, DE, ES, FR, IT, NL, FI, SE, UK
Sample B: Maximum of countries available (see Table 2.2)

Source: WIFO calculations using OECD.

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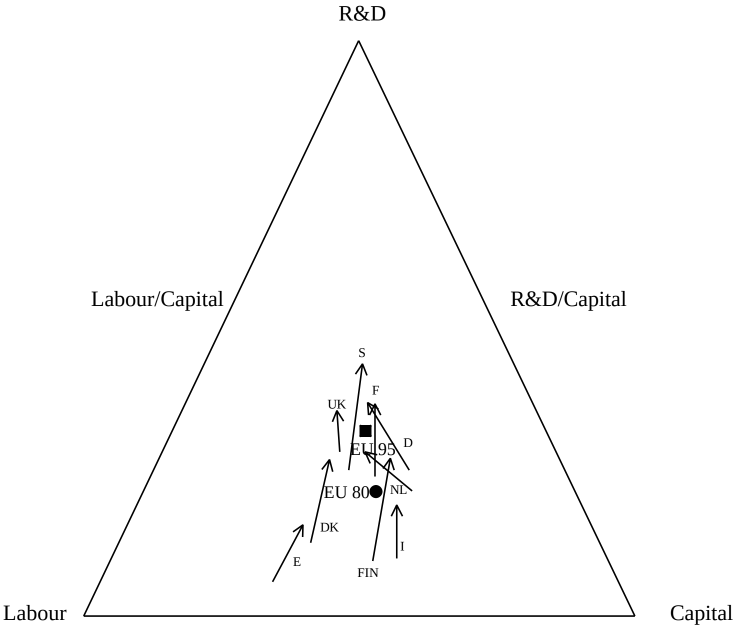
[15] See Leamer (1987) for the construction and use of endowment triangles.

The calculated indicators confirm these findings. Resource abundance ratios can be analysed from the perspective of individual countries (specialisation profile) and from the perspective of the input factors (geographic concentration of the factor). Both perspectives should in general arrive at the same conclusions and they do so for our data set. Analysing resource abundance profiles of countries first, we find that the standard deviations in seven out of nine countries decrease indicating that abundance profiles in these seven countries moved closer toward the EU average profile. Secondly the standard deviation of the factor abundance ratios across countries decrease, suggesting a lowering of the relative geographic concentration of all the three factors considered. This process of deconcentration is more pronounced for labour and the R&D-stock and less so for the capital stock (Table 2.3).

Fig 2.1: Changes in endowment ratios: 1980 and 1995



All countries move closer to the R&D-vertex and are grouped
more tightly around the EU average in 1995 than in 1980.

Source: WIFO calculations using OECD.

Trade theory builds its forecast on relative endowments. Economic geography also emphasises the importance of absolute size. The results on absolute concentration indicators for the 9 EU members point clearly to a decrease in the geographic concentration over time of the R&D-stock and the capital stock too, but to a higher absolute concentration of labour. The geographic concentration of labour decreased in relative terms so that a combination of the two results, suggest that the importance of the factor labour shrinked in some of the small countries and gained in some of the larger (Germany, United Kingdom) with the effect of bringing countries like Spain and Denmark closer to the rest.

A comparison between the factors shows that the R&D-stock is the most geographically concentrated of the endowments, but also the factor which according to our data converges fastest.

Robustness proved by an extended data set

As we look at each of the factor endowment variables individually and extent the data set for each to the longest time period and highest country coverage possible (which is different for the different variables) we arrive at basically the same results. Measures of relative concentration indicate a clear tendency for a more equal spread of physical capital and R&D-capital as well as for labour over the whole period. Standard deviations of factor abundance rations across countries clearly indicate the tendency for decreases in the geographic concentration of the endowment variables considered.

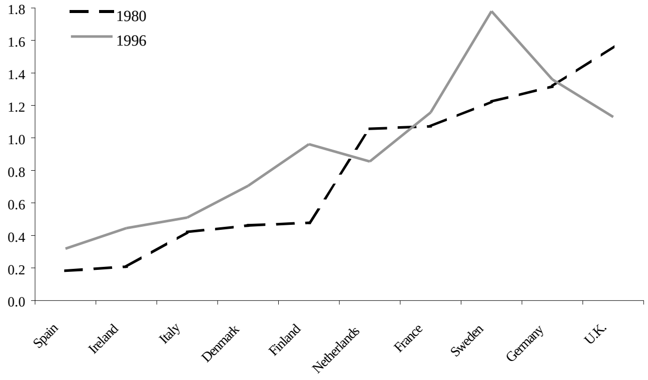
In Figure 2.2 we plotted the corresponding country share data for the individual factors to better assess the developments underlying the overall process of deconcentration. The first important point to note is that the line connecting the country points became flatter for all three factors considered and mostly so for the R&D capital stock which is an indication of the decreasing concentration.

As revealed by Figure 2.2, deconcentration in the R&D-stock is mainly driven by a catch up of Ireland and Finland, but also Spain and Denmark. On the other hand Germany’s geographic share of the R&D-stock only increased slightly, while relative shares shrinked for the Netherlands and the UK. Looking at indicators of absolute concentration one gets the same picture with all the relevant indicators decreasing, and the same tendencies in the share data.

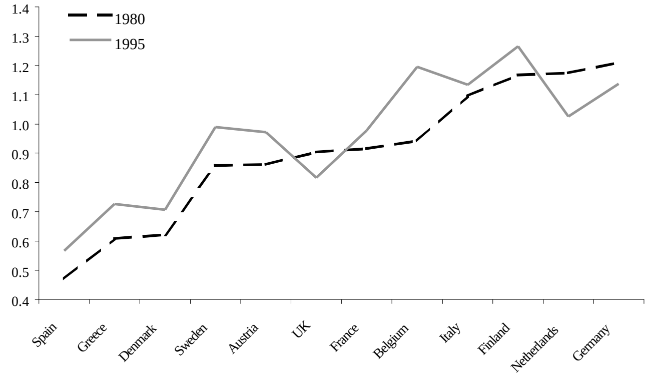
Data for the capital stock comprise the 13 countries as indicated in Table 2.3 and from Figure 2.2 one can see that the relatively strong capital accumulation in Spain and Portugal, but also investments in physical capital in Greece and Denmark on the one hand and the decline in Germany’s capital abundance ratio on the other hand are at the bottom of the overall decrease in the relative concentration of the factor capital. Again, also absolute concentration measures underline this deconcentration process over the last 15 years from 1980 to 1995. Concentration as measured by the share of the three countries with the absolute largest capital stocks decreased by roughly one percentage point from 62.4% to 61.5% in 1995. The decrease was stronger for the CR5, which can be explained by a loss of shares of the UK and the Netherlands.

Fig 2.2: Changes in country abundance ratios

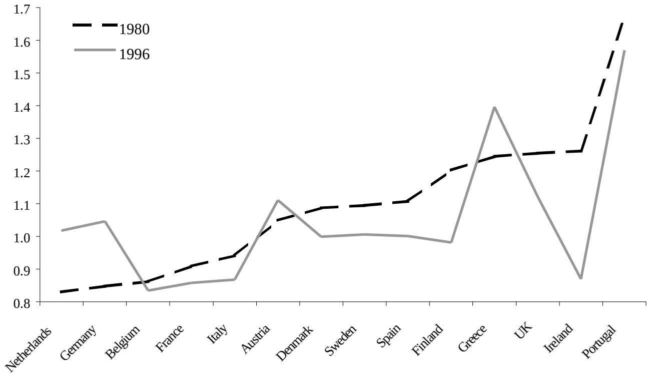
R&D capital stock 1980 and 1996 relative to GDP



Capital stock 1980 and 1995 relative to GDP



Labour 1980 and 1996 relative to GDP



Source: WIFO calculations using OECD.

Finally, looking at the labour data for all 15 EU member countries, we see relative concentration measures decreasing, while absolute concentration of labour increased in the same period. This is a result we have already derived in the analysis of the subgroup of nine EU countries. It indicates that the importance of the factor labour obviously decreased in some of the smaller, labour abundant countries while the importance of labour must have increased in some of the larger, traditionally capital- and R&D-intensive countries. From the share data plotted in Figure 2.2 we can read this tendency especially for Ireland, Finland, but also for Spain, Denmark and Portugal. Underlying the increase in the CR3 is the increase of Germany's geographic labour share, which could come as a result from the German unification.[16]

Conclusion

All these results taken together lead us to conclude that factor endowments indeed became more similar over the past 15 years. We have also seen that this process of deconcentration is driven by a catch-up of countries like Spain, Ireland, Finland and Denmark by accumulating R&D-capital and to some extent also Portugal and Greece by investments in physical capital. Any increase in specialisation arising due to integration will be therefore be dampened by the decreasing differences in endowments within the member countries.

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[16] Having found that a process of convergence of endowments is going on, the question arises whether it is fast or slow. A convenient – albeit partial measure is – to calculate how long it would take to close the gap towards the leading countries. We did this for research intensity (the input which changed fastest) and defined the top ranking three countries in research intensity as the benchmark. The time period needed to close 50% of the gap to the chosen benchmark is lies between nine years for Ireland and more than 50 years for Italy. These hypothetical calculations assume that the tendency shown between 1980 and 1996 will prevail. We conclude that firstly, the catching up process if very different across countries and secondly that it seems to be possible to accelerate it by active policies promoting research and development. Further investigations should monitor the convergence of endowments, extend the data on endowments and measure convergence speed for other inputs.

3. Specialisation of European Manufacturing

3.1 Empirical strategy, definitions, data

The main task of this chapter is to describe the empirical specialisation pattern of production and trade in the European Union, and more specifically to determine whether specialisation is increasing or decreasing. The theoretical chapters have provided background hypotheses, some of which can be confronted with empirical data. Trade theory suggests focusing on exports and trade balances, and looking for patterns of specialisation arising from endowment differences, product differentiation or economies of scale - all of which are magnified by deeper integration. Economic geography suggests investigating the shifting division of labour across countries and regions and looking at whether concentration is increasing and production is shifting between the core and the periphery. The predictions allow for different outcomes, depending on the relative strength of the economies of scale, on the importance of transport costs and on the degree of comparative advantage, even if the problem at hand is well defined. Empirical data are influenced by a multitude of forces, be it globalisation, integration, cyclical development, or policy influence, so that we cannot expect the outcome to be in line with a specific theory.

In this chapter, we report on trends in the specialisation of countries; in the next chapter we investigate trends in the concentration of industries, first rather descriptively (see Box 3.1 for definitions of the terms specialisation and geographic concentration). Finally, we take a step towards explanation, looking at the influence of inputs, scale economies, skills and market structure, to learn from typologies and classifications - partly proposed by the theory, and partly by previous empirical studies on the underlying forces of real world shifts.

We use data on value added from 1985 to 1998 to determine specialisation in production and trade, and data from 1988 to 1998 to analyse how specialisation in trade has changed. We chose seven indicators of specialisation to show us whether increasing specialisation or de-specialisation (dispersion across industries) is the stronger trend. The same indicators are used in chapter 4 to evaluate the concentration or de-concentration of industries. For trade, we add an additional indicator, which combines information on exports and imports, while the others refer to exports only (see Box 3.2).

Box 3.1: Definitions of specialisation and concentration

The terms ***specialisation of countries*** and ***geographic concentration of industries*** are defined differently. Many indicators are used to quantify the trends. We must be clear in our definitions.

We define ***specialisation*** as the (distribution of the) shares of an industry in total manufacturing in a specific country *j*. Sweden is said to be specialised in the paper industry, if this industry has a high share in the value added of Swedish manufacturing. The production structure of a country is called "highly specialised", if a small number of industries is responsible for a large share of the production. This will be called **"production specialisation"** [17]. Specialisation can also be measured for exports, or for exports and imports together. If we take exports alone, we are speaking about **"export specialisation"**, if we use information about exports and imports we are speaking about **"trade specialisation"**. If the production or export structures disperse (shares become more equal across industries), we are speaking about de-specialisation or dispersion.

We define geographic ***concentration*** as the (distribution of the) shares of EU member countries in an individual industry i. The pulp and paper industry is said to be concentrated, if a large part of production is carried out in a few countries. Again, this interpretation can be applied to various variables (production, exports, trade) and different indicators can be used to measure concentration and its change. We use the term "geographic concentration of an industry" to make clear that the distribution in the geographic dimension is addressed. We do not use the term regional concentration, since regional economists maintain correctly that countries are not the best regional unit (being too large and too different in size). Note further that concentration is used in industrial economics to express the shares of large firms within an industry; geographic concentration should not be confused with firm concentration.

Specialisation, as well as geographic concentration, can be investigated at the sectoral level (22 sectors, NACE 2 digit) or at the industry level (95 industries). Data are available for 14 member countries (Belgium and Luxembourg are reported together).

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[17] More precisely, we measure output or production by the value added at factor costs. While this has some disadvantages (exports are gross), it has many advantages; double counting and differences in the vertical integration over time will not effect the value added. The value added is one of the indicators most closely related to the goal of competitiveness, namely to contribute to rising factor incomes and welfare.

In brief, there are three choices to be made:

- The direction in which shares are analysed (across industries or countries)
- The variable to be addressed
- The indicator used to quantify the trends

3.2 The main trends for production and exports

The data reveals no single, dominating tendency, either in the direction of increasing specialisation or in the direction of dispersion. However, the data show that production specialisation tends to increase marginally, while export specialisation tends to decrease.

Production specialisation increases weakly

The increasing specialisation of countries is a weak tendency; it depends on indicators and the time period analysed. There are significant differences across countries. However, the share of the largest industries in ***production*** (i) increased in most individual countries, (ii) increased at the sector level, as well as at the industry level and (iii) in the average of the member countries. Taking 7 indicators, 14 countries and two levels of aggregation results in 196 signs, 133 of which are positive, indicating that the forces towards the specialisation of European production are dominant.[18]

If we look at the development over time, we see that specialisation tended to decrease from 1985 to the beginning of the nineties, and to increase since then. A comparison with the period 1988 to 1998, which we use to maximise the comparability with trade data, may to some extent overestimate the trend towards production specialisation. On the other hand, starting the analysis in 1990 or 1991 would aggravate this even more. We simply index and average the seven specialisation indicators for production and the eight indicators for trade into a "composite indicator", illustrating this trend in Fig. 3.2.

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[18] This result is statistically significant at the 99% level. Significance tests relying on one indicator only prove the significance of rising specialisation for all countries (taken together) and for Ireland.

Table 3.1: Production specialisation increases, export specialisation decreases

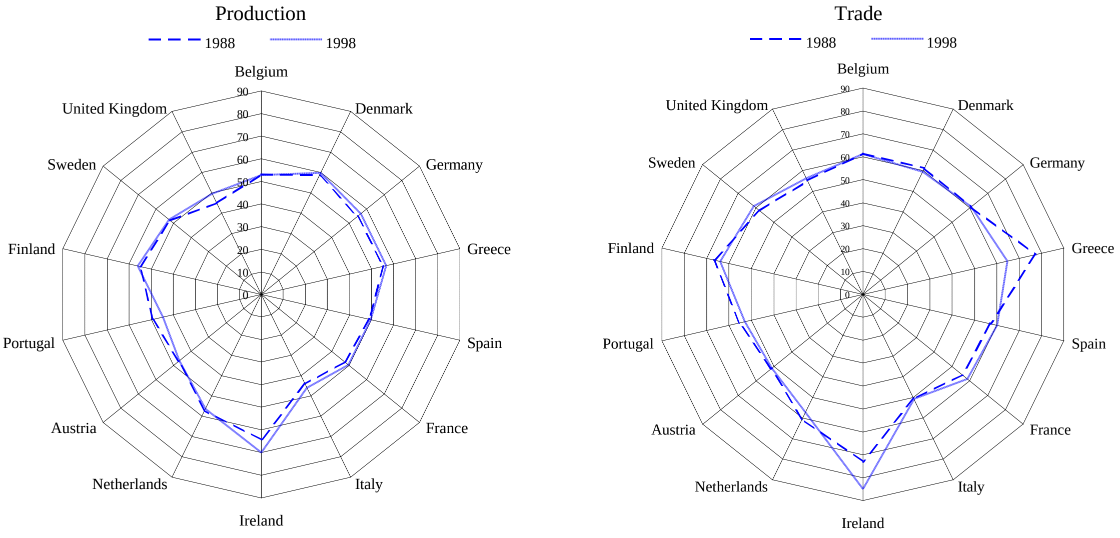
	Production Indicators increasing/decreasing						Trade Indicators increasing/decreasing					
	Sector level		Industry level		Total		Sector level		Industry level		Total	
	+	-	+	-	+	-	+	-	+	-	+	-
Belgium	2	5	3	4	5	9	2	6	0	8	2	14
Denmark	3	4	7	0	10	4	0	8	1	7	1	15
Germany	7	0	6	1	13	1	6	2	5	3	11	5
Greece	6	1	4	3	10	4	0	8	0	8	0	16
Spain	4	3	2	5	6	8	6	2	5	3	11	5
France	6	1	1	6	7	7	6	2	4	4	10	6
Italy	7	0	3	4	10	4	7	1	3	5	10	6
Ireland	7	0	7	0	14	0	8	0	7	1	15	1
Netherlands	0	7	1	6	1	13	2	6	7	1	9	7
Austria	5	2	6	1	11	3	3	5	4	4	7	9
Portugal	0	7	4	3	4	10	0	8	0	8	0	16
Finland	7	0	7	0	14	0	1	7	1	7	2	14
Sweden	7	0	7	0	14	0	4	4	2	6	6	10
United Kingdom	7	0	7	0	14	0	1	7	4	4	5	11
Sum of signs	68	30	65	33	133	63	46	66	43	69	89	135

Remark: Number of positive and negative changes between 1988 and 1998 (indicators see box 3.2)

Source: WIFO calculations using SBS and COMEXT.

Fig 3.1: Production and trade specialisation: 1988 to 1998

Share of the largest five sectors



Source: WIFO calculations using SBS and COMEXT.

Box 3.2: Indicators of specialisation and concentration: an overview

Specialisation and concentration indicators are numerous. Each offers some advantages and highlights certain aspects. They are similar to the indicators used in industrial organisation and welfare economics, where the main goal is to measure the market power of firms and the degree of income inequality. In order to minimise the chance that different indicators produce different results, we use the same indicators to measure specialisation and concentration.

Concentration ratio: This indicator calculates the share of the largest n units in the total and is called CRn, e.g. CR3, if we are talking about the share of the largest three industries. It is easy to calculate and easy to interpret. Its disadvantages are that it makes use only of the information provided by the largest units, that the relative size of each unit within the group of large units is not accounted for, and that there is no good guide as to how large n should be. We have chosen n to be either three or five, if we are analysing specialisation at the sectoral level or concentration at the country level; and five and ten, if we are analysing specialisation at the industry level.

***Herfindahl* (H)**: This measure is popular in industrial economics and in competition policy. It sums up the squared share of each sector or industry in total manufacturing. Though the measure formally makes use of all information, its value is heavily influenced by the largest (market, export, country) shares.

Standard deviation of the shares (sd-shares): This takes into account all available information, highly weighting positive and negative outliers. In the literature on the convergence of income, it is one of the most commonly used indicators. Sigma-convergence is reported if the standard deviation of per capita income or between productivity falls. It is regularly used in specialisation studies, but less often in industrial organisation.

Specialisation rates (SR): these divide the share of an industry in one country into the share of the same industry in some total. If we are measuring specialisation, a specialisation rate divides the share of a country in an industry into its share in total manufacturing. If we are measuring geographic concentration, it divides country shares in an individual industry into the country shares in total manufacturing. In trade analysis, this indicator is called RCA-Balassa (in contrast to a net-RCA which combines information on exports and imports), in geography it is sometimes called the locational coefficient. The information about the relative position in each industry must then be summarised again by calculating the standard deviation of the specialisation rates. This indicator uses all available information; it needs a norm and gives a rather large weight to small industries and countries. It is sometimes called a measure of "relative concentration", since the share in a specific industry is related to that in manufacturing. Indivisibility causes the ratio to grow quite large for small industries and small countries, heavily influencing the resulting indicator. Furthermore, since the ratio is not symmetric (it is between 1 and infinity for positive specialisation and between zero and one for negative specialisation), SRA = (SR –1)/(SR + 1) must be used to transform the ratio into symmetry. This transformation is specifically useful in econometric work; its standard deviation is known as sd-SRA.

Sum of absolute differences (dissimilarity, sum-AD): Here, the differences between the shares in a country and the norm are summed up, without regard to the signs. It strengthens the dissimilarity of a specific country from a norm; all available information is used. Since absolute differences are added together, problems do not arise from relations and the weight assigned to small industries is correctly sized.

Gini coefficients: this indicator sums up differences in the specialisation rates by accumulating the (differences in the) shares of a country and the shares of the norm (EU), after ranking the industries according to their specialisation ratios. It is a summary measure using all information, and weighting it. Its advantages and disadvantages are discussed in the literature on income distribution (Lorenz curves). A specific Gini coefficient can correspond to different distributions, and it is difficult to interpret the absolute value derived.

The above mentioned indicators define a wide span. The CRn is the most intuitive, the Ginis and Herfindahl may be the most abstract. Some of the indicators do not measure a country against a norm and are therefore called absolute indicators (the first four). Others relate industries or countries to such norms as specialisation rates, the dissimilarity index or Ginis (the last three indicators). Absolute indicators implicitly focus attention on large countries; relative indicators often implicitly give more weight to small countries. The difference between absolute and relative indicators was stressed in Haaland et al. (1999) and in Knarvik et al. (1999), whereas the latter defines a parallel for each indicator and an absolute and a relative version.

Export specialisation decreases

Switching to ***exports,*** we find there is a tendency of decreasing specialisation. There are only five countries in which the majority of indicators exhibit increasing specialisation in exports: Germany, Ireland, Italy, France and Spain. With the exception of Ireland, these are large countries. There is a group of countries in which export specialisation is declining, while production specialisation is increasing. This group includes the United Kingdom, Sweden, Finland and to some extent Greece. In the other five countries, export specialisation is declining, contributing to a total of nine countries with downward trends. The indicator for which this downward trend is most pronounced is the RCA value, which provides information on net trade (see Table 3.3).[19] It declines in 12 countries on the sectoral level and in 13 on the industry level; the average decline is rather strong. It is this indicator which is used predominantly in empirical work, in efforts to provide evidence on specialisation, as predicted by the Heckscher Ohlin theory, namely on the relative specialisation of exports and imports. If we again count signs, we see that 89 of the total 224 indicators[20] are positive, showing that the data reject the hypothesis that the result could just come by chance. In our following work, we do not give country specialisation profiles[21], but rather only highlight developments which are significant to an understanding of the main movements of changing specialisation.

The different trend in production and in export specialisation may be a consequence of the fact that the latter had been higher before and that deeping of the integration leads to an adjustment of the production structure. It may also come from differences in definitions used for exports and production, different dynamics of consumption and imports and from strategies of multinational firms. We try to get information by analysing the trends by countries and investigate in which industries the trends diverge most.

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[19] The RCA is measured here as exports related to imports in an industry relative to total exports/imports. On the 3 digit level, this ratio is declining in all countries except Ireland. The specialisation rates (called RCA-Balassa) declined in all 14 countries.

[20] For trade, we have 224 signs (8 indicators, 14 countries, 2 levels of aggregation). Since only 89 are positive, we can reject the possibility that this result is driven by chance (with 99% significance, applying a binomial test).[21] See Aiginger (1999).

Germany, Italy and Ireland: Production and export specialisation rise robustly

Germany

Germany starts from a position with a moderate degree of specialisation. Production specialisation decreased between 1985 and 1990 or 1991, and has been exhibiting a rising trend ever since.[22] The large sectors are those which are large in the EU total - of which Germany has been producing slightly less than one third. However, German manufacturing is more specialised in its leading sectors. These are the skill intensive mainstream sectors of machinery, motor vehicles and chemicals, with electrical machinery and metal products following. The ranks of the leading sectors are constant, their share is now slightly larger.

Export specialisation follows production specialisation in its upward trend; 11 of 16 indicators are on the rise. However, if we measure trade specialisation by the standard deviation of the net exports (exports minus imports, see the net RCA value), specialisation declines for sectors, as well as for industries. The reason is twofold and holds more generally for other countries: the first is an increase in *intra*-industry trade in a stronghold, the second is weak demand in resource intensive industries with traditional trade deficits.

- The share of the motor vehicle industry in German total exports is increasing from an already high level of 17.4% to 18.9%. But since imports surged from 8.4% to 12.1%, the relative specialisation (more precisely, the export surplus of the industry relative to total manufacturing) declined. This relation is captured by the RCA-value which amounted to 0.67 in 1988 and declined to 0.55 in 1998. The economic background is an increase in the *intra*-industry trade.
- Most of the resource intensive industries had large negative RCA-values in 1988, which declined up to 1998. Petroleum products and pulp and paper are examples of sectors with traditional import surpluses. However, while the low exports kept us with the general growth of total exports, the absolutely higher imports did not with import growth, thus decreasing the net RCA. Economically the low income elasticity of these industries, the ability of downstream industries to economise on inputs, as well as the ability to uphold exports in niches or across borders contributed to decreasing specialisation as measured by RCA.

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[22] The data now includes the Neue Länder; these new regions did not decrease the degree of specialisation but rather complemented the old structure.

Table 3.2: Country tableau of specialisation trends

		Trade specialisation		
		Increasing	No change	Decreasing
Production specialisation	Increasing	Ireland Germany Italy	Denmark Austria	Finland United Kingdom Sweden Greece
	No change	Spain	France	Belgium
	Decreasing		The Netherlands	

Source: WIFO calculations using SBS and COMEXT.

Box 3.3: Data bases used and treatment of missing values by WIFO

Terminology: 2 digits are called sectors, 3 digits are called industries

Scope: Manufacturing is from NACE 15 to 36

Export data**:** COMEXT (provided by EUROSTAT) available from 1988 to 1998

EU = EU 12 up to 1994, EU 15 since then

WIFO added data for A, SF, S for 1988 – 1994 by SITC (UN) + conversion

Estimated due to missing data - December 1998 for Ireland

Production Data

SBS (Structural Business Statistics, provided by EUROSTAT) from 1985 to 1998

Complete for total manufacturing (up to publication in 1997; in the 1998 data set some previously reported figures on total manufacturing were deleted).

Some missing entries on 2 digit and up to 30% missing values on 3 digit, specifically early and late years, were interpolated or substituted by techniques described in Aiginger (1999).

These two components of decreasing standard deviation of net RCA values are valid for other countries, as well (see Table 3.3).

Germany has a larger than average sector of mainstream industries, and is holding this constant. The share of research intensive industries decreased, while the small segment of advertising intensive industries increased. Moderately globalised industries have a high share in Germany, which they are strengthening.. The increase in the sector of low wage industries may be due to the incorporation of the Neue Länder (of the new provinces from former East Germany).

Italy

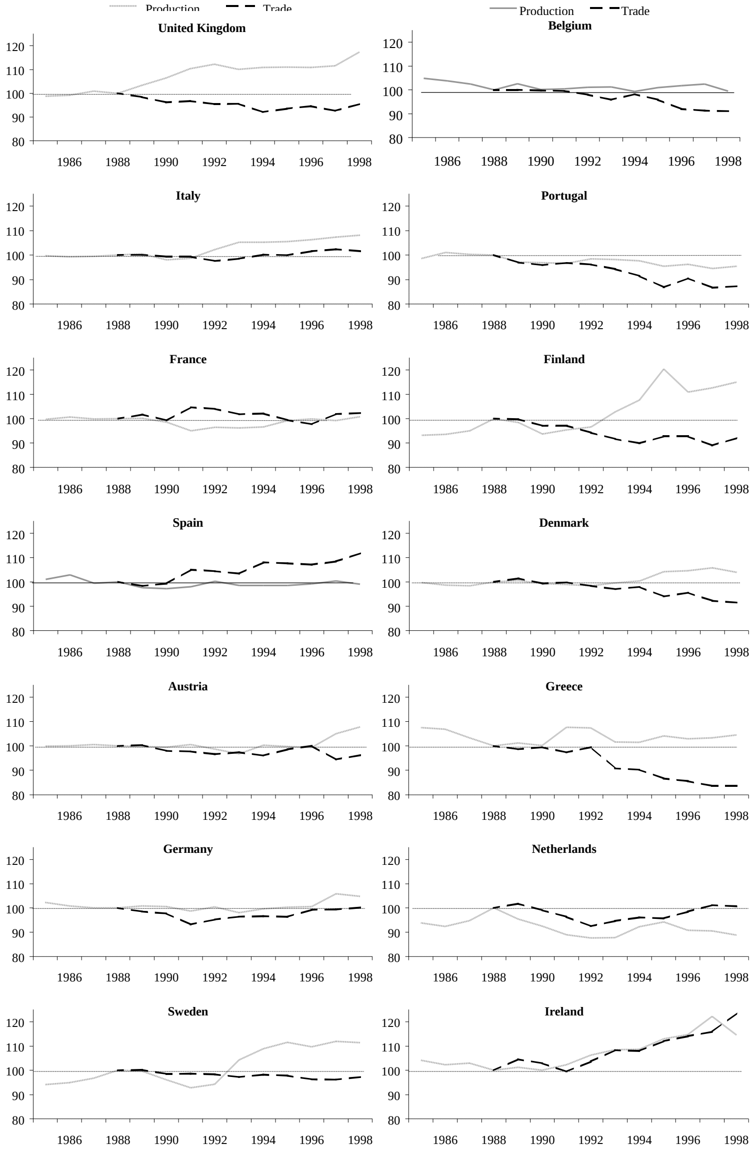
Italy started from the lowest level of specialisation among the member countries; its specialisation is now increasing for production and exports. The driving force is the persistent rise in the machinery industry, which presently accounts for 14% of production and 21% of exports. A stronghold which has been lost is office machinery. The shares of the textile industries have been decreasing slightly, but less than in other countries, leading to increasing market shares for Italy in this sector, to an increase in Italy’s share of labour intensive industries, and to more dissimilarity in Italy’s production structure from the EU average. However, Italy is focusing on the quality segment of the textile industries. The unit value of its exports is significantly higher than that of average European exports (see chapter 5.1). Italy was confronted with a strong currency devaluation during the period under investigation, in addition to a shift in its policy regime to meet the criteria for the Monetary Union.

Ireland

Ireland maintained its position as the most specialised country. During the last ten years, it continued to intensify its specialisation. The top three sectors in Ireland produce 56% of its industrial output. The largest sector is the chemical sector (basic chemicals and pharmaceuticals), whose production share increased from 16.4% to 27.2%. Large increases also took place in office machinery and in the printing and publishing sector (reproduction of recorded media). Ireland also has the highest degree of structural change (mobility of structure): the food industry, which was a former stronghold, lost seven percentage points; textile industries and wood related industries were never strong, and continued to decrease their shares.

Ireland now has the largest share in manufacturing in research intensive industries, although these are mainly subsidiaries of multinational firms with headquarters outside of the country. Ireland’s share of labour intensive industries is the lowest in Europe. Ireland is positively specialised in high growth, highly globalised industries, in the high productivity sector, and has reinforced all of these strengths during the last decade. The structural funds, a tax policy favourable for businesses, the upgrading of its educational system and the return of skilled workers have together created a successful policy mix which attracts and upgrades firms in dynamic industries.

Fig 3.2: Specialisation trends in production and exports



Remark: Composite indicator (indicators are indexed; unweighted average, 1988=100). Countries are ranked from low to high specialisation in 1988.

Source: WIFO calculations using SBS and COMEXT.

United Kingdom, Finland, Sweden and Greece: Specialisation in production but not in exports

United Kingdom

The difference between increasing the specialisation of production and decreasing the specialisation of exports is driven by developments in three sectors: food, chemicals, and publishing and printing. In the food sector, production seems to have substituted imports. In the chemical sector, this has not been the case. In printing, export shares are generally low. In machinery, industry production as well as exports has lost shares. In basic metals production, the decline was less steep than export losses, contributing to the divergence of production and export trends. The contrary development has been evident in car manufacturing, where production has risen less than exports.

Relative to the EU, specialisation is strongest, as well as increasing, in other transport (aircraft and spacecraft) and publishing and office machinery (the share of which is falling, but increasing relative to the steeper decline in other countries). On the industry level, motor vehicles, office machinery and telecommunications equipment increased their export shares and contributed to an overall increase in the standard deviation of export shares and the Herfindahl. However, a parallel increase in import shares leads to a declining RCA value. On the other hand, positive specialisation in publishing, medical equipment and again office machinery was strengthened. Negative specialisation in wood and pulp and paper diminished.

Table 3.3: Countries with differences between production and export specialisation trend

	Value added		Exports		
	Specialisation (CR3) of sectors		Specialisation (CR3) of sectors		Largest difference between production and export trends
	1988	1998	1988	1998	
Finland	40.50	40.74	53.62	50.36	Pulp & paper, Ships & boats
Sweden	34.88	35.51	44.22	42.31	Machinery, Pulp & paper
United Kingdom	31.70	33.62	37.90	37.75	Food, Publishing & printing, chemicals

Source: WIFO calculations using SBS and COMEXT.

Finland

Finland has a moderate position in specialisation, and also combines increasing production specialisation with decreasing export specialisation. Finish production is characterised on the one hand by pulp and paper, while on the other hand, machinery climbed to number two, and telecommunications tripled output. The food industry and the textile industries are losing shares; wood and wood related industries are rather stable.

Export specialisation is decreasing according to most indicators. The main reason is that the export share of paper dropped from 32% to 23%. This is in contrast to the rising production of the pulp and paper industry. One reason for the diverging trend between production and exports could be that the headquarter function of Finish firms is strengthening the basis for creating value added. A wood & paper cluster provides services which increase value added, but some of these services are not reflected in exports or at least are not reported as exports of manufactured goods.[23]

Sweden

Sweden has a moderate position in specialisation, with the same split between the trend in production and exports. The largest four sectors are in production, with paper and motor cars increasing their shares, while food and machinery are losing shares. The greatest jump occurred in telecom equipment, which increased its share in production by 5.9 percentage points to 8.9% of value added and is now the largest exporter.

Paper's share in production is rather stable, its share in exports is falling. For machinery, production shares are increasing, while export shares are on the decline. In neither case can imports account for the difference, possibly hinting again at the effect of multinational firms increasing headquarter services, but shifting part of their exports to foreign production and thus contributing to the divergence of production and export trends.

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[23] In general, the following circumstances can cause differences in increasing production and decreasing export shares in a specific industry in a specific country:

(i) Imports decline rather strongly.
(ii) Domestic demand increases overproportionally.
(iii) Production and trade statistics use different concepts. Production is classified according to main activities, exports to products. If the non characteristic products increase, production will be more dynamic.
(iv) Production is measured by value added, exports by sales. If the degree of vertical integration is reduced, value added can be more dynamic than exports, which do not depend on the degree of consolidation of production.

Greece

Specialisation in production is increasing in Greece, specifically in food, petroleum products and chemicals, and in construction related industries. It was once the country with the highest export specialisation, which despite declining specialisation is still above average. The decreasing specialisation is due to losses in the textile and apparel sector. The food sector is now the largest export sector. The share of *intra*-industry trade is lower than in all other EU member countries.

Portugal: robust decrease in specialisation

Portugal is the exception, insofar as specialisation is decreasing strongly and robustly in production, as well as in trade data. This declining specialisation reflects the shrinking share of the textile industry, which once accounted for 13.4% of production, but dropped to 9.4% in 1998. Food production and wood related industries lost, also. The apparel and leather industries maintained their shares in production. Since the other European countries decreased production, the shares of these sectors are now four, respectively five times higher than in total Europe (leading to increased specialisation rates in contrast to the trend of strongly decreasing specialisation, as shown by other indicators).

The drop has been compensated primarily by a rise in the motor industry and to a lesser extent by electrical machinery. On the industry level, motor vehicles are the largest item, accounting for 13% of exports and pushing the measured specialisation at the industry level up. It surpassed the apparel industry as the largest exporter.

Portugal managed to narrow its deficits in advertising intensive industries (tobacco, shoes) and in research intensive industries (agro-chemicals, electronic valves, telecom apparatus and motor vehicles).

No robust trend in other countries

The countries mentioned above demonstrated three tendencies: Robustly increasing specialisation in the first group, splitting production and exports in the second, and declining specialisation in Portugal. The other countries did not exhibit any clear trends in either the dimension of specialisation or dispersion. We refer to the Table 3.1 and Fig. 3.2 for the results and review specific developments in our discussion of concentration patterns.

Table 3.4: Declining imbalances of exports and imports in sectors

	SD of Net RCA		Examples for	
	1988	**1998**	**decreases in negative specialisation**	**decreases in positive specialisation**
Belgium	0.421	0.229	Wearing apparel; dressing and dyeing of fur, Machinery and equipment n. e. c.	Basic metals
Denmark	0.761	0.679	Chemical and chemical products Other non-metallic mineral products	Other transport equipment
Germany	0.671	0.546	Coke, refined petroleum and nuclear fuel Pulp, paper and paper products	Motor vehicles, trailers and semi-trailers
Greece	1.451	1.111	Electrical machinery and apparatus n. e. c. Radio, TV and communication equipment	Wearing apparel; dressing and dyeing of fur
Spain	0.967	0.627	Tobacco products Radio, TV and communication equipment	------------------------------------
France	0.482	0.411	Tobacco products Wood, products of wood and cork	Other transport equipment
Italy	1.311	1.213	Coke, refined petroleum and nuclear fuel Pulp, paper and paper products	Wearing apparel; dressing and dyeing of fur
Ireland	0.813	0.817	Coke, refined petroleum and nuclear fuel	Food products and beverages
Netherlands	0.577	0.591	Radio, TV and communication equipment	Chemical and chemical products
Austria	0.768	0.466	Coke, refined petroleum and nuclear fuel Furniture; manufacturing n. e. c.	Other non-metallic mineral products
Portugal	1.250	0.961	Electrical machinery and apparatus n. e. c.	Wood, products of wood and cork
Finland	1.035	0.951	Coke, refined petroleum and nuclear fuel Office machinery and computers	Pulp, paper and paper products
Sweden	0.874	0.867	------------------------------------	Pulp, paper and paper products ,
United Kingdom	0.811	0.733	Wood, products of wood and cork	Electrical machinery and apparatus n. e. c.
EU	0.210	0.193	Coke, refined petroleum and nuclear fuel Radio, TV and communication equipment Wood, products of wood and cork	Electrical machinery and apparatus n. e. c. Rubber and plastic products

Remark: Net RCAj= $\ln(X_i/M_i/X_{Total}/M_{Total})$; i=Sector; j=country

Source: WIFO calculations using COMEXT.

3.3 Summing up the trends for specialisation

There is no strong and general trend to be seen in direction of increasing or decreasing specialisation. Specialisation is increasing for production and decreasing for exports, and specifically large trade balances (positive or negative) decline. For the tendency for production specialisation to increase.

Large industries in large countries play a key role, like the manufacturing of cars in Germany, machinery in Italy, and food in the United Kingdom. This development is well in line with theories stressing the importance of clusters, with path dependency of strategic advantages and with knowledge spillovers within regions. In the smaller countries, there is no clear tendency of increasing or decreasing production specialisation, with the exception of Ireland. Ireland is increasing its degree of specialisation, specifically in research and skill intensive industries and now has the lowest share of labour intensive industries. The other small countries are successfully exploiting new opportunities for niche producers offered by the single market. They are partly extending former strongholds via exports, and partly going multinational and producing abroad. However, they are also losing some of their strongholds in resource intensive or labour intensive segments. This paints a mixed picture for the overall degree of specialisation.

The difference between the increase in production specialisation and the decrease in export specialisation, may to some extent depend on the fact that export specialisation has been higher and production specialisation is catching up, since production for the home market only has been reduced.

However, this observation does not explain why export specialisation is decreasing and why, for several countries, decreasing export specialisation concurs with increasing production specialisation. This could in part be a phenomenon of aggregating diverse trends in industries, but it can also be pinned down to specific developments. The pulp and paper industry increases or maintains its large production share in Finland and Sweden, and lowers its share in exports. The sectors of food, chemicals, and publishing and printing increase their shares of production in the United Kingdom, but decrease export shares. Production shares are rather stable for the steel industry in the United Kingdom, but the share of steel in exports has been on the decline. Some of these examples hint at a certain role which headquarters and services may play in this divergence. If firms provide additional services, they are reported in value added, since production statistics are classified according to main activities. Whether the services are incorporated in the export statistics is not clear; they can be reported in the category of main products, or separately, or not at all. Nevertheless, it does not seem to be a phenomenon of the statistics alone. The theory of multinational firms tells us that headquarters are providing knowledge and services to all of their subsidiaries. If the number of multinationals rises, and if they at least partly substitute domestic production with foreign production, production and export trends could go in different directions and many of the industry/country combinations in which the trend is seen are then characterised by large shares of multinational firms. Substituting imports may play a role in some industries, as does increasing domestic demand. But data are also consistent with the activities of multinational enterprises, and this should be investigated further.

Decreasing net trade balances are exhibited by all countries except Ireland (for the Netherlands on the industry level only), due to two movements. Firstly, the large net imports in resource intensive industries decreased due to the slow growth in demand for raw materials and semi-finished products. Secondly, large export surpluses decreased in strongholds, since imports – albeit still relatively small – increased faster. The first tendency shows that resource based trade, though still important to some industries, lost relative importance. The second shows that increasing the division of labour and *intra*-trade became even more important in the strongholds. This is consistent with the picture that comparative advantages as well as disadvantages are declining in Europe.[24]

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[24] It is also interesting to learn what is not shown by the data: there is no general difference between the trends for the sector and the industry level, and there is no difference in the pictures of indicators stressing absolute specialisation (CR, Herfindahl index, SD-shares) and those comparing the specialisation of a country with that of the EU (SRA, Gini, Dissimilarity index).

4. Geographic concentration of industries

4.1 Geographic concentration: the main trends

In this chapter we investigate industry concentration, specifically whether the share of the leading countries in the individual industries is rising or falling and whether locations of industries differ from overall location of manufacturing. High concentration of production or of exports means that a few countries supply a large part of a given sector (industry). Low concentration or dispersion means that a sector or an industry is evenly spread across the member countries. An evenly spread structure (low concentration) has two benchmarks: it can either mean that in a specific industry each country supplies an equal share of industry output, we call this an absolute perspective. Evenly spread can alternatively mean that in a given industry all countries supply proportionate to their size (measured by shares in total manufacturing), this is a relative perspective. Indicators measuring concentration from the absolute perspective are called indicators for "absolute concentration", indicators which take country size explicitly into account are called indicators on "relative concentration". Out of the indicators we use, the first four emphasise the absolute position, the others the relative position. What sounds rather technical becomes important, since absolute indicators implicitly focus on large countries (which have the largest absolute shares in most industries). Relative indicators focus on the development in small countries, whose shares in individual industries deviate usually stronger from total manufacturing. A complete picture needs both indicators, since they answer different questions.

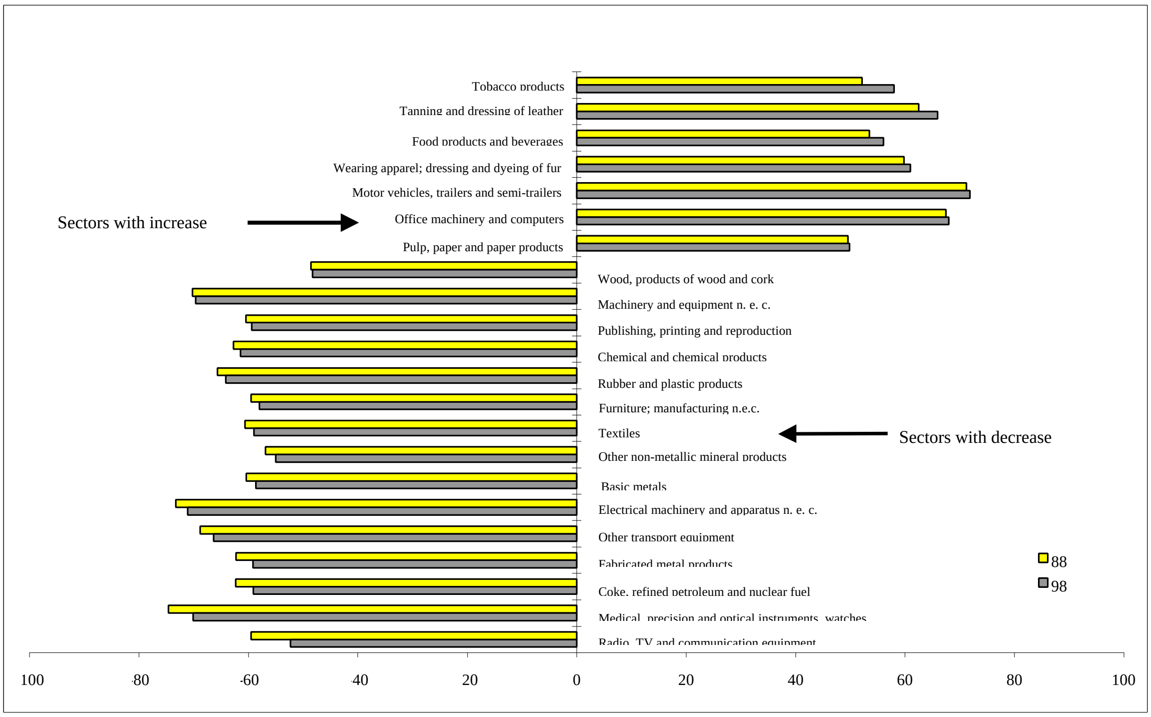
4.2 Shares of large producers decline

The main trend for production as well as trade data is that geographic concentration is robustly lower in 1998 than in 1988 as far as absolute concentration is concerned. If we use indicators, which stress the role of small countries production concentration increases in the majority of sectors and industries. Export concentration declines faster than production concentration. The decline for absolute concentration of exports is strong enough to prevent the opposite tendency for relative indicators. Large surpluses and large deficits in industries level off.

Part of the analysis on geographic concentration of industries overlap with that on the specialisation of countries, since specialisation of countries and of concentration of industries are two perspectives to look at the pattern of economic activity performed in countries and industries. We therefore focus now more on the question which industries are becoming more and less concentrated and what forces are behind this processes, and less in which countries specific industries localise.

Fig 4.1: Geographic concentration of production (sectors): 1988 and 1998

Share of the largest three producers (countries): CR3



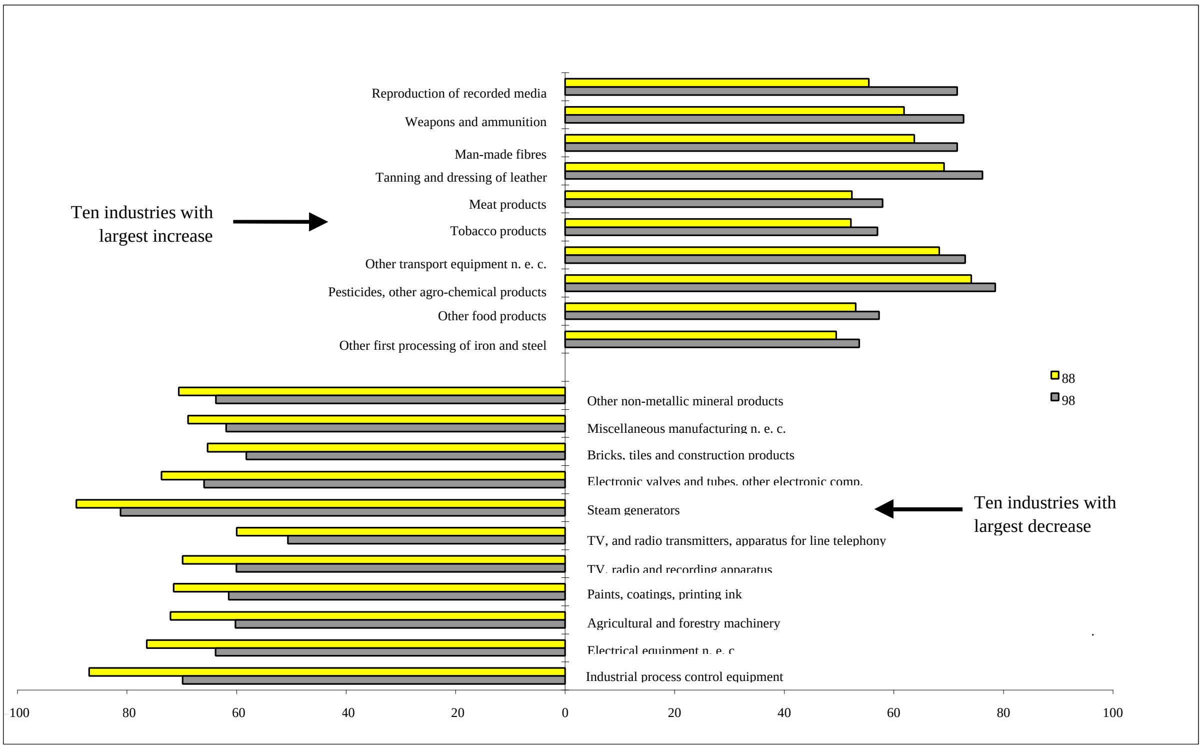
Source: WIFO calculations using SBS.

Motor vehicles, electrical machinery and machinery are the highest concentrated sectors. In these sectors 70% of European value added is generated in three countries. Germany supplies the largest production share in each sector, with France, United Kingdom or Italy alternatively complementing the top 3 countries. Office machinery and other transports are also heavily concentrated. In all these sectors the leading five countries together produce about 85% of the total EU output. However out of these heavily concentrated sectors only the motor vehicles sector has increased its regional concentration in the past years.

Least concentrated are wood and pulp and paper, food, mineral products and telecom equipment, here about 50% are produced in three countries and about 70-75% in five countries. The concentration decreases in most of these industries, strongly in the telecom equipment, where Germany and Spain lost while Sweden and Finland increased their shares. In food industry the concentration increases, due to increased market shares of Germany and the United Kingdom.

Fig 4.2: Geographic concentration of production (industries): 1988 and 1998

Share of the largest three producers (countries): CR3

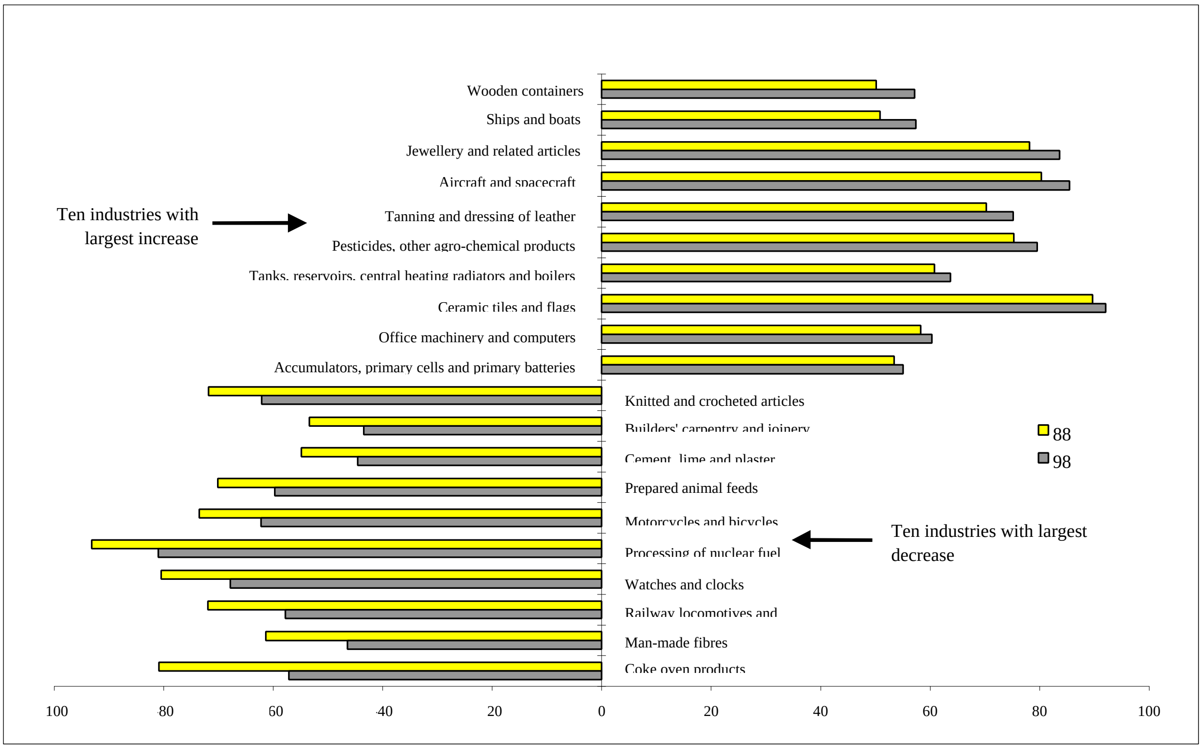


Source: WIFO calculations using SBS.

Geographic concentration of production as measured by CR5 increased only in four out of 22 sectors: tobacco, food, plastics, and other transport. As measured by the share of the largest three producers (country) absolute concentration increased in seven sectors (see Table 4.1). The unweighted average of the concentration rate over all sectors declined by 0.9% for the top Three countries and 1.6% for the top five countries. On the three digit level we see a lot of mobility, but the pattern is similar: concentration rates decline in two thirds of the industries, the weighted average decline being about 1.2% (for top three and top five). The largest increases occurred in reproduction of media, which concentrates in Ireland and in Austria. Other increases are reported in a small basic steel subindustry[25], and in the weapons and ammunition industry (United Kingdom, France). Games and toys is geographically concentrated in Germany, Denmark and United Kingdom, three textile industries in Italy and partly Spain. In three industries the increase in concentration (CR5) was larger than five points and none of these belong to the top ten concentrated even after this increase. On the other side concentration decreased in 13 industries by more than 5%. Some of them are high tech industries like telecom industries, medical equipment and process control.

Fig 4.3: Geographic concentration of exports (industries): 1988 and 1998

Share of the largest three producers (countries): CR3



Source: WIFO calculations using COMEXT.

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[25] "other first processing of iron", which concentrates in Italy and France.

Box 4.1: *Extra* vs. i*ntra*-exports

Trade can be subdivided into trade within European countries (*intra*) and trade of European countries with Non Member Countries (*extra*). While this divide could reveal important differences, it would not be possible to find a parallel divide for production. Most calculation is therefore for total exports.

Specialisation figures and trends are surprisingly similar. The specialisation of total EU as measured by the largest 3 sectors is 40%, and 39% respectively, the three industries are the same. Both rates are stable, *intra*-specialisation is increasing if measured by CR3, but decreasing if measured by CR5, *extra* is marginally decreasing according to both. The largest difference across sectors is that motor vehicles have higher and increasing *intra*-shares, while machinery and other transport has substantially higher *extra*-shares. Specialisation of *extra*-trade is higher in Belgium, the Netherlands, Denmark, Germany, French, Italy and Sweden but lower in Greece, Spain, Ireland, Portugal, Austria, Finland and the United Kingdom. This looks very much like a core-periphery pattern: core countries export a rather broad range of products to other member countries and a specialised towards non-members, while peripheral countries have rather low transport costs to non-members. For most countries specialisation in *extra*-and *intra*-exports go in the same direction.

Regional concentration is somewhat less for *intra*-trade than for *extra*. The direction of change is the same: measures of absolute concentration decline, those for relative change show mixed evidence. More on differences between *intra* and *extra* see in the chapter on *intra*-industry trade (chapter 5.3).

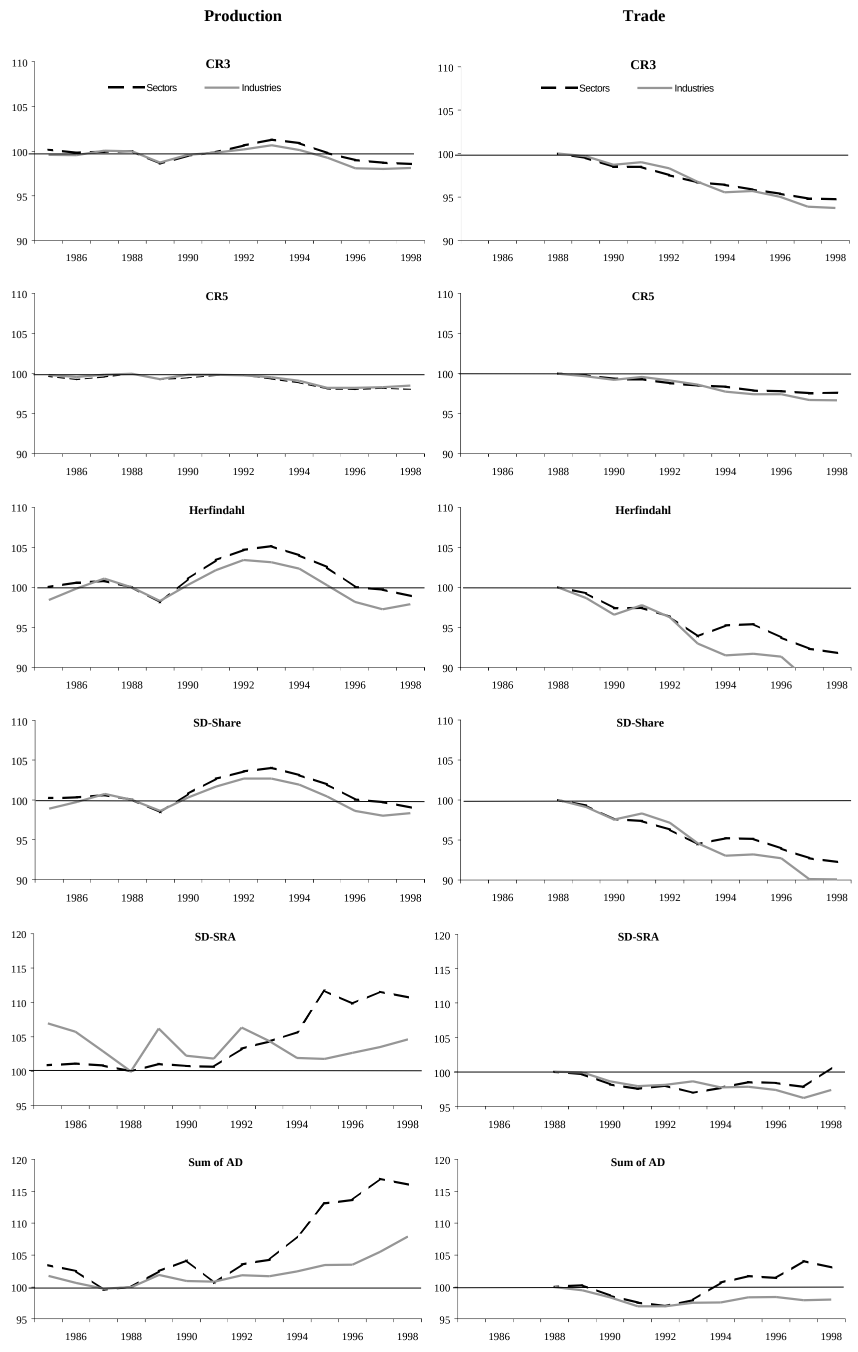
4.3 The role of small countries for indicators on relative concentration

The specialisation rate (or location rate since we focus on geographic concentration) compares the share of a country in a specific sector with its overall share in manufacturing. The dissimilarity indicator (sum of absolute difference) adds up differences in the shares of a specific industry from those in total manufacturing. Both indicators highlight the role of small countries since one large firm (or a few large firms) usually produce more than the small average "market share" of a small country. Economically, high specialisation rates of small countries come from the fact that minimum efficient scale, while not to large in relation to total European demand, is often large relative to the average market share of a small country, this effect is also called lumpiness of investment.

The specialisation rate increases in 17 out of 22 sectors, the dissimilarity index in 16. Relative production concentration is increasing in the majority of the industries too. Specifically we find two industry groups in which absolute and relative indicators diverge strongly.

The first are textile industries. Textile industry and apparel industry have below average concentration rates but are among the top specialised sectors as revealed by location and dissimilarity indices. Concentration is shown to decrease if we measure the share of the top five countries and to increase if we calculate relative indicators. The reason is that Italy and Austria in textiles and Portugal in apparel have higher shares in these industries than in total manufacturing. The large countries like Germany, France and the United Kingdom reduced their shares, thus increasing their negative specialisation and becoming less similar to the total.

Fig 4.4: Concentration trends in production and trade



Remark: Composite indicator (indicators are indexed, unweighted average).

Source: WIFO calculations using SBS and COMEXT.

The second group are three high tech sectors in which location decisions and headquarters of large multinational firms play a role: office machinery, telecom equipment and medical instruments are high tech sectors in which absolute concentration decreases and relative concentration increases, this is also the case for reproduction of recorded media on the industry level. In the first and last case the inroads of Ireland play a major role, in telecom equipment those of Finland and Sweden, for medical equipment it is Denmark, Ireland and again Sweden and Finland which pushed up indicators on relative concentration, while Germany loses market shares contributing to lower absolute concentration.

The five sectors with the largest increase in relative concentration (as opposed to absolute concentration) are rather small sectors.

Table 4.1: Where absolute and relative concentration differ

	Increase in dissimilarity	Dissimilarity level		Decrease in CR5	CR5		Top 3 winners	Top 3 loosers
	1998-1988	1998	1988	1998-1988	1998	1988		
Wearing apparel; dressing and dyeing of fur	20.36	54.96	34.60	-1.16	84.77	85.93	IT, PT, BE	DE, FR, UK
Radio, TV and communication equipment	15.74	35.03	19.29	-6.64	72.30	78.94	FI, SE, BE	DE, ES, NL
Office machinery and computers	12.60	50.31	37.71	-3.26	86.61	89.87	UK, IE, NL	IT, FR, DE
Tanning and dressing of leather	13.82	75.85	62.03	-1.79	86.94	88.73	IT, PT, ES	UK, DE, FR
Textiles	9.32	45.49	36.18	-3.88	78.87	82.75	IT, BE, AT	DE, FR, ES

Top 3 winners (loosers): countries with largest gain (decline) in total value added of the sector in the EU.

Dissimilarity: sum of absolute differences of country share in specific sector from country share in total manufacturing.

Source: WIFO calculations using SBS.

4.4 Geographic concentration of exports decline

Concentration decreases robustly for exports and trade imbalances across countries shrink. The shares of the largest three countries in a typical sector decreased by 3.2% and by 4.0% in the average of industries. Only in two sectors absolute export concentration increased: in office machinery due to the inroads of Netherlands and Ireland and other transport due to the gains of France, Italy and the United Kingdom. On the industry level the highest export concentration rates are to be seen in processing of nuclear fuel, and aircraft and spacecraft, in two leather industries and some resource related industries (bricks, tobacco, jewellery). Increases in concentration are reported in one quarter of the industries, the largest in leather, wood containers and bricks, as well as in pesticides, ships and boats and air and spacecraft. The more robust decline of export concentration downgrades the conflicting evidence between absolute and relative concentration indicators, but its main picture of increasing relative concentration in the textile industries and some high tech industries remain. For the majority of industries even the relative indicators show declining concentration, underlining the picture drawn by absolute indicators. The highest export concentration rates are reported in pulp and paper, wood, leather, apparel and office machinery, the largest increases in chemical industry, publishing and printing and in tobacco. The regional imbalances of exports and imports of countries in specific industries – as measured by the RCA-value-decline.

4.5 Summary for concentration trends

The overall picture is one of decreasing absolute concentration. This dispersion trend is stronger for exports than for production. Indicators in this group focus on absolute size and therefore implicitly on the position of larger countries. Indicators of relative concentration, which implicitly focus on the smaller countries, show an increase for production concentration. Different trends in absolute and relative concentration are seen (i) in the textile sector, where southern countries increase their share, (ii) high tech industries in which small countries host successful multinational firms or profit from foreign direct investment. The main difference between indicators on absolute and relative concentration arises in small sectors or industries in which small countries produce a large share. Concentration of labour intensive industries is one reason, indivisibility of plants and the size of large firms the other. Historically large trade imbalances decrease; exports are becoming less concentrated by absolute measures, and for relative measures on the industry level.

Box 4.2: Explaining (weakly) rising specialisation, while the concentration of industries decrease

Specialisation is defined as production structure of an individual country, while country structure of an individual industry, it seems to be a puzzle that one can rise and the other can fall, since both are shares in a supermatrix with a country and an industry dimension. Specialisation and concentration are like two perspectives to look at a "data hill", or to put it more formally two "marginal distributions". For two equal sized industries, two equal sized countries the results have to be identical. In our case we have 22 sectors and 95 industries in one dimension and 14 countries of very different size in the other, both are skewed distributions, and concentration rates, means or variances always pick out one or moment of the distribution. Therefore it is feasible that differences occur. Nevertheless it is interesting which economic factors contribute to the difference in the results. One of them is the different growth in small and large countries combined with a stronghold of large countries in large industries.

On the one hand the five largest sectors - chemical, machinery, food, motor vehicle, metal products (measured by shares in EU total) - are getting larger. From 1988 to 1998 they together increased their share of European production by 2.2%. The trend in these absolutely largest sectors influence measured specialisation rates in most countries. It is of additional interest that the largest industries growth faster in large countries, they grow only slightly above average in small countries.

For geographic concentration the dynamics of large industries is less important. What is important here is the growth performance of large countries. Since the share of the large countries declines, the absolute concentration rates in those industries where the large countries have the highest shares tend to decline. High growth in small countries increase dispersion (decrease concentration) as measured by absolute indicators.

5. The underlying forces of changing specialisation and concentration

Theory suggests that production and location decisions depend on such variables as spillovers, economies of scale and specific inputs, on the relation between fixed and variable costs, and on the degree of product differentiation. Trends should therefore differ, depending on the industry type and region. We investigate which trends are reflected in the data, and specifically whether integration has been asymmetrical, favouring the core. Secondly, we investigate which role foreign direct investment plays in shaping the dispersion and concentration of industries. Thirdly, we look at whether the trend of increasing *intra*-industry trade continues, whether countries with lower shares are catching up, and whether the horizontal or vertical components dominate.

5.1 Characteristics behind the trends for de-concentration

Convergence across industry types

The level of concentration has been historically higher in research-intensive and in skill-intensive sectors. This is well in line with modern theory, which stresses spillovers and pooled labour markets in dynamic industries. In both groups, however, geographic concentration is declining (see Table 5.1).

The WIFO taxonomy[26] classifies industries according to factor intensities into labour-intensive, capital-intensive, and research- and advertising-intensive sectors. It has as a fifth segment a mainstream sector, which uses the average mix of factors.

The research-intensive sector is the most highly concentrated sector. In a typical research-intensive industry, the largest three countries produced 71.6% of the EU output in 1988; this share now amounts to 68.8%. This decrease in concentration in the research intensive sector has been more rapid than on average in the other sectors. Concentration has been declining specifically in process control equipment - where France, Italy and Finland have made gains - in the audio and video and the telecom industries - in which Finland, Sweden and, in part, Austria and Belgium have increased their shares - and in the pharmaceutical industry - where Ireland has made some inroads.[27] Significant increases in concentration are evident for two chemical industries (agro-chemicals and other chemicals, where Germany and the United Kingdom have both increased shares), in electronic components (Germany and Italy), and in office machinery (Ireland and the Netherlands).

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[26] First applied in: EU-DGIII Report on the Competitiveness of European Manufacturing 1998 (Part 2: Manufacturing, provided by K. Aiginger, St. Davies, M. Peneder, M. Pfaffermayr), Brussels, 1998. For the methodology see: M. Peneder, Intangible Investment and Human Resources. The new WIFO Taxonomy on Manufacturing, WIFO Working Paper 114, 1999.

[27] The losses in these sectors occurred in Germany (in the first two) and United Kingdom.

Table 5.1: Geographic concentration of production in research intensive industries

Ranked according to change in CR3	CR3		Change of CR3	SD SRA		Dissimilarity index		Largest share 1998			Largest gain 1998-1988		
	1988	1998		1988	1998	1988	1998						
Pesticides, other agro-chemical products	74.1	78.5	4.4	0.48	0.48	81.86	66.69	UK 34%	F 28%	D 17%	P +18%		
Other chemical products	58.4	62.5	4.1	0.36	0.36	28.55	26.60	D 29%	UK 19%	F15%	UK +4%	IR +4%	
Office machinery and computers	67.5	69.8	2.3	0.49	0.57	38.02	53.75	D 32%	F 25%	IR 14%	IR +9%	NL +6%	D +6%
Motor vehicles	71.3	73.2	1.9	0.44	0.43	33.46	34.31	D 46%	F14%	UK13%	D +5%	UK +1%	B +1%
Electricity distribution and control apparatus	84.9	85.5	0.6	0.30	0.26	76.33	77.56	D 69%	F 11%		F +1%	D +1%	
Optical instruments and photographic equipment	73.5	73.6	0.1	0.38	0.41	27.56	33.66	D 33%	I 24%	UK 17%	I +13%	IR +1%	P +1%
Instruments for measuring, checking, testing, navigating	78.6	77.6	-0.9	0.37	0.38	40.57	40.71	D 31%	F 28%	UK 19%	D +3%	S +2%	
Aircraft and spacecraft	78.7	77.4	-1.3	0.41	0.43	55.41	52.41	UK 32%	F 23%	D 22%	D +2%	S +1%	P +1%
Pharmaceuticals	58.9	56.7	-2.2	0.18	0.26	24.18	25.95	F 20%	D 17 %	UK 16%	IR +3%	E +1%	
Medical equipment	66.4	61.3	-5.0	0.40	0.42	37.76	33.01	D 38%	F 13%	UK 11%	F +2%	IR +3%	SF +2%
Electronic valves and tubes, other electronic comp.	73.7	65.9	-7.7	0.40	0.40	50.65	36.32	D 24%	UK 22%,	F 20%	D +6%	I +6%	IR +2%
TV, and radio transmitters, apparatus for line telephony	60.0	50.6	-9.3	0.21	0.39	21.15	53.21	F 19%	UK 17%	D 15%	SF +8%	S +6%	
TV, radio and recording apparatus	69.9	60.0	-9.9	0.48	0.49	61.50	72.87	D 21%	UK 13%		B +4%	A +4%	
Industrial process control equipment	86.9	69.9	-17.0	0.42	0.47	57.75	35.33	D 28%	F 23%	I 19%	UK +11%	F +8%	I +5%

SD SRA: Standard deviation of (adjusted) localisation coefficients (see Box 3.2)
Dissimilarity index: Sum of absolute differences of country shares for industry from that of manufacturing.

Source : WIFO calculations using SBS.

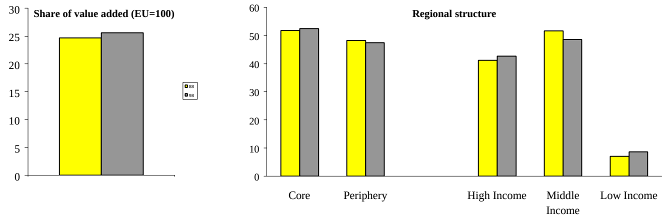
Least concentrated is the advertising-intensive segment. Concentration increased here slightly, but the top three share is still only 62.1%. The largest increases occurred in some food industries, as well as in publishing, the reproduction of recorded media (Ireland, Austria), in sports goods (United Kingdom) and in the games and toys industry (Denmark).

In the labour-intensive segment, concentration lies below the average and the trend varies across industries. The shares of the largest countries are increasing in many textile industries, but decreasing in construction and transport related industries and in electrical equipment. In the textile industries, the rising shares of Italy and of Portugal translate into high absolute and relative concentration, and an increase in the dissimilarity index. In four textile industries, Italy’s shares account for about one third of Europe’s value added (starting from about 20% in 1988). Portugal increased its share to 5%. The large increases in these countries’ shares reflect the declining production in other countries, since Italy and Portugal’s shares of manufacturing for the apparel industry are roughly constant.

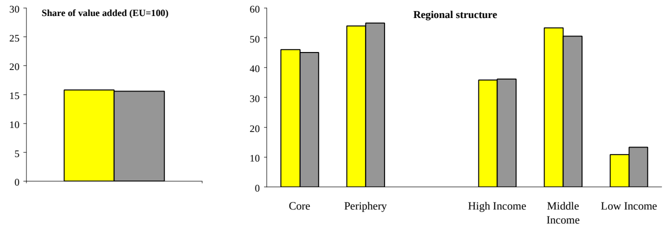
If we divide industries according to skill classes, we see the same convergence. Concentration is higher, but declining in the highest skill class. It is low in the low skill industries, in which absolute concentration is approximately constant.

Fig 5.1: Industry types and geographic structure

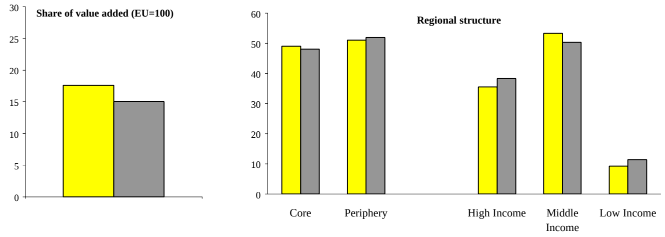
Mainstream industries



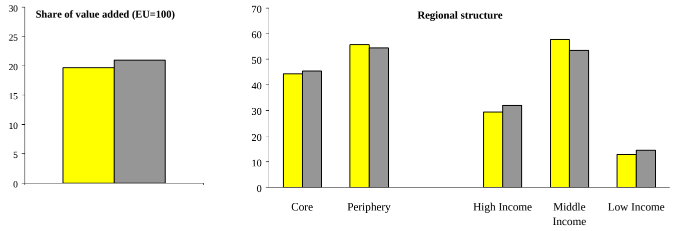
Labour intensive industries



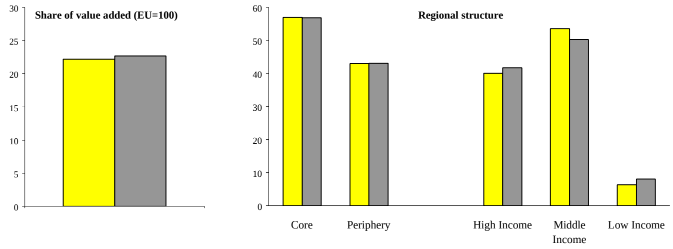
Capital intensive industries



Advertising intensive industries



Research intensive industries



Source: WIFO calculations using SBS.

The core - periphery pattern

Economic geography stresses the importance of a core region, in which dynamic economies of scale can be exploited, while the role of the periphery depends on trade costs, factor costs, mobility and trade barriers. The importance of market access, market size, income levels and sometimes also of a North-South split is discussed in this literature.

Having chosen a classification of countries that defines about one half of manufacturing as core and one half as periphery, we find stable shares of production over time. Roughly 50% of manufacturing was produced in the core and 50% in the periphery in 1988, as well as in 1998.[28] Some of the peripheral countries like Ireland, Portugal and Greece are winning value added shares (at different degrees). Sweden and Finland have lost shares, following a rather difficult period of restructuring during the ten years on which the analysis is focusing.

The core has its largest market shares in the research-intensive sectors, although it decreased its share in a typical research-intensive industry from 58.2% to 57.0%. The shares of the United Kingdom decreased and those of Ireland and Finland increased. The core made its largest gains in electric components, where Italy and Germany won shares, and pesticides (which shifted from Austria, Spain and Finland to Germany). The periphery made its greatest inroads in telecom equipment, control equipment and optical instruments, as well as considerable progress in audio and video, and aircraft and spacecraft. Low income countries, the South and specifically small countries increased their shares in research-intensive industries (without reaching the average).

The core produces less than half of the value added of some advertising-intensive industries. The industries in which the core managed to increase its share were publishing, games and toys, some food industries and beverages. Germany and the Netherlands increased their market shares, the losses for the periphery occurred in the Scandinavian countries and in Italy.

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[28] Dividing the member countries of the European Union into core countries and periphery to parallel models of economic geography is not an easy task, since some countries comprise core as well as periphery areas (Italy, United Kingdom). We defined Belgium, Denmark, Germany, France and the Netherlands as core. The main results remain the same if we switch these two countries from the periphery to the core. Details of the results depend however slightly on the indicators used. The share of the core is stable if we take the weighted average (or absolute value added); if we take unweighted averages of the market shares, the core loses and the periphery wins (since the periphery has higher market shares in smaller industries and small industries are growing at high rates in small countries). Note that we define industry characteristics; e.g. pharmaceuticals is classified as research intensive. This does not of course mean that a plant in this industry in a specific country has no research department.

In the labour-intensive industries, the typical market share of the core is low, but decreased only marginally (-0.3% to 45.7%. From a country perspective, Germany's share dropped, while the shares of Spain, Portugal and Italy in this segment increased. Spain increased its shares in transport and construction related industries; Italy in textiles (see Table 5.3) and machine tools; Portugal in wood, apparel and some engineering industries. In all these cases, the peripheral countries won not only in narrowly defined low cost industries.

In capital-intensive industries, the core and periphery have stable shares, partly at variance with the prediction that these industries would try to maintain and upsize plants in the centre. The core increased its shares in basic metals, cement and textile fibres, but lost larger shares in basic chemicals, pulp and paper, and tiles and flags. From the country perspective, France and the Netherlands decreased their shares in capital-intensive industries, and Ireland had the greatest increase (e.g. basic chemicals).

The core lost 4 percentage points in total exports, with no differences between *extra*- and *intra*-EU exports.[29] The industries that contributed to this trend were capital-intensive industries (coke, nuclear fuel, and basic chemicals), as well as textile industries, audio and video and telecom equipment. The core is losing exports in research-intensive industries, but to a lesser extent than for total exports. From the country perspective, the loss of the core is due to the decreasing market shares of Germany and to a slighter degree of the Netherlands; the gains for the periphery come from Ireland, Spain and the United Kingdom.

Income, country size, North - south pattern

The core-periphery dichotomy was based on regional criteria[30]. Dividing the member countries according to per capita GNP (at PPP) creates a pattern in which middle-income countries are losing shares, high-income countries are making small advances, and low-income countries are gaining strength. This split is particularly distinct in advertising-intensive countries in which middle-income

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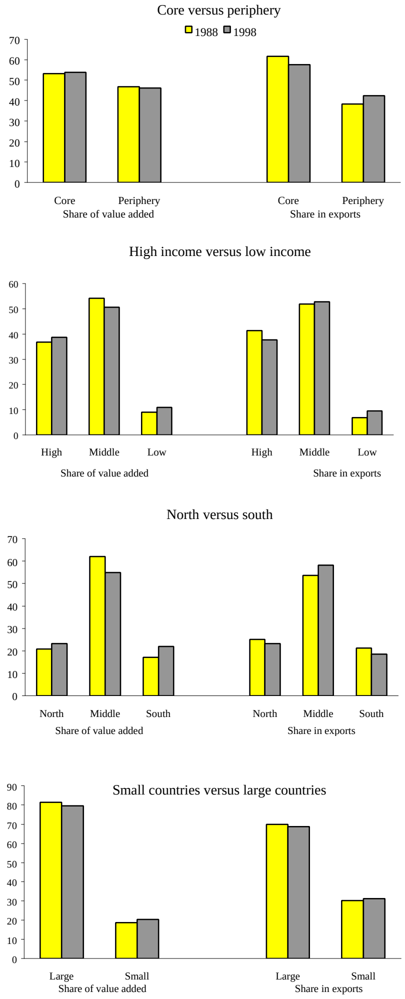
[29] The share of the core is now 57.6% of total exports, 55.7% for *extra*-EU and 58.8% for *intra*-EU (weighted data).

[30] We applied the following classification:
Core: Belgium, Denmark, Germany, France, Netherlands. - Periphery: Others.
High income: Belgium, Denmark, Germany, Austria. - Middle income: France, Italy, Netherlands, Finland, Sweden, United Kingdom. - Low income: Greece, Spain, Ireland, Portugal.
North: Denmark, Ireland, Finland, Sweden, United Kingdom. - Middle: Belgium, Germany, France, Netherlands. – South: Greece, Spain, Italy, Portugal.
Large: Germany, Spain, France, Italy, United Kingdom. – Small: Others.
For the core we checked the differences if United Kingdom and Italy were shifted to the core.

countries had an over-proportionate share and have now regressed to the average. For the labour-intensive segment, the same loss has been witnessed in the middle-income countries, while the share of the low-income countries has increased. The rising shares of the high-income countries in the labour-intensive segment are nevertheless a surprise. While high-income countries lost shares in the apparel industry as expected, some high-income countries, such as Germany, increased their production of construction material. In the research-intensive segment, the shares of the high-income countries are, as expected, over proportionate, but not by a large margin. The low-income countries have caught up by 2% and now have 8% of the value added generated by the industries in this group. Measured according to exports, the high-income group has lost at the expense of the other two groups.

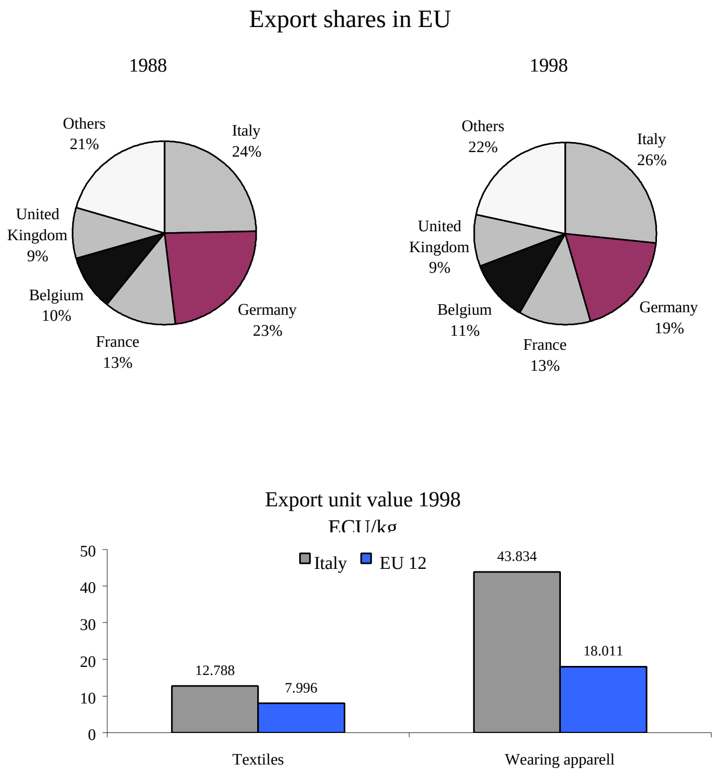
Fig 5.2: Geographic concentration of production and exports



Source: WIFO calculations using SBS.

North versus South is a divide in many theoretical studies, primarily from the US, implying that the South is specialised in labour-intensive industries, while the North is innovative, specialised in research driven industries and those with significant product differentiation. In Europe, the North produces 19.4% of the output in typical labour-intensive industries (1998), having reduced its share by 4.0%. The South produces 32.8%, having increased its share by 3.5 percentage points during the last ten years. A considerable amount of production in the research intensive industries can be attributed to the North, although its share increased only marginally. The South increased its share in typical research-intensive industries by 0.9%.

Fig 5.3: Italy as market leader in textiles



Source: WIFO calculations using COMEXT.

Large countries produced 79.6% of value added, their share decreased by 1.7 percentage points. The decline is due to the lower shares of Italy and the United Kingdom, while the shares of Belgium, Austria and Ireland increased. The share of large countries in research-intensive and in skill-intensive industries is over proportionate, but declined typically by 3.0% points. The same tendencies hold for exports. The share of large countries in capital-intensive industries is below average.

The influence of other determinants

Concentration is greater in industries with high multinationality[31], although it decreased in these industries between 1988 and 1998 by two percentage points. There are only three industries with high degrees of multi-nationality in which concentration rose: the reproduction of recorded media, other chemicals and other food. Large decreases in control equipment, audio and video, telecom equipment, electronic components, electrical equipment and ships and boats resulted in the dominance of declining regional concentration.

It is to be expected that integration enables a stronger exploitation of economies of scale[32]. The data show that industries with larger economies of scale are regionally more highly concentrated, but the difference from average concentration is rather small (about one percentage point) and the indicator of the minimum efficient scale does not show the same trend. For both indicators, concentration declines somewhat less in the two groups with high EOS and MES. Among the industries with strong economies of scale, we find increasing concentration in other transport, other chemicals, other food and agro-chemicals. There are, however, also industries with increasing returns, like electrical equipment, basic iron, and paints, in which regional concentration is declining.

Industries with high market growth are less regionally concentrated, average concentration is 64.3% in those with high growth and 65.9% in those with low growth. Regional concentration declined in both groups between 1988 and 1998. Concentration is six percentage points higher in the group of highly globalised industries, but no difference in degree of decrease between 1988 and 1998 is given for highly and lowly globalised industries.

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[31] Davies and Lyons classified industries according to the multi-nationality of their leading firms, the indicators roughly reflect the number of countries in which they produce as an indicator. The indicators had to be reclassified from old to new NACE by WIFO.

[32] As indicators for economies of scale, we use data from Davies and Lyons about Minimum Efficient Scale (in relation to industry size, MES) and Pratten´s classification into EOS classes according to a set of indicators.

Table 5.2: Industry characteristics and concentration trends

	CR3 88	CR3 98	CR3 98 88	CR5 88	CR5 98	CR5 98 88
High market growth	64.05	62.34	-1.72	82.46	81.55	-0.91
Medium market growth	64.70	63.33	-1.37	83.23	81.55	-1.68
Low market growth	65.91	65.31	-0.60	83.64	82.44	-1.20

	CR3 88	CR3 98	CR3 98 88	CR5 98	CR5 88	CR5 98 88
High degree of globalisation	67.37	66.35	-1.02	85.23	83.86	-1.37
Medium degree of globalisation	66.01	64.44	-1.58	84.50	82.82	-1.68
Low degree of globalisation	61.28	60.19	-1.09	79.59	78.85	-0.74

	CR3 88	CR3 98	CR3 98 88	CR5 98	CR5 88	CR5 98 88
High multinationality	66.47	64.49	-1.97	83.54	82.22	-1.32
Medium multinationality	65.17	63.66	-1.51	83.06	81.66	-1.39
Low multinationality	63.02	62.82	-0.20	82.73	81.64	-1.09

	CR3 88	CR3 98	CR3 98 88	CR5 98	CR5 88	CR5 98 88
High minimum efficient scale	63.53	62.94	-0.58	82.09	81.32	-0.77
Medium minimum efficient scale	65.10	63.82	-1.28	83.29	81.60	-1.69
Low minimum efficient scale	66.03	64.21	-1.82	83.94	82.61	-1.33

	CR3 88	CR3 98	CR3 98 88	CR5 98	CR5 88	CR5 98 88
High economies of scale	64.90	64.51	-0.39	83.32	82.92	-0.40
Medium economies of scale	66.10	63.50	-2.60	83.05	81.16	-1.89
Low economies of scale	63.66	62.97	-0.69	82.95	81.45	-1.51

	CR3 88	CR3 98	CR3 98 88	CR5 98	CR5 88	CR5 98 88
High product differentiation	68.67	66.50	-2.17	85.64	83.85	-1.79
Medium product differentiation	65.48	64.88	-0.60	84.23	83.77	-0.46
Low product differentiation	60.51	59.60	-0.91	79.46	77.91	-1.55

	CR3 88	CR3 98	CR3 98 88	CR5 98	CR5 88	CR5 98 88
High productivity	63.34	63.19	-0.15	81.68	80.87	-0.81
Medium productivity	67.54	64.72	-2.82	84.36	82.95	-1.41
Low productivity	63.78	63.07	-0.71	83.28	81.71	-1.57

	CR3 88	CR3 98	CR3 98 88	CR5 98	CR5 88	CR5 98 88
High wage level	68.08	67.69	-0.39	84.84	84.32	-0.52
Medium wage level	65.42	62.94	-2.48	82.98	80.98	-2.01
Low wage level	61.16	60.35	-0.81	81.50	80.23	-1.27

	CR3 88	CR3 98	CR3 98 88	CR5 98	CR5 88	CR5 98 88
Low skill industries	55.9	54.8	-1.08	79.7	78.3	-1.37
Medium skills/blue collar workers	64.2	62.5	-1.71	83.4	82.4	-1.00
Medium skills/white collar workers	63.3	61.3	-1.91	79.7	77.5	-2.13
High skill industries	66.5	63.7	-2.79	85.1	82.2	-2.89

Source: WIFO calculations using SBS.

High wage industries are significantly more concentrated, they did not reduce their concentration over the last ten years. Within the high-wage group, there are some capital-intensive industries (like agro-chemicals and steam generators), as well as some engineering industries (like machine tools, office computer, production of recorded media). Exactly half of them increased, and half of them reduced regional concentration. Within the low-wage industries, most textile industries increased concentration; in industries producing semi-finished or less processed goods, concentration decreased. Industries with high product differentiation[33] started from high levels of concentration, which declined during the last ten years.

Summary

The evidence does not support fears that the single market would strengthen the core at the expense of the periphery. The share of total manufacturing in the periphery is stable, and qualitative indicators are looking even brighter for the periphery, since, for example in research-intensive industries the differences have become smaller. Theoretical models had shown that lower transport costs could first favour the centre and in a later stage the periphery. The data are not sufficient enough to answer the question on which part of the U-curve European manufacturing is currently producing. Nevertheless, the data are more consistent with the possibility that Europe is eventually reaching the second side of the U. The periphery is catching up in several indicators (exports, research-intensive industries) and the low-income countries are making inroads in skill- and research-intensive sectors. However, we should take into account that the period is short and that the results for countries should be complemented by an analysis on the regional level.[34]

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[33] As an indicator of product differentiation we used the standard deviation of export-unit values. See Aiginger (1997).

[34] We applied the following classification:
Core: Denmark, Germany, France, Netherlands. - Periphery: Others.
High income: Belgium, Denmark, Germany, Austria. - Middle income: France, Italy, Netherlands, Finland, Sweden, United Kingdom. - Low income: Greece, Spain, Ireland, Portugal.
North: Denmark, Ireland, Finland, Sweden, United Kingdom. - Middle: Belgium, Germany, France, Netherlands. – South: Greece, Spain, Italy, Portugal.
Large: Germany, Spain, France, Italy, United Kingdom. – Small: Others.
For the core we checked the differences if United Kingdom and Italy were shifted to the core.

Box 5.1: Indicators, formulas, and notation

We denote values (production and exports) by *X* and shares by *s*. The index *i* refers to industries (e.g. 95 NACE 3 digits, or 22 NACE 2 digits), *j* to countries (14 member countries of the EU) and *t* to time (1988 to 1998). Below we define several measures of specialisation and geographic concentration. To simplify notation we define (note superscript *S* is for specialisation measures, C for geographic concentration):

$$s_{ij}^{S} = \frac{X_{ij}}{\sum_{i=1}^{I} X_{ij}}\,,\ s_{ij}^{C} = \frac{X_{ij}}{\sum_{j=1}^{J} X_{ij}}\,,\ s_{i} = \frac{\sum_{j=1}^{J} X_{ij}}{\sum_{i=1}^{I}\sum_{j=1}^{J} X_{ij}}\,,\ s_{j} = \frac{\sum_{i=1}^{I} X_{ij}}{\sum_{i=1}^{I}\sum_{j=1}^{J} X_{ij}}$$

Indicator 1 and 2: the share of the largest n industries/sectors and the largest n country-shares in particular industries:

$CR_{n,j}^{S} = \sum_{i=1}^{n} s_{ij}^{S}$, *i* runs over the 3 or 5 largest sectors, and over the largest five 5 or 10 industries

$CR_{n,i}^{C} = \sum_{j=1}^{n} s_{ij}^{C}$, *j* runs over the 3 or 5 largest countries

Indicator 3: Herfindahl, sum of squared shares

$$H_{j}^{S} = \sum_{i=1}^{I} \left(s_{ij}^{S}\right)^{2}\,,\ \ H_{i}^{S} = \sum_{j=1}^{J} \left(s_{ij}^{C}\right)^{2}$$

Indicator 4: standard deviation of shares

$$STD_{J}^{S} = std_{\,i}\left(s_{ij}^{S}\right),\ STD_{i}^{C} = std_{\,j}\left(s_{ij}^{C}\right)$$

Indicator 5: specialisation rates

$$SR_{j} = \sum_{i=1}^{I} \frac{s_{ij}^{S}}{s_{i}}\,,\ CR_{i} = \sum_{j=1}^{J} \frac{s_{ij}^{C}}{s_{j}}$$

or since these measures are not symmetric

$SRA_{j} = \frac{SR_{j} - 1}{SR_{j} + 1}$ and $CRA_{i} = \frac{CR_{i} - 1}{CR_{i} + 1}$ now ranging between –1 and +1

In trade theory the specialisation rate SR_j is called RCA- or Balassa-index. In the literature of economics geography CR_i is usually called localisation rate.

Indicator 6: Dissimilarity index, sums up the absolute differences

$$SUM\text{-}AD_j^S = \sum_{i=1}^{I} \left| s_{ij}^S - s_i \right| ,\ SUM\text{-}AD_i^C = \sum_{j=1}^{J} \left| s_{ij}^C - s_j \right|$$

Indicator 7: Gini, if it refers to specialisation uses for each country the cumulated shares of industries in total manufacturing, after ranking and weighting according to the specialisation ratio of industry *i* compared to the corresponding share of total EU. For concentration the cumulated shares of countries in industry *i* are used, this time ranking and weighting by the country's share in industry *i* in relation to corresponding the country share in total manufacturing.

$$GINI_j^S = \tfrac{1}{2} \sum_{i=1}^{I} \left(ES_{ij} + ES_{i-1,j} \right) \frac{s_{ij}^S}{s_i} - \tfrac{1}{2} ,\ GINI_i^C = \tfrac{1}{2} \sum_{j=1}^{J} \left(ES_{ij} + ES_{ij-1} \right) \frac{s_{ij}^C}{s_j} - \tfrac{1}{2}$$

ES_{ij} denote the cumulated sums of the shares s_{ij}^C and s_{ij}^S .

Indicator 8 (for trade only):

$STD(RCA_{ij})$ where $RCA_{ij} = \ln \left(\frac{X_{ij} / M_{ij}}{\sum_{i=1}^{I} X_{ij} / \sum_{i=1}^{I} M_{ij}} \right)$. This is a "net trade RCA type" measure including imports (M_i) and exports (X_i). It has to be distinguished from a "Balassa type RCA", which uses exports only (see indicator 5).

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5.2 The impact of direct investment

Theory models two possible impacts for deepening integration on the behaviour of multinational firms. The first could be that multinational firms concentrate their activities since market proximity loses its relevance, and decisions regarding plant size and location are now more based on low costs and the exploitation of economies of scale. On the other hand, integration could reduce the fixed costs of setting up new plants, thus intensifying the expansion of multinationals into more markets and spreading knowledge from the knowledge based headquarters to many de-centralised plants.[35] We present here stylised facts about the impact of multinational firms in recent years, and how they influence past production structure and specialisation.

Box 5.2: The theory of multinationals and trade: Implications for specialisation and geographic concentration.

Economic models of FDI and trade (Brainard, 1993, Pfaffermayr, 1997, Markusen 1998, Markusen, Venables, 1998) are overwhelmingly based on the market proximity/plant size trade-off in explaining multinational activity. These models offer several empirical predictions on the effects of integration and globalisation, and provide the theoretical framework for the empirical analysis below. Note that both FDI and trade are treated endogenously, depending on common exogenous determinants (e.g. transportation costs, plant economies of scale, factor endowments, market size, etc.). Thus, from an analytical point of view, the impact of FDI on trade volume and specialisation has to be analysed with respect to these determinants. In these theories (see Wolfmayr, 1999 for more details) the sector which gives rise to multinational activity produces modern differentiated goods under economies of scale.

The consequences of lowering transport costs are:

- Lower levels of horizontal two-way investment, as proximity loses its importance. The production structure is increasingly driven by comparative advantage, since the home bias disappears with decreasing transportation costs. So theory predicts *more specialisation* and market size loosing its importance as determinant of MNE activity.

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[35] A detailed survey is available in Wolfmayr (1999).

- A larger volume of vertical FDI. Lower transport costs induce endowment based *intra*-firm trade. The countries well endowed with skilled labour export skill-intensive intermediates and headquarter services. Particularly when there is no factor-price equalisation despite decreasing transportation costs, *intra*-firm specialisation becomes more pronounced (headquarters in skill abundant countries, labour-intensive production in labour abundant countries).
- A counteracting force is that integration is likely to decrease the costs of setting up plants, since, for example, legislation is more harmonised and currency risks disappear. If plant set-up costs and trade costs both decrease, the effects of integration are conceptually ambiguous.
- In an intermediate stage with medium transportation costs, horizontally integrated MNEs may dampen agglomeration tendencies. Markusen, Venables (1998) conclude that agglomeration requires mobility of the factor used intensively in the imperfectly competitive sector, and that the presence of multinationals seems to be a stabilising force, reducing the set of initial endowments from which factor mobility can induce agglomeration, and thereby contributes to the dispersion of economic activity**.** In their model, multinationals establish plants in both large and small countries, thereby increasing demand and the returns to capital in the smaller country, as well. This reduces factor price differences between the countries and dampens the tendency towards agglomeration.
- In the presence of medium transportation costs, vertically integrated MNEs may also subdue the tendencies towards agglomeration, as they establish the production of labour-intensive intermediates in low-wage peripheral regions.
- If transportation costs within Europe are lower than those of exports from the outside, European multinational activity of non EU-based multinationals increases in relation to activity with EU-based multinationals. We expect some tariff jumping FDIs by MNEs from outside Europe, when trade costs within Europe decrease, but not from the outside.

Stylised facts about multinational firms

The main empirical stylised facts on multinational activity are as follows (Markusen, 1995 and 1998, Pfaffermayr, 1998):

- FDI, especially in Europe, is mainly two-way between similarly endowed countries. Thus far, there is not much evidence that FDI is based on comparative advantage. Furthermore, we are confronted with the presumption that FDIs are mainly horizontal (i.e. the same goods are produced at several locations), although there is some evidence that during early stages of multinationalisation, vertical FDI in distribution and services prevails.
- Vertical investments, when they can be identified, often are made in middle income countries.
- The trade of goods, *intra*-firm trade and FDI all grow complementarily. Contrary to the predictions of economic models based on a proximity/plant-size trade-off, FDI increased along with exports over the course of the EU-integration process.
- Multinationals produce R&D intensive products and employ a highly skilled labour force. Multinational activity is less frequently in labour-intensive industries, where they could take most advantage of low labour costs abroad. They may, however, locate labour-intensive production processes in low cost countries (vertical FDI).
- The primary characteristic of MNEs is their possession of firm specific assets with public goods characteristics within the firm. They transfer technological and organisational know-how to their host countries. This is reflected, for example, in the higher labour productivity of industries with large shares of FDI.
- Multinationals operate in concentrated industries, especially in R&D and advertising-intensive sunk cost industries.
- MNEs are typically larger and older than exporting firms. Thus, going multinational is part of a firm’s growth process.
- There is evidence that agglomeration effects form an important determinant of FDI.

Dynamics continue

Both inward and outward FDI developed more dynamically than during the period 1994 and 1996. This trend is evident since the eighties (see Competitiveness Report 1998) and continued also in the recent years. The stock of inward FDI into the EU15 received from the world increased by an average rate of 7.3%, much faster than production. In particular, the new EU-members Austria, Finland and Sweden experienced above average growth in inward FDI. In the larger EU-countries France Germany, and Italy growth of inward FDI has been less dynamic. Similar dynamic holds for outward FDI (7.8%), again with bigger increases for Denmark, Finland, (both 11.4%) and Austria (9.0%), and smaller ones for the larger EU-countries.

Extra–EU exports grew complementarily to inward FDI over this period by an average of 3.2%, however as expected in the ongoing integration process, especially the single market program, *intra*-EU exports increased by 11.3% on average and contributed significantly to the 8.3% average growth in total exports.

Table 5.3: Average growth and importance of FDI stocks by country: 1994 to 1996

	Growth				Importance	
	Inward FDI		Outward FDI		Inward FDI	Outward FDI
	from the world	from EU15	to the world	to EU15	from the world	to the world
Denmark	7.1	3.1	11.4	12.2	56.3	60.7
Germany	5.0	7.1	7.6	6.8	54.4	54.3
France	4.5	3.1	5.1	2.3	63.7	52.1
Italy	5.6	-	5.5	-	57.1 **	61.3 **
Netherlands	7.5	6.8	9.5	9.0	51.5	47.8
Austria	9.7	14.2	9.0	9.5	67.7	45.9
Finland	8.7	13.5	11.4	14.8	70.3	71.5
Sweden	14.6	-	5.4	-	50.2	62.0
United Kingdom	7.2	7.4	8.2	16.0	33.2	43.3
EU15	7.3		7.8		56.7	52.2

** 1994

FDI: Foreign direct investment.
Importance: Share of *intra*-EU as source of FDI.

Source: WIFO calculations using EUROSTAT.

The majority of direct investment activity is between European countries: 56.7% of the stock of inward FDI originate from EU member countries and 52.2% of total outward FDI of EU member countries is held in other EU-Member countries. The variation across countries is considerable, however. In the United Kingdom which receives a large part of inward FDI from the US, the corresponding ratios amount to 33.2% and 43.3%, respectively. On the top end, the Finish economy receives 70.3% of inward FDI from other EU-member countries and holds 71.5% of all outward investments in other EU-member countries.

Out of the nine EU countries with consistent FDI data available only Austria holds a positive FDI balance receiving more investments than investing in other countries. All other countries - as is the EU15 on aggregate - are net direct investors. But remind that the southern European countries as well as Ireland as important host countries are not in the sample. For the EU 15 the total stock of inward FDI (including *intra*-EU FDI) amounted to 86.9% of total outward investment in 1994 decreasing slightly to 85.6% in 1996. This trend holds true for the analysed countries with exception of Austria and Sweden.

Specialisation and geographic concentration

Disaggregated information on 12 mainly two digit sectors are available for three small European countries (Austria, Denmark and the Netherlands) and two large ones (Germany and the United Kingdom). Disentangling vertical and horizontal FDI, as well as greenfield investments and mergers, is not possible with the data at hand.[36]

The degree of specialisation of total inward FDI is comparable in size among all five countries. It is most pronounced in Denmark and Germany. The specialisation pattern of the Netherlands corresponds least with the aggregate, absolute specialisation is highest. Specialisation of *intra*-EU FDI, in contrast, differs more widely across the five countries. In the two big countries - Germany and the United Kingdom - the specialisation of production and exports is more widely dispersed, whereas the specialisation of FDI, trade and production fit together more closely for the smaller countries.

Production shares are significantly positively correlated with the corresponding shares of total inward FDI, highlighting the important role of FDI in shaping the pattern of specialisation of the host countries. The current stock of inward FDI represents the multinational investment activity of the previous years, and is even more highly correlated with 1988 production. However, the change in relative specialisation is negatively correlated with the relative FDI-shares from 1996. This implies that multinational firms invested most in those sectors in which host countries are now less specialised and lost their comparative advantage.

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[36] Disaggregated data into greenfield investments and mergers are not available. All five countries enjoy above average income per capita. This should be borne in mind when interpreting the empirical findings below.

Table 5.4: The impact of production, trade and inward FDI on specialisation

1996	Total FDI 1996	*Intra-* EU inward FDI
Nominal Value Added	0.35 **	0.16 *
Extra- EU exports	0.25 *	0.21
Intra- EU exports	0.40 **	0.33 *
1989		
Nominal Value Added	0.41 **	0.25 *
Extra- EU exports	0.20	0.17
Intra- EU exports	0.43 **	0.35 **
Change		
Nominal Value Added	-0.21 *	-0.27 *
Extra- EU exports	0.12	0.10
Intra- EU exports	-0.10	-0.05

Correlation coefficients for the relative shares in total manufacturing across countries
** Significant at 5%
* Significant at 10 %

Source: WIFO calculations using EUROSTAT.

The results are replicated for the perspective of geographic concentration. Both total inward FDI and *intra*-EU FDI are geographically more concentrated than production and trade. This is due to the dominance of the United Kingdom as a host country of FDI. It holds 40% of the inward FDI from the world into these five countries, whereas the corresponding production share amounts to 27%. The Netherlands comes in at second place, with an inward FDI share of 35%, but a production share of only 8%. Germany’s share in inward FDI is much smaller than its share in production. On the other hand, there is also evidence that FDI coincides with the country pattern of concentration in some industries. The correlation between the relative country shares in FDI and production is positive, but weakening between 1988 and 1996. The relative FDI shares (geographic concentration) and the change in production concentration are negatively correlated (at the 10% level of significance). We take this as a piece of evidence that the distribution of FDI (especially of *intra*-EU FDI) played an important role in changing the geographic structure of production within Europe. FDI has to be seen as an important means of promoting structural convergence.

Table 5.5: The impact of production, trade and inward FDI on geographic concentration

1996	Total FDI 1996	*Intra*-EU inward FDI
Nominal Value Added	0.35 **	0.16 *
Extra-EU exports	0.25 **	0.21
Intra-EU exports	0.39 **	0.33 **
1988		
Nominal Value Added	0.41 **	0.25 *
Extra-EU exports	0.20	0.17
Intra-EU exports	0.43 **	0.35 **
Change		
Nominal Value Added	-0.21 *	-0.27 *
Extra-EU exports	0.11	0.10
Intra-EU exports	-0.10	-0.04

Correlations for the relative shares in the corresponding aggregate sector across countries
** Significant at 5%
* Significant at 10 %

Source: WIFO calculations using EUROSTAT.

The impact of the European affiliates of US multinationals

Detailed data on FDI over time are not available in official statistics. We therefore utilised additional information on the activities of European affiliates owned by US multinational firms for the period 1989 to1996. This database allowed us to analyse sales and employment instead of FDI-stocks.

During the period 1989 to 1996, US affiliates increased their sales nominally by a yearly average of 6.0% (including newly set-up affiliates), which was slightly more than the increase in their activities world-wide. Employment in EU-affiliates amounted to 1.8 million people in 1996, indicating that US multinationals play an important role in European manufacturing. However, due to high productivity growth, employment increased only slightly (0.3% on average per year). Overall average sales growth was highest in plastic products, printing and publishing, fabricated metal products and chemicals, whereas some high tech industries, such as electronics and machinery, performed below the industry average. Note that most labour-intensive industries likewise grew below average.

Table 5.6: Specialisation of affiliates of US-multinationals

(Herfindahl index based on employment data)

	1989	1996
All host countries	0.127	0.123
EU	0.129	0.118

Source: WIFO calculations using BEA.

Three interesting features related to specialisation emerge. First, compared to the overall specialisation pattern of the affiliates around the world, affiliates in the EU are less specialised. Secondly, there is a clear trend of de-specialisation over time. The activities of US-multinationals dispersed over time, contrary to what generally seems to be happening with production in the EU (see chapter 2.3). Thirdly, the measurement of European specialisation against worldwide specialisation reveals that specialisation in Europe has increased. This picture indicates that affiliate production in Europe was concentrated in specific sectors, but broadened over time.[37]

Conclusions

Inward FDI grew faster than production during the period 1988 to 1996. In particular, growth of *intra*-EU inward FDI and *intra*-EU exports outperformed value added growth and growth in *extra*-EU exports. Secondly, *intra*-EU FDI is an important component of inward FDI. Much of the FDI into Europe comes from European countries themselves, which can be expected more and more integrated market. Thirdly, with exception of Austria, all 9 EU-countries, for which data are consistently available, are net direct investors - as is Europe as a whole.

Inward FDI plays an important role in shaping specialisation within countries. Multinational firms invested in those industries where their host counties traditionally hold a comparative advantage. But on average, sectors with a large share of FDI in 1996 did not gain importance as compared to 1988. This could be tentatively interpreted as follows. Multinational investment are primarily of the vertical type and targeted at specific industries. The range of the industries have broaded, the number of countries in which investments are done is increasing. Thus multinational firms are spreading knowledge across countries instead of increasing specialisation and concentrating in specific countries.

The effect of lower set-up costs for new plants (or takeovers) seems to be more important than the exploitation of plant economies of scale.

Note that these findings should be interpreted cautiously as first evidence, due to the severe data constraints resulting from the insufficient coverage of the FDI data. Above all, southern European countries were not included due to lacking FDI data.

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[37] The same pattern is evident in investment outside Europe, which once exhibited a similar degree of specialisation which however diminished even more rapidly.

5.3. *Intra*-industry trade and vertical product differentiation

Introduction

Trade among countries can involve the exchange of products between industries (inter-industry trade) or the exchange of products within industries (*intra*-industry trade). Shifts from endowment based trade to trade based on economies of scale and imperfect competition as well as the convergence of incomes had led to an increase in the *intra*-industry trade, specifically for rather homogenous areas like the EU. Agglomeration tendencies and the reduction of transport costs (which magnifies the impact of economies of scale), had led to the prediction that this tendency may come to an end. We investigate how *intra*-industry trade (IIT) developed over the last ten years, secondly whether it involved horizontal or vertically differentiated trade. Differences between countries and industries and between *intra*-EU and *extra*-EU trade show how it contributed to the changing pattern of concentration.

Box 5.3: Measuring *intra*-industry trade

The most widely used concept to empirically identify IIT is the Grubel-Lloyd (GL)-index (Grubel - Lloyd, 1975). The index relates the amount of "matched" trade to gross trade in a particular industry j, so that the formula reads:

(1) $GLj = 1 - \frac{|Xj - Mj|}{(Xj + Mj)}$ where Xj and Mj are exports and imports of industry j respectively.

Thus, if exports of a certain product category equal imports of that category, the GL-index takes a value of "1" indicating that all trade in the specific commodity is IIT; if either exports or imports equal zero, the GL-index is "0" and IIT does not exist.

The most important problem related to the empirical identification of IIT and the various indices of IIT suggested in the literature is the issue of categorical aggregation, that is, how to properly group together products which constitute an industry. Practically, the empirically observed amount of IIT depends on the chosen level of aggregation and the risk to overestimate IIT is higher the higher the chosen level of aggregation.

For this reason, the GL-indices for manufacturing industries reported here are derived from calculations on the very detailed 6-digit level of the NACE classification. The detailed GL-indices were weighted together by the shares of the different commodities i in total *intra*- res. *extra*- EU trade (exports and imports) in industry j (2 digit NACE level) of country k. Accordingly, the following specification of the GL-index for each country k has been used:

(2) $GL_k = 1 - \frac{\sum_{i\in j}\left|Xi - Mi\right|}{\sum_{i\in j}\left(Xi + Mi\right)} = \sum_{i\in j} wi * GLi$

where $wi = \frac{Xi + Mi}{\sum_{i\in j} Xi + \sum_{i\in j} Mi}$ and Xi and Mi are exports and imports of commodity i respectively.

Intra-industry trade for the EU as a whole is then calculated as the weighted average Grubel-Lloyd indicator of *intra*- respective *extra*-EU trade flows by summing up over the declaring EU member countries and products being part of industry j:

(3) $GL_{EU} = 1 - \frac{\sum_{k\in EU}\sum_{i\in j}\left|X_{ki} - M_{ki}\right|}{\sum_{k\in EU}\sum_{i\in j}(X_{ki} + M_{ki})}$

Separating horizontal and vertical *intra*-industry trade

In a next step we adopt a procedure that has been suggested among others by Greenaway - Hine - Milner (1994, 1995)[38] to disentangle vertical and horizontal IIT. Relative unit values of exports and imports serve as discriminating factors and means for measuring quality differences in trade. Horizontal IIT is defined as the simultaneous export and import of a product on the 6-digit NACE level where the relative unit values are within a specified range. In accordance to the studies of Greenaway - Hine - Milner, and that of Abd-el Rahman (1991)[39]) a range of relative export and import unit values of +/-15 percent, or 0.85 to 1.15 was chosen to identify horizontal IIT. Where the relative unit values are outside that range, IIT was classified as vertical.

Using the unit value information, observed IIT at the detailed 6-digit NACE product level was thus divided into vertical (VGL) and horizontal (HGL) IIT and then aggregated using the procedure used above. The GL-index is then the sum of its components:

(4) $GLi = VGLi + HGLi$

where $HGLi$ is given for those products that satisfy the condition:

(5) $0.85 \leq \frac{UV_i^{EX}}{UV_i^{IM}} \leq 1.15$

and $VGLi$ is given for products satisfying condition:

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[38] Greenaway, Hine, Milner (1994) and Greenaway, Hine, Milner (1995).

[39] Abd-el Rahman (1991).

(6) $\frac{UV_i^{EX}}{UV_i^{IM}} < 0.85$ or $\frac{UV_i^{EX}}{UV_i^{IM}} > 1.15$

The calculations are based on the Eurostat COMEXT databank on foreign trade and cover the period from 1988 to 1997. There are, however, no declarations for Austria, Sweden and Finland before their entry into the EU in 1995. To overcome this problem and to make indicators comparable over the whole period considered, a time series corrected by the break 1994/95 was calculated.

Intra-EU trade

Intra-industry trade continued to increase. Within the member countries it accounted for 58.7% of total *intra*-EU trade in 1988 and increased by four percentage points to 62.8% in 1997. The larger part is vertical in nature (37% of total trade) the smaller part is hoizontal involving the exchange of similar qualities (26%). The largest part of the increase between 1988 and 1997 is again in vertical trade. Within the period a certain flattening of the increase can be observed since 1991 in which todays IIT share had already been reached.

Analysis by country

Analysis by country (see Table 5.1) suggests to distinguish between three groups of countries. The first group Greece, Portugal, Finland and Ireland is characterised by an inter-industry specialisation. It is particularly pronounced for Greece – as much as 82% of its *intra*-EU trade remains inter-industry in nature. The second group has a specifically high share of IIT in vertically differentiated products. The United Kingdom, Spain, Sweden and Austria belong to this group of countries. Finally, France, Germany, Belgium/Luxembourg and the Netherlands as a third group combines a high share of IIT and high shares in horizontal trade.

The general dominance of vertical IIT is seen in Figure 5.3, since all countries with the exception of France, are on the right hand side of the triangle.

All but two countries further increased *intra*-industry trade. The strongest increases occurred in Portugal and Spain. Portugal increased both types of *intra*-industry trade, but the share of inter-industry trade remains high, while Spain’s trade already resembles those of some of the more advanced countries in the EU. For most countries the increase in IIT came from the already higher vertical component. Italy and Ireland saw a slight decrease in IIT. In addition, Ireland has a very small share of horizontal IIT.

Table 5.7: Trade types by countries: 1997

	Intra-EU Shares in total trade in %				*Extra*-EU Shares in total trade in %			
	Inter-industry trade	IIT	Horizontal IIT	Vertical IIT	*Inter*-industry trade	IIT	Horizontal IIT	Vertical IIT
Belgium	32.5	67.5	***32.0***	35.5	53.8	46.2	***15.4***	30.9
Denmark	48.6	51.4	16.1	35.4	59.9	40.1	7.8	32.3
Germany	30.7	69.3	***33.1***	36.2	49.7	***50.3***	9.5	***40.8***
Greece	***82.0***	18.0	3.2	14.8	***68.1***	31.9	7.8	24.1
Spain	39.6	60.4	20.2	***40.2***	54.0	46.0	11.0	34.9
France	25.4	74.6	***37.6***	37.0	45.0	***55.0***	***18.7***	36.3
Italy	48.7	51.3	16.2	35.1	58.6	41.4	6.3	35.1
Ireland	***61.2***	38.8	5.3	33.5	58.0	42.0	7.1	34.9
Netherlands	37.0	63.0	***29.5***	33.5	55.5	44.5	11.7	32.8
Austria	41.4	58.6	18.1	***40.5***	47.8	***52.2***	9.4	***42.8***
Portugal	***63.6***	36.4	13.9	22.5	***69.6***	30.4	6.8	23.6
Sweden	46.1	53.9	13.9	***40.0***	59.3	40.7	8.1	32.6
Finland	***64.0***	36.0	9.4	26.5	***70.6***	29.4	6.3	23.1
United Kingdom	33.3	66.7	20.0	***46.7***	43.5	***56.5***	11.6	***44.9***
EU	37.2	62.8	25.8	37.0	51.4	48.6	11.0	37.6

IIT: *intra*-industry trade; bold figures indicate highest share (all shares - including the two components of *intra*-industry trade - in % of total trade).

Source: WIFO calculations using COMEXT.

Indicators on geographic concentration indicate that *intra*-industry trade in horizontally differentiated products is more concentrated than IIT in vertically differentiated products (Table 5.8). Secondly, for IIT as a whole and its two components, indicators on absolute concentration display a clear process of de-concentration, which has been stronger for the more concentrated horizontal IIT. The picture is less clear cut for the relative concentration measure.[40]

Table 5.8: Geographic concentration of *intra*-industry trade

	Intra-EU trade						Extra-EU trade					
	IIT		Horizontal IIT		Vertical IIT		IIT		Horizontal IIT		Vertical IIT	
	1997	Change[1] 1988/97	1997	Change[1] 1988/97	1997	Change[1] 1988/97	1997	Change[1] 1988/97	1997	Change[1] 1988/97	1997	Change[1] 1988/97
Absolute concentration												
CR3	53.4	-1.7	59.7	-3.7	50.5	0.8	62.4	-1.8	63.9	-1.0	61.9	-1.9
CR5	73.2	-2.1	80.3	-1.3	69.9	-2.5	79.7	-2.0	79.2	-4.3	80.0	-1.0
Herfindahl Index	13.2	-1.3	15.8	-1.8	12.1	-0.7	15.9	-0.7	15.9	-0.8	16.3	-0.4
Standard deviation of trade type shares	6.8	-0.7	8.2	-0.8	6.2	-0.6	8.2	-0.3	8.2	-0.4	8.4	-0.2
Relative concentration												
Standard deviation of localisation rates	25.4	0.3	40.6	-0.2	21.9	1.0	17.7	-5.4	32.9	-4.2	17.9	-4.2

[1] Change in % points.

Source: WIFO calculations using COMEXT.

Analysis by industry

In an analysis of trade types in total *intra*-EU trade by sectors, tobacco products, leather products, petroleum, wood and food products turn out to be characterised by a high share of inter-industry trade suggesting specialisation along lines of comparative advantage (Table 5.9). *Intra*-industry trade based on an exchange of horizontally differentiated varieties, is most prominent in *intra*-EU trade of other transport equipment, motor vehicles and basic metals and to a lesser extent also paper products. Finally, specialisation along ranges of qualities is most important for medical and optical instruments, recorded media and apparel.

Intra-industry trade rose in basically all sectors. For the majority of the sectors the larger part of that increase concerned the exchange of vertically differentiated products. This trend towards more vertical IIT was especially pronounced for plastic products, recorded media, machinery and leather products. Finally, the most significant movement toward more horizontal IIT can be discerned for other transport equipment (especially aircraft), computers as well as food and tobacco, with the latter also decreasing significantly the share of inter-industry trade.

A division of industries according to the WIFO typology[41] shows that *intra*-industry trade in vertically differentiated products is predominant in all industries, except for capital-intensive industries. Capital-intensive industries and research-intensive industries exhibit the largest share of horizontal IIT, while vertical differentiation is more important in *intra*-industry trade of mainstream and labour-intensive industries. The highest gains in IIT can be discerned for advertising-intensive industries and also mainstream industries.

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[40] Standard deviations of localisation rates of trade types calculated across countries are more or less constant for total IIT and its horizontal component and increases slightly for IIT in vertically differentiated goods.

[41] For the methodology see: M. Peneder, 1999.

Table 5.9: Trade types in *intra*-EU trade by sectors

		Shares in 1997 in %				Change 1988 to 1997 in %-points			
		Inter-industry trade	IIT	Horizontal IIT	Vertical IIT	*Inter*-industry trade	IIT	Horizontal IIT	Vertical IIT
15	Food products and beverages	49.9	50.1	23.4	26.7	-6.7	***6.7***	***6.0***	0.5
16	Tobacco products	***65.4***	34.6	13.4	21.3	-3.4	3.4	***9.4***	-2.9
17	Textiles	37.0	63.0	17.2	***45.8***	-3.6	3.6	-2.2	6.0
18	Wearing apparel; dressing and dyeing of fur	35.4	64.6	13.9	***50.7***	-7.3	***7.3***	0.6	5.0
19	Tanning and dressing of leather	***55.4***	44.6	11.8	32.8	-6.8	***6.8***	-0.8	***8.4***
20	Wood, products of wood and cork	***55.0***	45.0	11.6	33.4	-2.4	2.4	-4.6	5.7
21	Pulp, paper and paper products	45.6	54.4	32.7	21.7	-4.3	4.3	2.0	2.1
22	Publishing, printing and reproduction	34.5	65.5	10.9	***54.6***	-1.6	1.6	-9.7	***11.7***
23	Coke, refined petroleum and nuclear fuel	***55.6***	44.4	28.5	15.9	-3.6	3.6	3.3	-0.6
24	Chemical and chemical products	34.8	65.2	23.8	41.5	-3.0	3.0	-2.1	4.8
25	Rubber and plastic products	25.7	***74.3***	32.3	42.1	-4.5	4.5	-4.5	***12.6***
26	Other non-metallic mineral products	44.7	55.3	16.2	39.1	-1.2	1.2	-3.0	3.8
27	Basic metals	36.9	63.1	34.7	28.4	-1.7	1.7	-3.8	4.3
28	Fabricated metal products	28.6	***71.4***	24.6	46.9	-4.3	4.3	-1.3	4.4
29	Machinery and equipment n. e. c.	37.8	62.2	16.9	45.2	-4.3	4.3	-5.6	***9.3***
30	Office machinery and computers	32.6	67.4	19.8	47.5	1.8	-1.8	***9.5***	-20.7
31	Electrical machinery and apparatus n. e. c.	34.3	65.7	17.7	48.1	-4.4	4.4	-3.2	7.6
32	Radio, TV and communication equipment	32.2	67.8	21.4	46.4	0.1	-0.1	***8.7***	-10.6
33	Medical, precision and optical instruments, watches	32.6	67.4	12.2	***55.2***	-1.9	1.9	0.3	3.1
34	Motor vehicles, trailers and semi-trailers	33.3	66.7	***42.0***	24.7	-6.3	6.3	0.7	4.9
35	Other transport equipment	27.8	***72.2***	***44.7***	27.5	-2.7	2.7	***12.8***	-7.7
36	Furniture; manufacturing n. e. c.	42.5	57.5	15.1	42.4	-1.5	1.5	1.7	-0.5

IIT: *Intra*-industry trade; bold figures indicate highest shares (all shares - including the two components of *intra*-industry trade - in % of total trade).

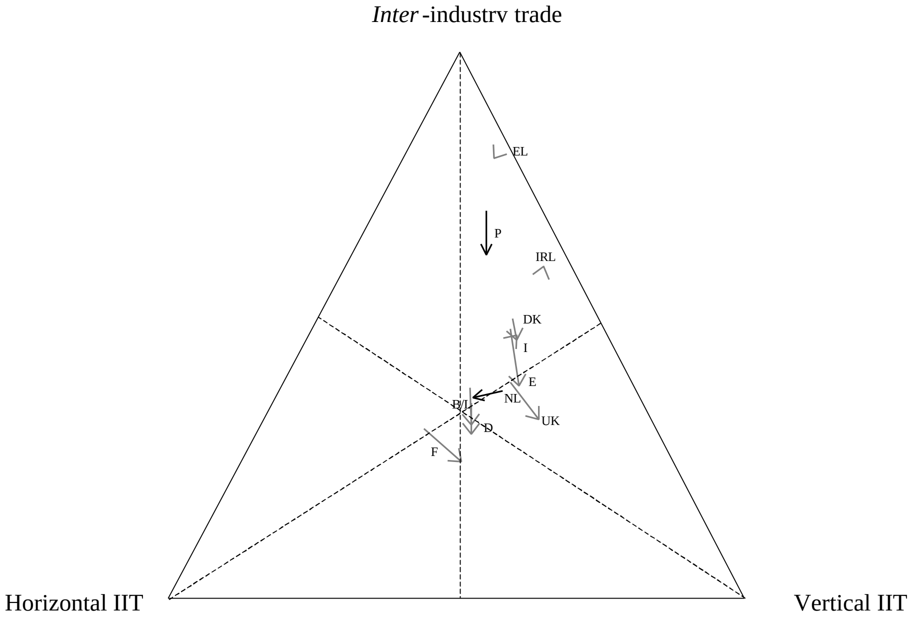
Source: WIFO calculations using COMEXT.

***Extra*-EU**

While the major part of *extra*-EU trade of the EU member countries is still inter-industry in nature and *intra*-industry trade with non-members accounts for a much smaller share than in *intra*-EU trade (48.6% of total *extra*-EU trade in 1997), it increased by 4.4%-points, in parallel to *intra*-EU trade. The difference in the level stems from the much lower part of horizontally differentiated products, which amounts to only 11% of total *extra*-EU trade compared to 25.8% in *intra*-EU trade. Generally, the rise in IIT is higher for the smaller countries and lower for the larger ones. Most outstanding however, is the jump of IIT in *extra*-EU trade for Greece (in the vertical segment), which stands in contrast to what we saw in the analysis of *intra*-EU trade. Also, Portugal and Spain significantly increased the share of IIT.

Most large countries have large shares of IIT, including Spain which reaches the same amount as Belgium, and overtook countries like the Netherlands and Italy in a country ranking according to the importance of IIT in its *extra*-EU trade. Figure 5.4 shows that the pack of countries is much tighter than in *intra*-EU trade. From this follows, that trade structures of countries in *extra*-EU trade are much more similar in their division between the three components of trade than in *intra*-EU trade.

Fig 5.4: Trade types in *intra*-EU trade by country: 1988 to 1997

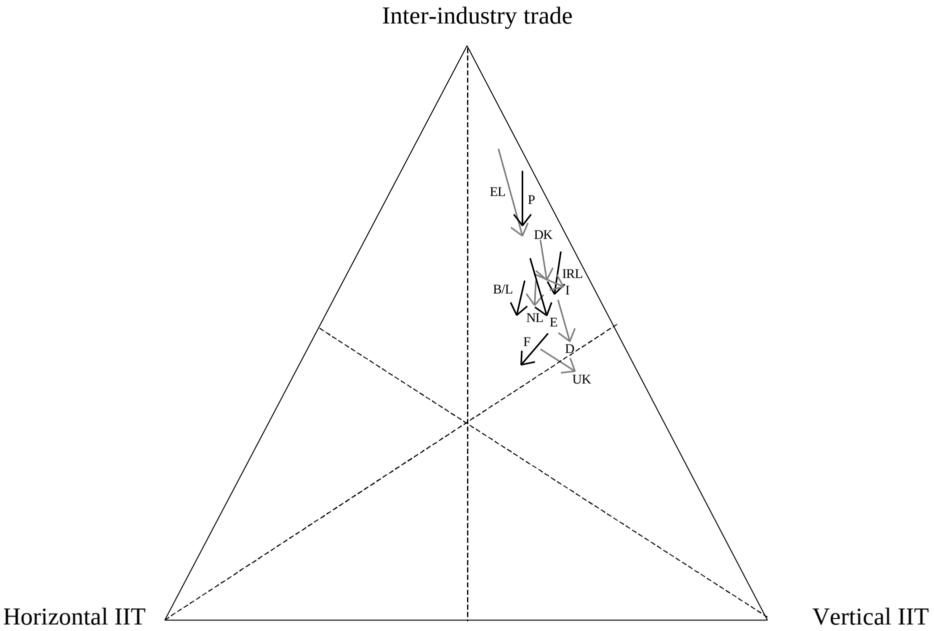


Source: WIFO calculations using COMEXT.

For the majority of countries the lions share of IIT as well as its rise in IIT concerned vertically differentiated products (Fig 5.5). This is especially true for Greece and Spain, but also for such countries as the United Kingdom, Italy and Germany. The exceptions are Portugal, seeing increases in both types of IIT, France, Belgium/Luxembourg and Ireland for which changes in trade structures point to higher shares of horizontal IIT. Note, that Ireland increases *intra*-industry trade versus non members, probably since production of subsidiaries are targeted to oversees markets. On the other hand the relatively high specialisation of Germany and also Austria in an exchange of vertically differentiated products in *extra*-EU trade could be due to higher than average trade relations with Eastern Europe, which are likely to be more subject to an exchange of products of differing quality.

Absolute as well as relative concentration for IIT and its components in *extra*-EU trade decrease.

Fig 5.5: Trade types in *extra*-EU trade by country: 1988 to 1997



Source: WIFO calculations using COMEXT.

Summary

These results show that *intra*-industry trade continues to increase, for most countries and industries. The deepening of integration as well as the effects of globalisation did not result in a recurrence of inter-industry trade or lead to heavy agglomeration. Portugal and Spain have the largest increase in *intra*-industry trade. Within *intra*-industry trade the largest share and the steepest increase is given for the *intra*-industry exchange of vertically differentiated products. The outcome suggest specialisation of European countries along a quality ladder. This is not IIT in the strict sense of the mainstream of new trade theory models which stress horizontal differentiation and trade in varieties.

The classical horizontal IIT displays a relatively high level of geographic concentration in *intra*-EU trade, but a stronger tendency of de-concentration, too. Basically the same tendencies are prevalent in *extra*-EU trade, although *intra*-trade remains to the most part inter-industry in nature.

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6. Why do growth rates differ in industries?

This chapter focuses on the determinants of industry growth in the EU member countries, complementing the analysis on the specialisation of countries and the concentration of industries. We review theoretical hypotheses, previous empirical literature and present stylised facts about the growth process over the past ten years. We explain the growth pattern econometrically in a panel of European three digit industries and informally discuss policy variables, which may lie behind the country effects found.

6.1 The determinants of industry growth from a theoretical point of view

In contrast to theories explaining the aggregate growth of countries, theories on the growth of industries are rare.[42] Usually, they combine determinants from the demand side, focusing on income growth or demand for new varieties, and from the supply side, focusing on cost shifts or new technologies. A third group of explanatory factors refers to structural determinants, market structure, and economic policy.

Physical capital and labour input growth

Besides improvements in technology, growth of factor endowments as major sources of growth are evident (Pugel, 1992). The effects of a country‘s factor endowment growth are summarised in the Rybczynski magnification relationships, which predict faster growth for those industries which use the faster growing factor more intensively.

Human capital

Investment in human capital increases the qualifications of the labour force and leads to higher productivity levels. Ceteris paribus, an industry will grow more quickly, the more it invests in human capital. Output growth follows from the productivity growth achieved by upgrading the skills and qualifications of the labour force. Note that investment in human capital goes hand in hand with investment in intangibles.

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[42] For macro growth see Barro and Sala-i-Martin (1995). For the industry level, the growth accounting (explaining output by the inputs used) is a popular line, which will not be followed here, see Oulton and O‘Mahony (1994).

R&D and innovation

Technology can be tangible or intangible (know how, skills). New technologies improve the production processes, or generate new products, and a competitive advantage of firms. Spillovers extend these to the industry level. New growth theory demonstrates that knowledge can generate endogenous growth in total factor productivity or enhance the quality or variety of products. The growth potential is shown to be higher for heterogeneous differentiated products than for homogenous ones.

Technical opportunities

In the new growth theory, Ricardian-type models characterise different activities with different rates of productivity growth originating from differences in the availability of technological opportunities. Thus, industries specialising in activities with a higher potential for productivity growth are expected to achieve faster overall growth.

Product differentiation

Firms differentiate their products, either through quality improvements (product upgrading) or through marketing efforts (e.g. the creation of branded goods), decreasing the possibility of substitution and thus the degree of price competition. Both strategies allow the producer to charge a mark up over marginal costs to recover the funds for investments in new innovations and continued growth.

Demand conditions

The growth of an industry is, ceteris paribus, higher, (i) the lower its price elasticity of demand, (ii) the lower the rate of increase of its relative price, (iii) the higher the income elasticity of demand, (iv) the faster the rate of income increases, and (v) the greater marketing efforts and the faster product invention are. One stylised fact is Engel's law: If income increases the demand for basic goods decreases and the demand for sophisticated goods ("luxury goods", "non-necessities") increases. Increasing income shifts demand to industries producing goods with higher income elasticities. National demand preferences can establish a national lead-market, which can be the basis of international expansion (home market effect).

Market structure and industry dynamics

In a more competitive framework, the incentives to invest in new technology and products and to adapt new technologies earlier may be stronger (Aiginger, Pfaffermayr, 1998) and fewer opportunities for inefficient behaviour exist. On the other hand, endogenous growth theory assumes that imperfect competition is necessary for innovation and growth. The empirical evidence favours the former argument. Baldwin (1992, 1995) has shown that the "churning" of businesses within and between industries is an important determinant of the growth of industries. Challenging the incumbents often spurns new ideas for products and processes of production. Entrants can be new firms or new lines of business for existing firms.

Public support and economic policy

Public support can create additional demand or reduce costs. It is justified if it eliminates market failures, as is the case in subsidising R&D or in the case of public goods that would otherwise be underprovided by the market. Modern growth theory stresses the role of public support in (knowledge) spillovers and external effects, which are of special importance to R&D investments. Reservations as to whether real policy will succeed in providing sector specific aid efficiently exist due to information problems (Neven, Vickers, 1992). Strong cases in favour of intervention include limiting the strategies of incumbent firms to deter entry, functional aid (e.g. R&D), and regional subsidies to alleviate the asymmetrical costs of economic shocks.

Catching up and previous specialisation

If structural convergence takes place, lagging industries grow systematically faster than the leaders. Country specific economic policy could speed up convergence, for example, by enforcing knowledge spillovers, fostering external economies and more generally creating a favourable business environment. Early specialisation likewise affects economic growth. During the process of integration, factor movements, restructuring etc. reshape specialisation patterns and in this way lead to differences in growth rates during the period of transition to the new long run equilibrium.

Long run growth

Neo-classical multisector growth models imply that differential growth in a particular industry cannot last forever. However, differential growth can be observed in the transitional dynamics to a new steady state, i.e. during the course of economic adjustment to the new long run equilibrium.

6.2 Previous empirical evidence

Technical change and endowment growth

In an empirical study about industry growth, Salter (1960) identifies technological opportunities and the stage of an industry in the life cycle as determinants of growth rates. Furthermore, fast growth may be self-enhancing, because faster growing industries often tend to install newer plants embodying the latest techniques ("best practice techniques"), which shortens the average age of the capital stock.[43]

Pugel (1992) focuses on structural change within the manufacturing sector in Europe (EU-12), the US and Japan, and draws two major conclusions. First, the growth rates of manufacturing industries vary widely across industries, indicating substantial structural change, but are similar for the three areas. Secondly, growth in individual industries in Europe and in the US is significantly related to the human-capital intensity of the industry, but is only weakly related to the R&D intensity of the industry. In Japan, on the other hand, both variables are positive and significant.

Table 6.1: Determinants of industry growth rates: 1963 to 1987

	Europe		USA		Japan	
	Regression coefficients (t values in parentheses)					
Own R&D intensity	0.22		0.14		2.63	
	(0.84)		(0.52)		(5.54)	**
Physical capital intensity	0.00		0.00		0.00	
	(0.88)		(0.81)		(0.03)	
Human capital intensity	1.07		1.69		1.56	
	(2.05)	**	(2.08)	**	(2.74)	**
Constant	-10.82		-17.29		-16.98	
	(1.82)		(1.91)		(2.70)	**
R²	0.30		0.28		0.77	

**Significant at 5%

Own R&D intensities are measured by industry R&D-sales ratios.

Physical capital intensity is measured by the ratio of gross depreciable assets to the number of employees

Human capital intensity is measured by the median years of education of the labour force.

Source: Pugel (1992), Table 3.8, pp. 70.

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[43] Arrow (1962) and Schmookler (1966) emphasise endogenous technological progress. The rate of improvement will be highest if new problems keep appearing. Higher rates of investment and therefore output growth will induce faster technical progress.

Structural convergence and knowledge spillovers

Literature on "technological gaps" (Nelson, Wright, 1992, Abramovitz, 1986) and on catching up as a source of different growth rates, which may be conditional on educational efforts (see Fagerberg, 1994), usually restricts itself to the macro level, but does sometimes shift to the question as to whether convergence differs between manufacturing and services or within the manufacturing sector.

Bernard and Jones (1996a, b) claim that while aggregate productivity was converging for a group of 14 industrialised countries over the 1970 to1987 period, the sectors show quite disparate behaviour.[44] Similar results are presented by Carree et al. (1997) for 18 OECD countries and 28 manufacturing industries over the period 1972-1992. The authors claim that one reason for slow or lacking convergence in productivity is the existence of knowledge and capital barriers. In industries with high barriers, convergence to the leader's level may be slow and the output and productivity growth rates of these industries are lagging behind quite a long time period.

In contrast, Dollar and Wolff (1988, 1994) find convergence in nearly every individual industry analysed. Dollar and Wolff (1988) conclude that the convergence of productivity within industries is the main cause of convergence in aggregate labour productivity. Convergence was strongest in the heavy industries.

Selvanathan and Selvanathan (1993) estimate demand equations for ten commodity groups in 18 OECD countries. Preferences are heterogeneous across countries. Half of the estimated income elasticities is smaller than one ("necessities"), the other half is larger than one ("luxuries"). In all countries, food and housing are necessities, confirming Engel´s law. Medical care is a necessity in all countries except Canada and Italy, where it is a luxury good. Durable goods are luxuries in all countries, and clothing, transport and recreation are almost always luxury goods. The study proves that differences in income and price elasticities exist across commodity groups and across countries. These differences in elasticities can induce differential growth rates of industries.

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[44] The countries are Australia, Belgium, Canada, Denmark, Finland, France, Italy, Japan, the Netherlands, Norway, Sweden, the United Kingdom, the United States, and West Germany. The six sectors at the one digit level are agriculture, mining, manufacturing, electricity/gas/water, construction and services. The data source is the OECD Intersectoral Database (ISDB).

Table 6.2: Income elasticities of ten commodity groups for 18 OECD countries

Country	Food	Beverages	Clothing	Housing	Durables	Medical care	Transport	Recreation	Education	Miscellaneous
Belgium	0.49	0.98	1.14	0.58	1.49	0.58	0.88	0.94	0.06	2.37
Denmark	0.36	0.69	1.63	0.38	1.59	0.49	2.25	1.24	-0.14	0.95
Germany	0.62		1.50	0.16	1.44	0.83	2.30	1.00		0.71
Spain	0.85	0.91	1.29	0.19	1.46	0.95	2.37	1.36	0.40	0.62
France	0.46	0.48	1.29	0.44	1.57	0.56	2.21	1.02	0.78	1.31
Italy	0.86	0.70	1.81	0.49	1.53	1.03	1.42	0.67	0.62	0.95
Ireland	0.45	0.74	1.34	-0.04	1.89	0.76	2.49	1.44	-0.01	1.72
Netherlands	0.50	0.62	2.06	0.58	1.41	0.60	1.77	0.95	0.80	0.76
Austria	0.21	0.50	1.79	0.18	1.95	-0.73	3.11	0.80	-0.40	0.54
Finland	0.55	1.28	1.67	0.15	1.56	0.65	1.80	1.89	1.16	0.71
Sweden	0.55	1.10	1.45	0.16	1.87	0.05	2.01	1.59	0.58	1.03
United Kingdom	0.33	1.03	1.20	0.35	2.14	0.61	1.66	1.34	1.01	1.17
Norway	0.23	1.14	1.21	0.00	1.29	0.79	3.20	1.03	0.52	0.84
Switzerland	0.97	1.35	1.82	0.15	2.10	0.30	1.58	1.01		0.61
US	0.61	0.28	1.33	0.41	1.74	0.37	2.31	1.22	0.82	0.70
Canada	0.96	0.59	0.82	0.03	1.57	2.45	1.56	1.86	1.05	0.93
Japan	0.62		1.88	0.22	2.08	0.78	1.35	1.15		1.49
Australia	0.26	0.83	1.29	0.63	2.22	0.70	1.49	2.25	2.82	0.54
Mean	0.55	0.83	1.47	0.28	1.72	0.65	1.99	1.26	0.67	1.00

Source: Selvanathan and Selvanathan, 1993.

Firm growth, size, and industry evolution

Many empirical investigations of firm growth find that the evolution of firm size follows a random walk, and that mean reversion (i.e. that in the long run, the sizes of firms within an industry converge to a common mean), if it exists at all, is extremely slow. For a sample of 77 large, quoted UK companies observed over a thirty year period from 1955 to 1985, Geroski et al. (1997, 1998) find that differences in growth between any two firms persisted typically for only about two years. No spells of superior relative growth performance lasted longer than seven years, and the sign of the difference between the growth rates of any two firms changed seven times. Thus, corporate growth rates appear to be random, even when observed over a 30-year period. The reason for this may be that firms are irregular and erratic innovators (see Geroski et al., 1997). If firms innovate erratically and innovations are major determinants of firm growth, then firm growth rates will evolve in an unpredictable fashion.

A natural conclusion seems to be that industry or economy wide growth rates may also be random. However, even if the growth rates of existing corporations are random, systematic differences in industry growth rates may prevail if there are systematic differences in entry and exit rates. Studies analysing the growth of small and/or new firms find much better support for convergence, indicating that the finding of random growth rates for the larger firms can be subject to a selection bias. The growth of smaller or younger firms is driven much more by transitional dynamics, as these firms usually started out at a suboptimal size. If the fraction of industry output produced by young start-up businesses varies systematically across industries and these young start-up businesses indeed exhibit systematically different growth rates than established firms, it follows that industry growth rates vary systematically (if only in the transitional period).

Firm size distribution and industry growth

Small firms are sources of considerable innovative activity, stimulating industry evolution and creating an important share of newly generated jobs (Acs, Audretsch, 1993). In a study of 13 OECD countries and 14 manufacturing industries covering the period 1990 to 1994, Carree and Thurik (1998) find that industries with a low presence of large and medium-sized firms, relative to the same industries in other countries, perform better in terms of output growth. Small firms may be more flexible in adjusting their organisational structure and adapting to economic shocks.

Conclusions of previous empirical evidence on the determinants of industry growth

The substantial long run differences in industry level growth rates typically shown by the data are worth investigation, even if firm data reveals that annual growth rates appear random. The forces of catching up, technological factors, and endowment growth (such as growth in human capital through education) are confirmed for the supply side; income and price elasticities for the demand side. Higher valued and, presumably, higher quality products, have income elasticities larger than one. Industries producing these products exhibit, ceteris paribus, higher growth rates.

6.3 Sources of variance in industry growth

The average rate of nominal growth[45] in a typical 3-digit industry amounted to 2.1% during the nine-year period 1989-1997. The standard deviation of 6.3 percentage points reveals the high variation between EU member countries and between industries, a picture confirmed by the very high extremes in the distribution and by the analysis of variance in Table 6.3. Forty-seven percent of the variation can be explained by country, sector, and combined sector and country effects. The variation across countries is more pronounced than the sector effects, indicating that the country specific environment, economic policy and macroeconomic development have a significant impact on industry growth. This picture is consistent with the view that European manufacturing is not yet fully integrated. However, as the regressions below illustrate, there is a strong tendency towards catching up and deeper integration. Most of the variation in average growth rates comes from combined country-industry effects, suggesting that country specific environments combined with industry specific determinants common throughout the entire EU - such as demand growth - are the ingredients of long run performance.

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[45] Note that the sample is two years shorter than that used for the previous chapters, due to losing one year at the beginning and one at the end (the data substitution process chosen would have influenced the variance and covariance properties. As before, we stick to the nominal figures for several reasons: First, previous experience shows that value added deflators are of poor quality and methods of measurements differ across the EU-member countries. Secondly, in some industries, most prominently in the computer industry, dynamics is determined by quality improvements. Since quality adjustment is a very difficult task and beyond the scope of this contribution, it is better to stick to nominal figures instead of real figures. Thirdly, note that price increases have been very moderate over the period 1989-1997, so the bias from overall inflation should be very low. Additionally, we control for country fixed effects in our econometric estimations, which control for this among other country specific latent influences.

Table 6.3: Country effect, industry effect, and combined country/industry effect on growth

Analysis of variance of industry growth 1989 to 1997

Source	Partial SS	df	F	
Model	18370.3	214	3.3	**
Intercept	3124.1	1	118.9	**
Country	5705.3	11	19.7	**
Industry effect	2527.9	17	5.7	**
Country*industry effect	8796.5	186	1.8	**
Residual	20574.6	783		
Total	38944.9	997		
N	998			
R^2	0.47			

SS = Explained, unexplained variance; df = degrees of freedom.
** Significant at 5%

Source: WIFO calculations using SBS.

The Irish manufacturing industries performed best, growing on average by 6.5% per year, combining a remarkable catching up process with significant specialisation in fast growing industries. With average growth at 5.8%, Portugal came in second, also a country, which has been catching up. Austria placed third with 4.0% average annual growth in a typical industry. Average growth in France, the UK and Spain was below the industry average. At the bottom end of the scale, Finland experienced a period of a deep recession, induced by the large reduction in trade with the countries of the former Soviet Union, and the average growth rate of its industries fell to –2.5%. Like Sweden, Finland was also faced with the devaluation of its currency during the early nineties. Note that on average, employment has been decreasing in the industries of every country, with exception of Ireland and Denmark.

Table 6.4: Average industry growth by countries: 1989 to 1997

	Nominal value added		Employment		Nominal labour productivity		Nominal labour productivity 1989	
	Unweighted mean	SD of the mean	Unweighted mean	SD of the mean	Unweighted mean	SD of the mean	Unweighted mean	SD of the me
Germany	2.1	0.5	-2.7	0.4	4.9	0.2	32.7	0.9
Denmark	3.9	0.4	1.4	0.3	2.4	0.3	40.7	1.6
Greece	2.3	0.9	-2.1	0.8	4.6	0.6	14.5	1.0
Spain	0.8	0.4	-1.3	0.4	2.2	0.4	27.1	1.3
France	1.8	0.3	-1.3	0.3	3.2	0.2	37.1	1.5
Italy	2.1	0.4	-0.9	0.4	3.2	0.3	38.5	1.1
Ireland	6.5	0.9	2.4	0.4	4.0	0.8	38.5	3.7
Austria	4.0	0.8	-2.2	0.6	6.3	0.5	32.5	1.3
Portugal	5.8	0.9	-1.3	0.7	7.3	0.7	12.8	1.1
Finland	-2.5	0.7	-1.7	0.7	-0.7	0.3	46.4	2.1
Sweden	-2.2	0.5	-2.5	0.6	0.2	0.3	52.4	1.9
United Kingdom	1.0	0.4	-2.6	0.2	3.7	0.3	33.0	1.9
Total	2.1	0.2	-1.3	0.2	3.4	0.1	34.1	0.6
Levene-Statistik	8.5 **	(11, 986)	7.9 **	(11, 977)	9.4 **	(11, 977)	9.0 **	(11, 985)
Kruskal-Wallis *	213.6 **	(11)	163.7 **	(11)	320.9 **	(11)	453.4 **	(11)

Note a significant Levene test indicates that variances are not homogenous accross industries.
In this case the usual F-test on common goup means cannot be applied. Instead the Kruskal-Wallis test is used.
The growth rates refer to a typical industry and are therefore not weighted to account for size and composition effects.
Thus they do not present the growth of aggregate manufacturing.

*) Degrees of freedom in parentheses.
** Significant at 5%

Source: WIFO calculations using SBS.

The analysis of variance highlights the country and industry specific contribution to the growth of industries. The country specific effect illustrates the average bonus/or deficit coming form the location. So this contribution to industry growth is the same in all industries of a country (Table 6.4 below provides an overview). On the other hand the industry specific effects reflect the fact that on average some industries are growing faster than others in all countries (see Table 6.5). They reflect differences in product space, market structure, etc. For example differences in demand growth or different stages in the product cycle could be explanations.

The country growth pattern is consistent with the catching up process in some of the EU-countries, which had below average per capita income at the start of the nineties. Proceeding from a position of low average labour productivity in 1989, Ireland and Portugal managed to catch up considerably (Table 6.4). However, not all lagging countries have been able to initiate the process of catching up. Most notably, Greek industries only just barely achieved average growth performance (2.3%) and Spain performed below average, with the average growth rate of its industries amounting to just 0.8%.

Table 6.5: Average industry growth by sectors: 1989 to 1997

	Nominal value added		**Employment**		**Labour productivity**	
	Unweighted mean	SD of the mean	Unweighted mean	SD of the mean	Unweighted mean	SD of the mean
Food products and beverages	2.0	0.5	-0.5	0.3	2.5	0.4
Textiles	-0.2	0.5	-4.0	0.4	3.9	0.3
Wearing apparel; dressing and dyeing of fur	-1.9	1.5	-5.4	1.0	3.7	1.4
Tanning and dressing of leather	-1.1	0.8	-4.1	0.7	3.0	0.6
Wood, products of wood and cork	1.9	0.7	-0.7	0.5	2.6	0.5
Pulp, paper and paper products	3.0	1.4	-1.3	0.6	4.4	1.6
Publishing, printing and reproduction	3.8	1.1	0.2	0.5	4.0	1.3
Chemical and chemical products	3.2	0.7	-0.5	0.6	3.7	0.4
Rubber and plastic products	2.0	1.6	-1.5	1.4	3.6	0.6
Other non-metallic mineral products	1.8	0.5	-1.4	0.3	3.4	0.4
Basic metals	0.0	1.2	-2.8	0.5	2.9	1.1
Fabricated metal products	2.0	0.6	-0.6	0.5	2.7	0.5
Machinery and equipment n. e. c.	3.0	0.4	-0.2	0.4	3.3	0.4
Electrical machinery and apparatus n. e. c.	3.9	1.0	-0.1	0.7	4.1	0.7
Medical, precision and optical instruments, watches	4.5	0.8	0.2	0.8	4.3	0.6
Motor vehicles, trailers and semi-trailers	3.5	0.9	-0.1	0.7	3.7	0.9
Other transport equipment	1.1	1.1	-3.0	1.0	4.3	0.5
Furniture; manufacturing n. e. c.	4.0	0.9	0.5	0.6	3.6	0.6
Total manufacturing	2.1	0.2	-1.3	0.2	3.4	0.1
Levene-Statistik *)	2.1 **	(17, 980)	3.5 **	(17, 971)	1.9	(17, 971)
Kruskal-Wallis	103.5 **	(17)	115.6 **	(17)	21.9	(17)

Note a significant Levene test indicates that variances are not homogenous accross industries. In this case the usual F-test on common goup means cannot be applied. Instead the Kruskal-Wallis test is used. The growth rates refer to a typical industry and are therefore not weighted to account for size and composition effects. Thus they do not present the growth of corresponding aggregates.

*) Degrees of freedom in parentheses.

** Significant at 5%

Source: WIFO calculations using SBS.

Across industries - at the two digit level - the average growth rate varies between -1.9% in the apparel industries and +4.5% in the medical, precision and optical instruments industries (Table 6.5). In particular, the R&D intensive industries performed above average (4.2%) and experienced growing employment (0.4%) despite above average labour productivity growth (3.8%). The next in line are the mainstream industries (2.3%), which are overwhelmingly skill intensive, but do not use either labour or capital more intensively than total manufacturing. Labour and capital intensive industries grew much slower, at 1.5% and 1.4%, respectively. In addition, since average labour productivity growth does not deviate to a great extent from overall productivity growth, employment decreased significantly faster in these industries. The main driving force behind this growth pattern lies in differences in demand growth: this was only 1.6% in both labour and capital intensive industries, whereas R&D intensive industries enjoyed an average demand growth of 3.3% and mainstream industries of 2.2%.

Table 6.6: Average growth by type of industry (WIFO typology): 1988 to 1997

	Nominal value added		Employment		Labour productivity		Apparent Consumption	
	Unweighted mean	SD of the mean	Unweighted mean	SD of the mean	Unweighted mean	SD of the mean	Unweighted mean	SD of the mean
Mainstream industries	2.3	0.4	-1.3	0.3	3.6	0.3	2.2	0.1
Labour intensive industries	1.5	0.4	-1.9	0.3	3.5	0.3	1.6	0.2
Capital intensive industries	1.4	0.7	-2.0	0.4	3.4	0.5	1.6	0.2
Advertising intensive industries	2.1	0.4	-0.8	0.3	3.0	0.3	2.4	0.1
Research intensive industries	4.2	0.6	0.4	0.5	3.8	0.4	3.3	0.2
Total	2.1	0.2	-1.3	0.2	3.4	0.1	2.1	0.1
Levene-Statistik *)	0.3	(4, 993)	1.2	(4, 984)	0.1	(4, 984)	13.4**	(4, 993)
F-test*)	3.6 **	(4, 993)	5.2 **	(4, 984)	0.8	(4, 984)		
Kruskal-Wallis *)	27.4 **	(4)	22.6 **	(4)	2.7	(4)	98.3**	(4)

Note a significant Levene test indicates that variances are not homogenous accross industries. In this case the usual F-test on common goup means cannot be applied. Instead the Kruskal-Wallis test is used. The growth rates refer to a typical industry and are therefore not weighted to account for size and composition effects. Thus they do not present the growth of corresponding aggregate.

*) Degrees of freedom in parentheses.
** Sgnificant at 5%

Source: WIFO calculations using SBS.

At this descriptive level, in addition to weak demand growth, two other hypothesis on the sluggish growth in labour and capital industries seem to find support: Labour intensive industries lose ground in European manufacturing due to the forces of the intensified globalisation process, which lead to de-location of labour intensive production to low wage countries outside. Capital intensive industries seem to substitute labour more intensively through stronger rationalisation. The former hypothesis is supported by the fact that highly globalised industries, which are to a large extent, labour intensive, expanded at a slightly below average rate of 1.8%. The latter hypothesis is confirmed by the below average growth (1.7%) of mainly capital-intensive high wage industries, which reduced employment the most.

Box 6.1: Growth performance of European manufacturing industries – an econometric investigation

From the many possible determinants of industry growth, we concentrate on the country and industry characteristics inherited from the past in explaining growth performance. We especially look at productivity, specialisation and regional concentration[46], and skill endowments at the beginning of the estimation period. We control for demand growth, spillovers generated by trade, measures of globalisation and introduce policy variables.

Growth performance depends is significantly determined by the starting position. We measure this by the level of labour productivity at the beginning of the estimation period (1989)[47]. Industry specialisation is measured by two indicators also taken for the year 1989, - which likewise characterises the starting position. The specialisation term is defined for each country as the share in value added of a specific industry in total manufacturing (at the beginning of the estimation period). Secondly, we use the combined *intra*- and *extra*- EU trade balance as a measure of revealed comparative advantage. Both indicators are uncorrelated (0.08), so it is justified to introduce both of them. The low correlation is consistent with the notion of an ongoing home bias, since a large share of an industry in a particular country does not necessarily imply a trade surplus.

The indicator of geographical concentration is calculated as a country's industry share of value added in total EU-valued added for this industry. This indicator is related to that of specialisation, especially if it is taken relative to country size. From the perspective of new economic geography, this indicator can loosely be interpreted as a measure of geographical concentration, if we take countries instead of regions as a first, very imperfect approximation of the unit of locational choice. This index is correlated positively to the other two, but is not very high (0.13 and 0.15, respectively).

Motivated by the new growth theory we include growth in *intra*- and *extra*- imports in the basic specification. Helpman (1992), for example, has shown that in a model of endogenous growth, trade is an important channel for knowledge spillovers from one country to another, inducing endogenous growth.

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[46] Recall that regional concentration is defined at the country level, providing just a rough proxy; it should be emphasised that these measures ought to be interpreted relative to country size, which is implicitly done in the regression below.

[47] Note that the specification is not exactly comparable to the growth equations of the convergence literature (Barro, 1998), which would introduce lagged value added to measure the speed of catching up.

Table 6.7: Explaining industry growth I: fixed effects regressions

	Specification I			Specification II		
	Coefficient	t value		Coefficient	t value	
Labour productivity 1989	-5.2	-12.20	**	-3.5	-6.10	**
Interaction: productivity & skill	-	-		-6.4	-3.80	**
Specialisation	18.2	1.1		19.8	1.20	
Concentration	-4.8	-2.0	**	-5.2	-2.20	**
Trade balance	0.0	0.5		0.0	0.60	
Growth of extra EU imports	0.6	2.8	**	0.8	3.50	**
Growth of intra EU imports	0.2	0.7		0.3	1.00	
Denmark	4.4	6.4	**	4.3	6.40	**
Germany	2.6	2.9	**	2.6	3.00	**
Greece	-3.0	-3.3	**	-2.3	-2.60	**
Spain	-0.1	-0.6		-0.3	-0.50	**
France	2.7	3.9	**	2.7	4.00	**
Italy	3.3	4.7	**	3.3	4.80	**
Ireland	4.9	4.1	**	4.9	7.30	**
Austria	2.4	3.5	**	2.4	3.60	**
Portugal	-1.1	-1.2		-0.8	-0.90	
Finland	-0.1	-0.2		-1.6	-0.30	
United Kingdom	1.0	1.4		1.1	1.50	
Constant	-18.0	-12.9	**	-17.1	-12.40	**
N	980			980		
R^2	0.37			0.38		
σ	4.0			4.0		
Fixed industry effects	3.6	F(85, 877)	**	3.1	F(85, 876)	**
Fixed country effects	21.0	F(11, 877)	**	19.6	F(11, 647)	**
Fixed vs. random industry effec	83.2	$Chi^2(17)$	**	70.7	$Chi^2(18)$	**

** Significant at 5%
Remark: Sweden as the country with the highest labour productivity in 1989 is basis category for the fixed country effects.
16 outliers are skipped.

Source: WIFO calculations using SBS.

Other growth determinants we consider are either country or industry specific, lacking variation in one of the dimensions. Therefore, they cannot be included in the fixed effects regressions. So in a second step we regress the combined sum of industry effects and the error term on European-wide determinants of industry growth. These include a measure of market growth (defined as growth of apparent consumption in the triad); the degree of globalisation (measured by the exports and imports of the triad in relation to apparent consumption); non tariff trade barriers (Buigues, 1990), often also referred to as sensitivity, with respect to the single market program; a measure of skill and R&D intensity; as well as a differentiation by type of industry (see Competitiveness Report, 1998 and Peneder, 1998).

Table 6.8: Explaining industry differences II

Dependent variable: industry effects and error of regression in Table 6.7, spec. I

	Coefficient	t-value	
Market growth	0.3	3.1	**
Globalisation	-.02	-2.7	**
Sensitivity to single market (dummy for level 3 and 4)	8.8	1.1	
Skill intensity	5.2	3.1	**
Labour intensive industry (dummy)	-0.7	-1.1	
Capital intensive industry (dummy)	0.8	1.0	
Advertising intensive industry (dun	0.8	1.3	
R&d intensive industry (dummy)	2.5	3.3	**
Constant	-1.5	-2.5	**
N	86		
R^2	0.54		
Industry groups (WIFO typology)	5.0	F(4, 77)	

** Significant at 5%.
Remark: Between regression (Baltagi, 1995, p. 118)

Source: Results of fixed effects regression in Table 6.7.

The panel results

The panel regressions (Box 6.1) reveal a significant impact of the structure of specialisation and geographical concentration on growth. As a robust result, we find that geographical concentration in 1989 is significantly negatively associated with subsequent average industry growth. This implies that the industries of those countries already holding a relatively large share of value added compared to their size (remember we control for fixed country effects) grow significantly more slowly. This mirrors the results discussed previously in Chapter 2.3. Geographical concentration is decreasing and industry structure is becoming more equal across countries. Specialisation has no effect on growth; in contrast, here estimates are insignificant and there is no evidence that specialisation matters much as far as growth is concerned. These findings, however, do not imply that strong agglomeration effects leading to regional agglomeration of production in narrower defined regions within countries or groups of countries are absent.

There is significant catching up, which means that industries in countries with low labour productivity in 1989 grew considerably faster. Comparative advantages based on productivity differences level off. Although the direct measure of specialisation does not show any impact, the findings on productivity can be interpreted in this way. The process of convergence goes hand in hand with a decreasing degree of specialisation and thereby disperses the industrial structure of European countries. Inter-industry trade shifts more and more to *intra*-industry trade, which is determined by economies of scale, product differentiation and imperfect competition. As argued above, empirical evidence shows that not all countries managed to catch up.[48]

The regression shows that *extra*-EU imports are growth enhancing, whereas *intra*-EU imports are insignificant. Import growth that influences production is often interpreted as a spillover variable, transferring knowledge and stimulating further growth. This might be true for technology intensive imports from the US or Japan. Otherwise the variable could proxy dynamic industries in which imports and production both increase due to rapidly rising demand. Growth in *intra*-EU imports mainly captures two effects. First, deepening integration through the removal of trade barriers leads to efficiency gains, more competition and subsequently lower prices. For a given demand schedule, this should show up in higher growth rates, at least during an intermediate period. As we measure imports in nominal terms, we cannot disentangle these effects. Secondly, trading with neighbouring countries may serve as an important channel of knowledge transfer and thus speed up innovation and growth[49].

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[48] We can't calculate the speed of catching up with the present specification. Estimating a simply specification to measure conditional ß-convergence for value added growth (see Barro, 1995) shows that – taking the regressions literally - it requires generations to close the gap to the steady state growth path to 50%. Although we don't want to overemphasise the econometric estimations, we can conclude that industries in countries being farther away from their (individual) steady state growth path grow faster on average. The growth effect is not very big and the speed of structural change rather slow amounting to several decades to close the gap to 50%.

[49] Evidence of the effects trade has on enhancing productivity growth is given by Ben David (1996).

This hypothesis does not find support, most probably because our proxy of knowledge spillovers is rather imperfect.

Lastly, although we control for several growth determinants, significant country and industry effects remain. Given the control variables, the fixed industry effects cover all latent exogenous industry specific growth determinants, which are equal for all countries. They exhibit a clear pattern: The labour intensive industries - textiles, apparel and footwear - reveal the lowest values, whereas the skill and R&D intensive industries, such as, parts for motor vehicles, pharmaceuticals, pesticides and medical equipment achieved the highest European-wide growth rates.

Table 6.9: Lowest and highest industry effects (growth in %)

Five lowest industries		
	Leather clothes	-8.47
	Dressing and dyeing of fur; articles of fur	-6.52
	Other wearing apparel and accessories	-6.04
	Knitted and crocheted articles	-5.55
	Footwear	-4.58
Five highest industries		
	Railway locomotives and rolling stock	3.10
	Parts and accessories for motor vehicles	3.48
	Pesticides, and other agro-chemical products	4.33
	Pharmaceuticals	4.55
	Medical equipment	5.05

Source: Results of fixed effects regression in Table 6.7.

The second step (between-) regression provides further results on the determinants of European-wide industry growth. First, as expected, overall market growth, defined as growth of apparent consumption in the triad, plays an important role in fostering industry growth. Furthermore, there is a negative impact of globalisation, measured as the ratio of exports plus imports over apparent consumption in the triad. This reflects the impact of global competition on structural change with the more exposed industries growing slower on average.

The regression results also show that industries in which intangible assets are important - i.e. the skill and R&D intensive industries - grow faster even after taking into account the fact that demand in these industries is more dynamic. It strongly suggests that economic policies, which enhance the skills of the workforce and improve and liberalise the regulatory environment in R&D intensive industries, achieve the largest growth effects.

The fixed country effects capture a mix of influences; among them are differences in macroeconomic performance, economic policy and institutional settings. Significant country effects imply that during the period under investigation, there would have been growth differences, even if countries had similar structures with respect to productivity and geographical concentration, etc. They demonstrate that full integration still has to be achieved, although more recent data indicates that weaker effects can be expected. Compared to Sweden, country effects for Ireland, Denmark, Italy, France, Germany and Austria are significantly larger, whereas all others are insignificant, some of them negatively. Formally, the estimation results are consistent with convergence in structure, but represent different country specific steady states (conditional convergence). For a robust conclusion, the analysed time period is too short. The fixed country effects may stem from differences in macroeconomic performance, e.g. devaluation as mentioned above in the case of Sweden, but may also be due to from differences in industrial policy. The cases of Ireland and Italy especially show that successful structural change results in higher growth potential in the long run, whereas for other fast growing catching up countries like Portugal, this has not yet held true.

In the present setting, it is impossible to include these policy variables in our regressions. Instead, we make an informal comparison of growth performance and policy measures. Table 6.10 provides an overview:

Table 6.10: Economic policy and growth performance

			Regulation		Labour market			Education	State aid, growth rate 1986/88 and 1995/96		Tele-communication	R&D/GDP
	Average growth in valuer added	Average industry growth, model evaluated at mean	Overall Product Market Regulation[1]	Overall Regulatory Environment[2]	Parttime Employment[3]	Maximum weekly hours[4]	Active Labour market policy[5]	Educational expenditures[6]	R&D aid[7]	Aid to SMEs[8]	Employees in mobile communications[9]	Ratio[10]
Belgium	-	-	-	-	17.1	50.0	1.5	-	2.8	-0.9	7.0	1.6 *
Luxemburg	-	-	-	-	10.7	48.0	0.3	-	4.6	3.5	-	-
Denmark	3.9	5.2	1.9	1.6	17.0	48.0	1.9	8.5	6.5	30.4	9.9	1.8
Germany	2.1	3.9	2.1	1.9	15.0	60.0	1.5	6.0	-1.2	4.3	8.9	2.3
Greece	2.3	-3.1	2.9	-	8.5	48.0	0.3	3.7	-18.2	-13.1	4.8	0.5 *
Spain	0.8	0.2	2.1	1.9	7.2	47.0	0.7	5.8	-1.2	21.5	12.3	0.8
France	1.8	3.6	2.4	2.1	14.8	48.0	1.3	6.6	8.5	-3.4	4.9	2.3
Italy	2.2	4.2	2.6	2.3	11.6	60.0	1.1	4.7	-6.3	-4.0	11.1	1.1
Ireland	6.5	5.6	1.7	1.3	15.7	60.0	1.7	5.7	-4.4	4.9	8.3	1.4
Netherlands	-	-	-	-	29.4	60.0	1.4	5.4	-6.4	-19.2	7.4	2.0 *
Austria	4.0	3.4	2.2	2.1	10.7	50.0	0.4	5.5	-	-	11.1	1.5
Portugal	5.8	-1.2	2.5	2.9	7.6	54.0	1.0	5.5	5.7	-33.0	7.5	0.6
Finland	-2.5	-0.6	2.4	1.9	8.0	45.0	1.7	7.3	-	-	8.1	2.3
Sweden	-2.2	0.7	2.2	1.9	14.8	50.0	2.4	7.9	-	-	-	3.0
United Kingdom	1.0	1.8	0.9	1.4	23.2	-	0.4	-	-7.3	-14.6	8.7	2.1
Unweighted average	2.1	2.0	2.2	2.0	13.8	52.2	1.1	5.8	0.5	8.1	8.4	1.6

[1] *Source:* OECD, 1998.

[2] *Source:* OECD,1998.

[3] Parttime employment in % of total employment as of 1996. *Source:* Employment Outlook 1998.

[4] *Source:* Employment Outlook 1998.

[5] Spending on active labour market plocies as a % of GDP as of 1996. *Source:* Employment Outlook 1998.

[6] Total expenditure from public, private and international sources for educational institutions plus public subsidies to households as of 1995 as a % of GDP. *Source:* OECD Education Database.

[7] Nominal growth rate of state aid to innovation over the 1986 to 1996 period. *Source:* Berichte über staatliche Beihilfen (EU).

[8] Nominal growth rate of state aid to small and medium sized enterprises over the 1986 to 1996 period. *Source:* Berichte über staatliche Beihilfen (EU).

[9] As % of PTO employees as of 1997. *Source:* Communications Outlook 1999.

[10] As of 1995. *Source:* Science, Technology and Industry, Scoreboard of Indicators OECD 1997.

* 1993

Policy variables behind fixed effects

Looking at the five fast growing countries - Ireland, Portugal, Austria, Denmark and Greece - reveals important differences. First, observe that these are among the smaller EU-countries. Secondly, evaluating the growth regressions at their average value (i.e. assuming counterfactually the same structure and the same productivity level) creates a different picture. Whereas average industry growth in Denmark, Austria, and Ireland is still above the EU average, Portugal and Greece reveal negative values. So, in these countries, growth is primarily part of the catching up process. If this force levels off, structural change and active policy will be necessary for further growth.

Indices of liberalisation (OECD, 1998) measuring the impact of the regulatory environment give no clear picture: The index on the degree of overall market regulation lies above average in the fast growing countries Ireland, Denmark and Austria. In Greece and Portugal, on the other hand, it is below average. A similar picture emerges if we look at the index of the overall regulatory environment. Note, however, that there are also counter examples. The UK possesses the most liberalised regulatory regime, but performed below average.

Labour market regulation, a second field of policy concern, differs widely across European countries. For example, the share of part time workers varies between 29.4% in the Netherlands and 7.2% in Denmark. The maximum weekly hours people are allowed to work varies between 45 hours a week in Finland and 60 hours a week in Germany, Ireland and Italy. In the UK, there are no restrictions at all. Here we find no clear trend, but some indication that labour market flexibility and especially, more part time work, go hand in hand with higher long run growth.

Spending on education is normally seen as a prerequisite and the most important investment for long run growth. The regression estimates have shown that industries using skilled employees more intensively grow faster in the long run. Also, the process of catching up is faster in those countries where productivity is below average. The case of Denmark illustrates that public spending on education can speed up growth. Similarly, Ireland - the country that performs best in terms of growth - meanwhile has relatively high expenditures on education. However, the effect of investments on growth depends on the efficiency of the education sector, interaction with other policy instruments and the regulatory framework. Sweden, Finland and France likewise spend more than the EU average on education. Due to the above mentioned macroeconomic developments in the former two countries, the long run effects on growth are likely to be hidden. In the case of France, this aspect may be more relevant.

With respect to state aid, we focus on (i) functional subsidies for R&D and (ii) aid to small and medium sized enterprises. Various issues included in the Survey of State Aid in the European Union, made by DGIV[50], serve as our sources. The highest increases in innovation subsidies over the period 1989 to1996 were received by firms in France, Denmark and Portugal. Thus, looking at the latter two EU members, a case can be made for the promotion of growth by innovation subsidies. This is underlined by the programs for small-and medium-sized enterprises, which increased most in Denmark, Spain, and Ireland.

This informal analysis shows that with the exception of innovation and education, there is no single policy measure, which can simply explain growth differences. The effects of innovation and education can be captured by the shares of skill and research intensive industries. In other important areas, success seems to depend on the policy mix chosen. The best mix depends not only on national conditions, but also on whether growth is still in the catching up phase.

6.4 Conclusions

Industry growth rates show a large variance including important country differences, which are determined by the starting positions measured by structure and income per capita, but which may also reflect policy differences.

We find that there is significant decreasing geographical concentration. This is reflected by higher growth rates in the industries of those countries, which hold only small shares of this industry relative to their size. This finding reinforces the cases made in the previous chapters and has to be seen as an important stylised fact concerning structural development over the last ten years in Europe.

The strongest result concerns convergence: industries in those countries lagging behind in terms of productivity grew significantly faster. This process goes hand in hand with de-specialisation according to the old patterns and maybe the newly emerging ones, as well. This implies that comparative advantages based on productivity advantages are diminishing and the degree of specialisation is tending to decrease. This process is expected to deepen integration.

Industry growth is also driven by demand and by the strong forces of the globalisation process. The industries most exposed to the process of globalisation, mainly the labour intensive ones, exhibit significantly lower growth performance. In addition to the integration process, globalisation must be seen as the second important factor in shaping industrial structures within Europe.

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[50] Some regressions indicated the positive influence of functional subsidies. But they are not robust and a final assessment would need data with more variation about time or across industries.

Our analysis additionally provides evidence that industries in which intangible assets are important (i.e. skill and R&D intensive industries) grow faster even after controlling for the fact that demand in these industries is more dynamic. Our analysis strongly suggests that economic policies enhancing the skills of the workforce and research will foster growth. The remaining fixed country effects suggest that other policies, which could not be tested econometrically, will play an important role. This was done informally: liberal market regimes, flexible labour markets, and programs for small firms seem to be the ingredients for promoting growth, but the best policy mix may differ from country to country and depend on its position in income per capita. Denmark and Ireland, which have above average growth performance, may be benchmarks for successful policy mixes.

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7. The impact of structural change on competitiveness

7.1 Advantages and disadvantages of specialisation and concentration

The process of specialisation and concentration is driven by the decisions of firms and investors in a rapidly changing environment. The speed of the process, as well as whether it accelerates or looses speed, depends on the one hand on economic forces such as economies of scale, spillovers, technology, the price elasticity of demand and the mobility of labour; on the other hand on framework conditions. Institutions, regulations, liberalisation and public support directly determine the course of the process; national and European policies in pursuit of goals related to social and regional matters, as well as stability, influence the process at least indirectly.

In general there are advantages as well as disadvantages of specialisation. They can be grouped into an efficiency effect, a risk effect and a dynamic effect. On the firm level a specialised firm is supposed to be able to exploit economies of scale, to reap learning effects, to use specialised inputs etc (efficiency increases). On the other hand risks increase for less diversified firms (risk effect) and thirdly specialisation can be disadvantageous, if the firm is locked in a mature, declining industry and. Both effects translate to the regional and national level. Countries with higher specialised industries can enjoy a higher productivity if the specialisation occurs in dynamic markets, countries specialised in low wage industries, in mature industries or in industries with a low potential for product differentiation will not be able to grow fast (dynamic effect). Countries enjoy benefits from increasing specialisation, if they have specific endowments which can be exploited and if their main industries produce under the condition of significant economies of scale. The geographic concentration of industries is increasing competitiveness if significant spillovers exist, or cost savings through supply of industry specific inputs or of a complementary service sector.

The risk effect on the macro level has become a major policy issue as Europe is becoming a Currency Union. It is discussed in the literature about the optimal regional extension of areas with a common currency (OCA, Mundell, 1961, De Grauwe, 1996). If member countries of a Currency Union are too much specialised in narrow product markets, then external shocks will lead to asymmetries in demand, which can no longer be dampened by changes in the external value of currencies. The flexibility of the labour market has to be increased to prevent persistent differences in demand. If countries are specialised in different industries, it is advantageous if the specialisation occurs in unrelated industries (diversified production). The last chapter has shown that the trend towards specialisation is not too strong and furthermore does not tend to go into the direction which could be assessed as dangerous, since most countries have pictures of broad two or three tier specialisations.

Keeping in mind the arguments about advantages and disadvantages of specialisation and specifically the third group of arguments about the consequences for dynamics, it becomes clear that there is no easy general link between specialisation and concentration and the competitiveness of a country, where competitiveness is defined as the ability of a country to increase value added, exports and employment.

What we would however expect is a relation between the speed of change and competitiveness and growth. The relation between the speed an change and competitiveness should be stronger than the relation between changes in specialisation (and concentration) and competitiveness. The first reason is that speed of change is important on both sides of the spectrum, for making use of new chances and for leaving sectors with unfavourable prospects. The second is that measuring the speed of change offers a broader picture of the dynamics, than a comparison of the degree of specialisation in two points of time. A specific small increase in specialisation may be the net effect of two countervailing forces, one increasing specialisation and a second smaller one working against. We know from the theoretical hypotheses (summarised in table 7.1) that countervailing forces are working and we know from the empirical parts that most of the changes in the degree of specialisation had been minor and not general. We expect a measure on the speed of structural change which does not net out to be closer related to competitiveness, than measures comparing the initial and final value of specialisation and concentration.

Table 7.1: Counteracting trends of specialisation and concentration

A synopsis of trends favouring specialisation and concentration respectively dispersion

Regional dispersion	↔	Geographic concentration
De-agglomeration based on wage differences Mobility increases Outsourcing and break of vertical chain	Forecasts for geographic concentration	Importance of spillovers in the core Concentration based on economies of scale is enforced
Higher incomes support product differentiation and intra industry trade Globalisation pushes all countries up the quality ladder	Impact of globalisation	Globalisation eliminates low wage industries in high income countries
Set up costs for plants decrease	Impact of Multinationals	No more tariff jumping needed
Home biases and proximity lead specialisation decreases Endowments converge	Forecasts for country specialisation	Dynamic economies of scale (persistency of first mover advantages) Integration magnifies endowment based specialisation
Dispersion	↔	Specialisation

Source: WIFO summarizing trends reported in Wolfmayr-Schnitzer (1999).

7.2 The speed of change is crucial

The relation between the speed of structural change and growth is supported by the data. We calculated a "speed of change " indicator, summing up the differences between the sector shares of each country in 1988 and in 1998.[51] The "speed of change index " is zero when no industry changes its share of value added; it increases when many industries change their position. Countries are then ranked according to this structural change indicator and to their growth in value added and exports (total, *extra*, *intra*). This process is carried out for industries and sectors, providing eight comparisons of growth and speed of change (see Table 7.2). All ten correlations are positive, six of them are significant[52].

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[51] The index calculates the sum of the absolute differences between the shares of production in 1988 and 1998. This process is repeated for each country, and separately for value added, total exports, *intra*-exports and *intra* exports. This is again a dissimilarity index, but this time between structures for the same country at two points in time (for specialisation, the same calculation was made to compare a country with the EU; for concentration to compare an industry with total manufacturing; in both cases for the same year).

Table 7.2: Growth of production, employment and exports and the speed of change

	Rank correlation coefficient between speed of change and country growth	
	Sector level	Industry level
Production	0.42 *	0.38 *
Employment	0.18	0.23
Exports		
Total	0.48 *	0.47 *
Extra	0.43 *	0.51 *
Intra	0.09	0.13

* Significant at 90% level
Speed of change (dissimilarity) = sum of absolute differences of shares in specific country 1998 as compared to 1988.

Source: WIFO calculations using SBS and COMEXT.

Structural change in production was fastest in Ireland, followed by Portugal. These two countries assumed the same positions in value added growth. We show in Table 7.3 which sectors gained shares and which lost most heavily in these two countries of fastest changes. Germany, Austria and Belgium were better positioned in growth, while their structural change was slow. There was substantial structural change in Sweden and Finland, but these countries were not able to reap the benefits due to their specific problems in the mid nineties (devaluation, loss of the Russian market). The similarity of their positions in growth and speed of change was even more pronounced in exports, and here specifically in *extra*-trade. For *intra*-exports, growth in Spain was more dynamic; that of the Netherlands and Sweden was less than changes in industry structure would indicate. Since *intra*-European-trade is, to a higher degree, *intra*-industry trade, structural changes measured by sector changes may understate the speed of repositioning firms and sub-industries.

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[52] At the 90% level using the Hotelling Papst Statistics.

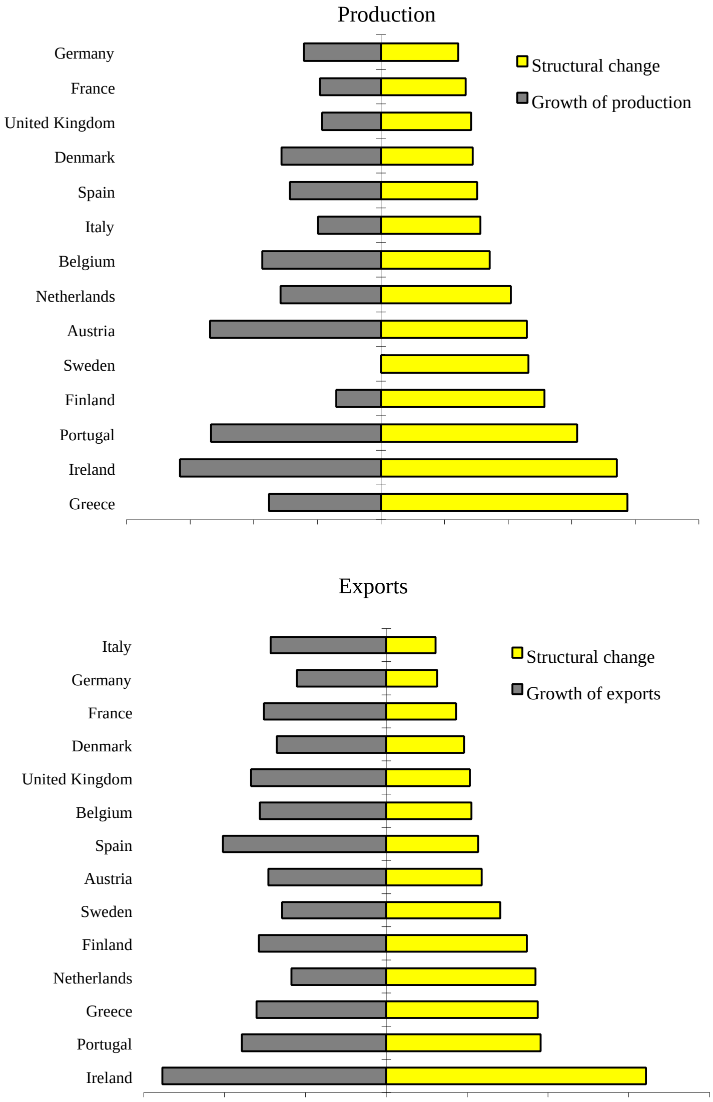
Table 7.3: Growth of production in Ireland and Portugal and the speed of change

	Ireland	
Sectors with largest increase	**1988**	**1998**
Chemical and chemical products	16.39	27.18
Publishing, printing and reproduction	4.94	8.73
Medical, precision and optical instruments, watches	3.72	5.13
Electrical machinery and apparatus n. e. c.	2.76	4.17
Radio, TV and communication equipment	2.12	3.09
Sectors with largest decrease		
Machinery and equipment n. e. c.	4.72	3.44
Office machinery and computers	10.34	8.89
Basic metals	2.54	0.57
Tobacco products	3.19	1.15
Food products and beverages	27.88	20.07
	Portugal	
Sectors with largest increase		
Motor vehicles, trailers and semi-trailers	3.01	7.67
Other non-metallic mineral products	7.10	8.91
Electrical machinery and apparatus n. e. c.	2.62	4.34
Furniture; manufacturing n. e. c.	1.44	3.04
Publishing, printing and reproduction	3.48	4.89
Sectors with largest decrease		
Machinery and equipment n. e. c.	3.82	2.91
Office machinery and computers	2.42	1.39
Basic metals	5.01	2.38
Tobacco products	13.43	9.36
Food products and beverages	10.50	5.26

Source: WIFO calculations using SBS and COMEXT.

The correlation demonstrates the importance of structural changes to growth in value added, exports and competitiveness. We use the word demonstrates since correlation do not prove causality. This could be done only for longer timer series and after controlling for intervening economic and political variables.

Fig 7.1: Speed of change and growth of production and exports



Remark: The scale on the right and the left side of the figure is not in the same dimension.

Source: WIFO calculations using SBS and COMEXT.

7.3 The speed of change increased

Since the speed of change is crucial for competitiveness, we try to measure it. A simple indicator is sum up the changes in the production structure over time. To eliminate short run fluctuations we measure differences in the production structure between three years (moving scale). Again we can measure change by looking at industry structure of countries or by looking at country structure of industries. Both indicators on the speed of change (fig.7.2) show that the change of structure had been faster in the nineties than at the end of the eighties. This is probably the effect of exogenous pressure as well as of the internal market program. Both have increased the speed of adjustment and at the same time competitiveness of European Industry. If we however compare the remaining productivity difference versus the US and the temporarily end of the catching up process in the productivity, it may have not been not enough from the efficiency point of view.

7.4 Productivity catch up needs restructuring and specialisation

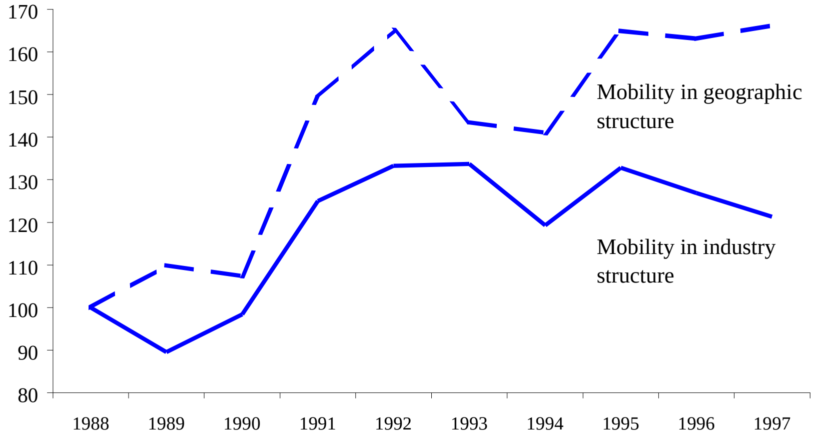
On the other hand it was - as expected - much more difficult to demonstrate the impact of specialisation (and of its change) on indicators of competitive success. The correlation between the specialisation indicators and growth in value added, exports and employment did not yield significant results. The only significant result on the industry level was that the growth in *extra*-trade relates significantly positively to specialisation, a weak indication that a strong base is needed for global expansion, or that a minimum scale is necessary to defend export capacity in a toughening environment. The correlation is much weaker for *intra*-trade and for total trade, and there is no relation between change in the degree of specialisation and export growth. The results are replicated weakly on the sectoral level.

The second significant result is that more specialised countries have smaller productivity gaps compared to the US. This result can be attributed to the high productivity and high specialisation in Ireland, and to the combination of low specialisation and large productivity gaps (relative to the US) in Italy, Spain, Portugal and the United Kingdom. The results are significant on the sectoral and industrial levels.

Thirdly, the increase in specialisation is negatively correlated with employment growth, implying that restructuring and repositioning decreases employment at least in the short run. This is well in line with evidence that merging and restructuring firms streamline production and reduce employment first, thus becoming more competitive.

These results, and the many correlations which did not show any significant relations, indicate the importance, as well as the complexity, of the link between structural changes and competitiveness. The data underline that adapting to new conditions and rapidly making use of new opportunities and challenges increase growth potential. Exploiting new opportunities always requires changes, which sometimes lead in the direction of specialisation and concentration, and sometimes make use of a firm's own capabilities to extend operations into other countries. This is consistent with the stylised fact that growth and speed of structural change correlate closer than growth and specialisation. The lower productivity gap of more specialised countries relative to the US and the correlation between *extra*-export growth and specialisation are consistent with larger economies of scale for exports into distant countries and with the role of multinational firms in technology transfer.

Fig 7.2: Speed of structural change increases



Mobility = absolute change of value added shares (sectors, total EU) over past 3 years.
Example: 1988 is difference between 1988 and 1985, 1989 is difference between 1989 and 1986 etc.

Source: WIFO calculations using SBS.

7.5 Speed of change, competitiveness and productivity catch up

Europe is currently faced by a series of profound changes in its internal structure and its environment. Some of the changes support specialisation (and regional concentration), some dispersion. We therefor measured the speed of change in the structure in a way which does not net out countervailing tendencies as much as specialisation and concentration rates do.

The data indicate that the speed of change and growth of value added and exports are positively related. The speed of change is important for competitiveness. Secondly the data indicate, that the speed of change is higher in the second half of the nineties as related to the second half of the eighties.

This is probable the consequence of increased external pressure, as well as of decreasing internal barriers due to the Single Market Program. Thirdly the link between the change in specialisation and the change in concentration is weak, as it could be expected from the netting out of different forces. However data weakly indicate that specialisation is important for extra EU trade and that more specialised countries have a smaller productivity gap. Taken together with the information that the patterns of specialisation found in the earlier part of this study does not indicate dangerous asymmetries, furthermore increasing the speed of change could foster competitiveness and catching up of European Manufacturing with US productivity.

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8. Conclusions and policy implications

8.1 Background and main results

The background of the analysis is that the process of the European Integration (via the Single Market Program as well as via the Monetary Union) was launched to increase income and welfare in Europe and to achieve convergence of incomes. Not all economist had been optimistic that higher efficiency and convergence of incomes were easily compatible out of the following reasons:

- New growth theory predicted that differences in the accumulation of knowledge may cause long run divergence of per capita income and growth of countries
- Economic geography predicted that lower transaction costs could sharpen at least initially core periphery differences
- Geographic concentration in the US - the largest integrated market - was much higher than in Europe
- The simultaneous trend of globalisation increased pressure on low wage countries

This report is the first comprehensive empirical evaluation - using data for a large part of the nineties-, whether the Single Market Program lead to more specialisation and concentration in production and trade. This is not an investigation on income convergence and not on productivity catch up, but on structural changes of production and exports and its underlying forces. These changes are interpreted against the background of the predictions of the theory and the possibility that structural changes might be unbalanced, increasing the destabilising forces and increasing the risks of asymmetric developments.

The result in a nutshell is the following. There is a robust tendency for exports to de-concentrate, for large imbalances to level off. Production concentration decreases in the sense that the shares of the large producers (countries) decline in many industries and in total manufacturing. Smaller countries increase their share in total manufacturing and make successful inroads in specific industries characterised by economies of scale and spillovers. In some industries they get rather large shares relative to their size, but fortunately (as seen from the risk aspect) not only in one or two narrow or closely related segments but in a few industries. This makes industry structure in the member countries more dissimilar, but the picture is more in line with the goal to make use of advantages, than with creating asymmetries. The periphery does not fall back, if anything it slightly decreases its gap in dynamic industries.

Underlying trends

The in depth analysis shows different concurrent, partly overlapping, partly counteracting features of structural changes in European Manufacturing. This had to be expected from the diversity of trends predicted by theory, and by the differences in cost and demand conditions of industries.

1. One movement is the strengthening of certain clusters, specifically of large industries in large countries (e.g. the manufacturing of cars in Germany, machinery in Italy, chemicals in France, and food in the United Kingdom). This movement is contributing to a rise in the specialisation indicators for production in a majority of countries. The tendency is however weak. Its strength varies between countries. Portugal, for example, is broadening its production structure and its exports, while Ireland is enjoying high and increasing specialisation.

2. The second movement is the de-specialisation of manufacturing exports. In most countries export specialisation in 1998 is lower than in 1988. Increasing specialisation of production for stable export specialisation is not unexpected, since the exports were at the beginning more specialised than production. Integration then implies that production specifically targeted for the home-market decreases. Production specialisation should therefor increase towards the level of export specialisation. However this does not explain the decrease in export specialisation.

3. In several countries, increasing production specialisation (higher shares of important industries) co-exists with decreasing export specialisation. Finish pulp and paper, machinery industry in Sweden, chemical industry in the United Kingdom are examples for this trend. It could come from a larger share of services, which are included in the value added but not in exports of manufactured goods. It could also be an effect of multinational firms which supply increasing services in their headquarter countries, while decentralising production (in part, horizontally, by purchasing firms and shifting some of their home production to subsidiaries; and, in part, vertically). This is in line with the theoretical prediction that firms use their firm specific knowledge to build plants in foreign markets. This process of multi-nationalisation is accelerated when the set up costs of establishing a new plant abroad decrease through integration. This may result from the convergence of business rules, decreasing national preferences, the convergence of

endowments, or the mobility of managers. Home biases and biases in favour of big countries as location of industries with a high minimum efficient scale decrease.

4. The fastest decline in specialisation is shown by the indicator of revealed comparative advantage, which summarises information on exports and imports. A decline in the standard deviation of the net-RCA indicator demonstrates that both large surpluses and large deficits are decreasing. One component contributing to the reduction of imbalances is increasing product differentiation and – related to this- a higher share of *intra*-industry trade. This tendency allows a parallel increase in imports and exports, thus pushing down the relation of exports to imports, specifically in industries in which exports were previously dominant. An example is the German car industry, which increased both exports and market shares. However, since imports expanded relatively faster (from a much lower level), the relation of exports to imports declined. The other component involved in lowering net-RCA is decreasing relative deficits: the demand for raw materials and semi-finished products (pulp, basic metals) is growing slowly, due to the technical progress made in reducing the consumption of raw materials. Furthermore, some of the necessary refinements (new materials, composites, upgrading characteristics) are done in industrial countries. This limits any increases in imports and stabilises exports in areas where high income countries have always had high deficits. Another way to formulating this process is that resource based trade patterns (as forecast by the Heckscher-Ohlin theory) lose importance and *intra*-industry trade increases.

5. Endowments among European countries – though still very different – are converging. Research intensity differs across countries, but the less research intensive countries such as Italy and Spain are catching up. Although skills are different, the shares of countries in the highest and lowest skill groups are converging. The trend of converging endowments counteracts the trend that integration would lead to more specialisation for given differences in endowments. However, the convergence of endowments is itself also a consequence of deepening integration.

6. The geographic concentration - defined as the share of the top three or five producers in sectors or industries - is declining. This holds on average, as well as in the majority of industries and sectors, for production and - even stronger - for exports. In production, only four out of 22 sectors (food, tobacco, plastics and other transport) had increasing absolute concentration rates (CR5), in exports only two. On the industry level, absolute concentration decreased in two thirds of the industries. Of the five sectors with the highest geographic concentration in 1988, decreases of the share of the largest producers (countries) were observed in four.

7. In line with theoretical predictions, geographic concentration is higher in research and skill intensive industries. But in both groups, geographic concentration is declining faster than average concentration. Concentration, as measured by the shares of the three largest countries, is specifically declining in control equipment, the audio and video sector, in telecom equipment and in the pharmaceutical industry. Increasing concentration is to be seen within the group of research intensive industries, in two chemical industries, electronic components and office machinery. Geographic concentration is higher in industries with strong economies of scale, and in industries with high globalisation, with high product differentiation and high wages. All of these trends are consistent with the theory. However none of them suffice for an explanation of the *changes* in concentration between 1988 and 1998. This indicates that strategies of individual firms may play a role for industry specific concentration, or that the period was too short and too strongly influenced by shocks, to permit a quantitative explanation of the sources of change.

8. In contrast to the picture drawn by absolute concentration indicators, geographic location of industries in the member countries are becoming less similar relative to the distribution of overall manufacturing. This is reflected in location rates and in the dissimilarity indicators, which are called indicators for relative concentration, since they relate the geographic distribution of a sector or industry to that of total manufacturing. This trend is due to the increasing shares of small countries in general and in specific industries. When small countries specialise, they build or upgrade plants and industry clusters which are relatively large with respect to their share in total manufacturing. Small countries are now also able to enjoy natural (endowment based) advantages, to upgrade existing or attract new plants in industries with increasing returns to scale. The economic horizon is widening from the national to the international perspective, which is specifically important for small countries with industries having a high minimum efficient scales. The increase in dissimilarity partly comes from textile and low wage industries, which are retreating at different speeds in different countries, increasing the specialisation of Italy and Portugal in these sectors. It is of great importance that these countries have also increased their specialisation in other industries - for example, Italy in several machinery industries and telecom equipment and Portugal in electrical machinery and motor vehicles. A second component of rising dissimilarity stems from the specialisation of small countries in technologically advanced industries, such as office computer, telecom equipment and the reproduction of recorded media.

9. The growth rates of individual industries in the member countries have a large variance. The variance which can be attributed to country effects is larger than that related to industry effects. Aside from the country and industry effects, the catching up effect provides the most robust explanation. Industries in countries which started from below average productivity are growing faster. This trend, and the negative impact of the starting level of concentration, proves that convergence of productivity and de-concentration of industries are underlying features of the current integration process. Furthermore the panel analysis shows that skill intensity fosters growth, as does research intensity, indicating that technology policy, as well as education, would support growth in manufacturing. Market growth increases as expected also the growth of production, while at the same time, the degree to which an industry is globalised limits growth. The remaining country effects found in the panel indicate the role of regulatory and institutional conditions and economic policy. Data on liberalisation, public support, flexibility of the labour market and the degree of regulation show some convergence in economic policy, which in part is actively promoted by the European Commission, and in part pursued by Member Countries in efforts to follow the best practice. The countries growing fastest seem to be able to chose an optimal policy mix, rather than adhering to a special strategy in a specific field. The strong convergence result seems to support the assumption that at least some countries have successfully made use of the structural funds to catch up in manufacturing productivity. The significant impact of research and skill intensity, together with geographic de-concentration is in line with the convergence of endowments, as well as with the importance of this policy to countries with different per capita incomes.

10. Globalisation increases competition in fast moving, as well as in labour intensive sectors. The differences in structural adjustment between *extra*- and *intra*-EU trade, which could indicate different impacts of globalisation relative to integration, are in general not great. The research intensive sector and the marketing driven sector are still smaller in Europe than in the USA, specifically the telecom sector, and to a lesser extent, other high tech industries. The deficit is larger in production than in trade, making domestic forces more responsible than global competition. Research intensive sectors are however growing faster than total manufacturing. Growth in labour intensive industries is below average, but the sector is still much larger than in the USA. It is concentrated in Italy and Portugal, and has been decreasing in other member countries more quickly. Product differentiation, the vertical differentiation between headquarters,

design production, and the manufacturing of labour intensive components within and outside of the European Union are becoming more important.

11. The shares of the more centrally located countries in value added did not rise over the past ten years. For the sake of being brief, we shall call the first group "core" and the non centrally located member countries "periphery", although these concepts are more appropriate for regions than countries. The result is robust to changes in the classification of countries. As to exports the core is losing market shares. As expected it has an over-proportionally large share of research intensive industries, however the share of the core in research intensive industries is decreasing marginally (stronger for exports). The periphery made inroads in telecom equipment, control instruments as well as aircraft and spacecraft. In advertising intensive industries, the core has traditionally had low shares, but has been increasing its share during the last ten years. Sport goods, music, games and some food industries are responsible for this trend. In the labour intensive industries, the periphery has been increasing its market share marginally. The increasing concentration of textile industries is complemented by labour intensive sectors of the construction industry.
12. Smaller countries have been growing faster over the past ten years than larger countries. In Ireland and in Portugal, this is partly a result of the catching up process, however this trend has also emerged in Austria and Denmark, which are members of the high income group. If classified according to income per capita, the medium income group has been losing output share, the high income group has been winning slightly and the low income countries have been gaining fastest. The high income countries are losing some of their lead in research intensive industries, while low income countries are catching up in endowment structure and in industry structure.
13. Investments by multinational firms are growing faster than production and exports. The majority of inward investments in the member countries comes from other member countries. The majority of the member countries are net investors, spending more on the purchase of firms abroad than they themselves are receiving in the form of inward investment. Investments utilise the strengths of specific countries, however they do not seem to magnify them, since investments and the change in production are negatively related. Earlier investments by multinational firms were more concentrated geographically than is the case today. The evidence is in favour of FDI as contributing to de-concentration: firstly, geographic concentration is decreasing in industries, where multi-nationality is high; secondly, the correlation between relative country shares of value added and FDI is decreasing, and today’s FDI shares are negatively related to changes in

geographic concentration. Thirdly, the specialised activities by the subsidiaries of US firms in Europe are declining over time. Taken together, the evidence is more in line with the trend that the costs of establishing new plants are decreasing and multinational firms are spreading knowledge by setting up plants in many industries and countries, thus contributing to de- specialisation and geographic de-concentration. This does not imply that ownership concentration or firm concentration, measured at the national or European level, are not going to increase. Both topics, ownership concentration and geographic concentration need further investigation. Data are very scarce and the evidence gathered comes from diverse sources, each of which does not cover all member countries and all aspects of activity.

14. The share of *Intra*-industry (IIT) trade has increased between 1988 and 1998. However, the increase seems to level off specifically in the trade between member countries. The largest part of IIT as well as the largest increase has occurred for the vertical component, where countries exchange products within an industry, which are of different qualities or goods at different stages of processing (measured by a difference in unit value of larger than 15%). The share of horizontal *intra*-industry trade is smaller than both vertical trade and inter-industry trade. There is however, no return to the old endowment based trade pattern, which could have been the consequence of a higher influence of economies of scale under lower transport costs.

15. Countries can be classified into three groups as far as the division of trade with other member countries are concerned. Greece, Portugal, Finland and Ireland – all peripheral countries- still have high inter-industry shares. The United Kingdom, Spain, Sweden, Austria are countries with particularly high vertical *intra*-industry trade. France, Germany, Belgium and the Netherlands - all belonging to the core and all being members of the EU since the beginning - combine high shares of *intra*-industry trade with a dominance of the horizontal component. A larger horizontal component is forecast by New Trade theory for countries with equal endowment and low trade barriers. The importance of this component also opens a favourable prediction for other countries deepening the integration. Horizontal product differentiation the component which bears no characteristics of asymmetry, it is probably also the least risky division of labour, and structural change is here seen as less costly for people, firms, and regions.

16. For the trade of European countries with non members (e*xtra*-EU trade), inter-industry trade still amounts to more than half of total trade. However the share of *intra*-industry-trade is rising for *extra*-EU trade in parallel with *intra*-EU trade. The increase stems from the vertical component.

Horizontal *intra*-industry trade amounts to only 10% for *extra*-EU trade, while it accounts for 26% between member countries. Ireland moves in the direction of horizontal *intra*-trade with non member countries, since production is targeted to overseas markets. Greece has a very small *intra*-industry share for trade with Europe, however, a larger share - mainly in the vertically differentiated segment - with non members.

8.2 Tentative conclusions for policy implications

1. The overall speed of change in the degree of specialisation and concentration over the past 10 years has not been dramatic. Trends in aggregates are often weak, so that the choice of the indicator, the exact time period, or the level of aggregation can yield different pictures; firm specific effects determine the development in specific countries and industries. The speed of change seems to have increased during the nineties, inter alia, due to the effects of the Single Market Program. Theories do not unambiguously predict rising or declining specialisation and the data are in line with the presence of overlapping forces, partly pushing towards specialisation and partly towards de-specialisation.

2. Fears of extremely fast and disadvantageous types of specialisation and concentration are not substantiated by the data. Notice however that we refer to the concentration of production in countries, not of firms, and not in regions. Extremely large imbalances in trade are evening out, highly concentrated industries are tending to spread across countries, low income countries and the periphery are catching up in endowments and in shares of fast moving industries. The strongest trend towards specialisation can be witnessed in Ireland, which has a favourable structure and growth performance. The vertical and horizontal division of labour within firms is increasing, high tech industries are not concentrating in the core, but are proliferating technology and skills. Labour intensive industries are concentrating geographically, but not at a high speed and in most cases not by increasing national shares, but rather by retreating more slowly to low wage countries. At the same time, in the countries in which labour intensive industries are concentrating, a second group of industries is actively expanding in mainstream and engineering sectors. To remain competitive, firms in less dynamic industries are co-operating with low wage countries, retaining the higher quality jobs and producing for the quality segment.

3. From the efficiency standpoint, there is still not enough structural change in Europe. Productivity is still considerably lower than in the US, the process of catching up in productivity has

temporarily come to a halt, since growth in manufacturing has been higher in the US during the last several years. Stronger growth is needed in Europe to stabilise employment. Specifically, growth in fast moving industries (information and telecommunications related, as well as marketing driven industries) is slower in Europe; modern services complementary to hardware products are not creating enough jobs to decrease unemployment.

4. Structural change is positively related to growth in exports and production. Countries with rapidly changing structures are leaders in industrial growth. Making use of opportunities in some cases means increasing specialisation, while in other cases it may imply dispersion. Countries with greater specialisation do not grow faster, although the productivity gap versus the USA is smaller, and *extra*-trade is growing faster. Neither of these tendencies can be shown in connection with increases in specialisation or concentration.

5. Combining structural change with catching up in productivity seems to be feasible without the danger of strengthening only the core, depriving the periphery, or permitting mono structures to increase the probability of asymmetric shocks. The upcoming division of labour is dominated more by *intra*-industry trade than by inter-industry trade; more by the proliferation of knowledge and technologies than by asymmetric investment decisions; and more by integration than by the negative impact of low wage competitors. It is expected that this picture would be reinforced by the inclusion of data on services. The trends of the last ten years suggest that the benchmark set by the considerably stronger geographic concentration in the US economy is not likely to be matched by European structures in the near future.

6. There are several caveats which should be added. The time span covered in the analysis is rather short and some exogenous shocks did take place during this period. Many additional mergers and much restructuring has occurred since 1998. And concentration is not measured on the firm level, but rather for industries which are still too broadly defined to reflect the "relevant market". In some industries, concentration in the sense of market shares held by the largest firms has increased considerably during the past years. Part of the de-concentration effect could have been an attempt to spread currency risks, which is no longer needed. Not all peripheral countries and regions did catch up, Greece did lose competitive advantages and is not so much integrated in the European Market as other members.

7. The positive influence of research, of liberalisation, of telecom applications, and of geographic restructuring for growth has to be accelerated. The removal of the trade barriers and the dynamics

unleashed by the Single Market Program is a strategy which fosters structural change. The fear of massive imbalances, shifts of sophisticated activities to the core, one sided low wage oriented specialisation of the periphery, and a wave of concentration pushing up Europe to the high level of geographic concentration seen in the US are not substantiated by the data. Seen from the goal of competitiveness, that is increasing value added and employment, the structural changes are, if anything, too small.