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DO INDUSTRIAL STRUCTURES CONVERGE ?

A SURVEY ON THE EMPIRICAL LITERATURE ON SPECIALIZATION AND CONCENTRATION OF INDUSTRIES

1. Objective and role of the survey[1])

The purpose of this survey is to give an overview on the existing empirical literature on the changes in the structure of industries, specifically on the questions (1) whether the industrial structure of countries become more similar or more different and (2) whether industries become more concentrated or more dispersed (in the geographical dimension). These research questions have some relation with the question of convergence of incomes, but constitute a separate research field. They have become increasingly important since both integration and globalisation are currently reshaping industrial structure and the question whether this is done in a balanced or asymmetric way is an important policy issue. We start in the next chapter with the discussion of this policy background (chapter 2). Chapter 3 presents the main empirical evidence on the issues of specialisation of countries and concentration of industries, its relation to the literature on convergence of income and on related issues (chapter 3). Chapter 4 makes a proposal for future studies how best to define specialisation and concentration and which indicators can be used for measurement. A synoptic table summarises predictions by theories what to expect for empirical data making use of a twin working paper (Wolfmayr-Schnitzer, 1999).

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[1]) This working paper was produced in preparation of the study Karl Aiginger, Michael Boeheim, Klaus Gugler, Michael Pfaffermayr, Yvonne Wolfmayr-Schnitzer, "Specialisation and (geographic) concentration of European manufacturing" Report on the competitiveness of European manufacturing 1999 by the European Commission, DG3.

2. The degree of specialisation and geographic concentration as policy issue

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.

3. Empirical Studies

3.1 Convergence of incomes and convergence of structures

The bulk of the literature on convergence is about the convergence of per capita income. This is inspired by the forecast of neo-classical growth models, that eventually productivity (output per labour) should converge to a common level. This literature is large as far as concepts, data and methods are concerned and it is summarised elsewhere[2]). Some of the main findings are, that (1) there is a certain tendency of convergence at least among country groups, (2) less convergence can be found between countries with very different starting income, or differences in levels of skills and technology (leading to the idea of convergence clubs), (3) the rate of convergence is relatively slow, (4) there is also regional convergence in regions like the US and Europe, (5) however convergence is stronger for productivity and less for per capita income (Europe), (6) convergence across countries and within countries can differ.

This working paper will refer only on empirical work on the convergence of production and trade. Research on the convergence of industry structure may be split in two sub-questions again. The first being whether the industry structure of the individual countries becomes more similar (sectoral specialisation of countries decreases), the secondly whether individual industries are getting more or less concentrated in countries (regional or geographical concentration of industries). The sub-questions are related, but in a world of many industries and countries the results can differ, and the research focus can be different.

The question of convergence of structure is in general not unrelated to the convergence of levels. If demand for specific industries depends on income (via income elasticities) and if demand determines supply (via home market effects), then convergence of incomes will favour also convergence of production structures. If convergence of incomes is correlated (however the causality runs) with convergence of endowments or the convergence of preferences, then convergence of incomes and de- specialisation of production could come together. Higher and more similar incomes favour intra- industry trade, i.e. the exchange of products of one specific industry produced with IRS, and using similar inputs. Convergence combined with a general trend

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[2]) Barro, Sala i Martin (1991), De la Fuente (1997), Economic Journal (1996), Molle (1994), Paci (1997).

of increasing incomes can lead to a decrease of relative importance of transport costs, initialising the location trends forecasted by new geography.

3.2. Empirical work on the convergence of structures

Regional concentration of industries in US

Krugman (1991) is to some extent the starting point of the literature on regional concentration. He measures regional concentration by calculating a locational Gini coefficient. This compares the regional market shares for one industry with the employment structure of manufacturing. He finds that many industries are highly localised (Krugman proposes as benchmark the automotive industry which is traditionally thought as localised), that the most highly concentrated industries are not cutting- edge, high technology sectors (in fact specifically textile related industries are highly clustered). Krugman stops short from saying that high tech industries are not localised. He considers the data to be biased insofar as some very localised technologically advanced industries are excluded and high tech products are buried in meaningless aggregates. However he concludes, that "whatever drives industries to concentrate in one place, it is not sole a matter of technological spillovers" (Krugman, 1990 p. 59).

Krugman shows that manufacturing is more regionally concentrated in the US than in Europe, by comparing four regions in the US (NE, MW, S, W) with four large countries in Europe (F, D, I, UK). The index to prove this is a measure of absolute differences of shares. Heuristically, Krugman adds that US Midwest has essentially no textile industry (as compared to Germany) and the South produces far less machinery than Italy. A tendency most important for this report is that the specialisation of regions – again measured by the absolute differences of production shares – declines in the US between 1947 and 1985, so that the "high water mark of manufacturing localisation in the US...was reached probably in the 1920s " (Krugman, 1991, p. 80). Karsten (1996) reports longer term evidence[3]), that economic development first lead to regional divergence, using a cross section evidence of countries plus time series evidence for single countries. Kim (1995) analysed the regional de-specialisation in the US between 1860 and 1987, finding specialisation up to the turn of the century, and converging patterns since the 1930s. In

[3]) His cites also evidence from Williamson (1965) and Wheaton and Shishido (1981).

his theoretical explanation Karsten (1996) develops the idea of an inverted u- shaped relation between concentration and per capita GNP (first concentration increases, then it declines)[4]). He presents evidence that the share of the population in the capital city and in urban areas are largest for middle income countries. He heuristically explains the more dispersed structure of Europe vs. developing countries by the dispersion of skills and the historical fact of dispersed production at the start of the industrial revolution (implying less fixed costs in existing factories).

The main focus of Dollar & Wolff (1995) is the extent of catching up of Europe with the US in income, productivity, capital intensity and wages. The productivity gap is found to be shrinking, so is the dispersion of the productivity gap across industries. The convergence of the trade pattern, particularly the export composition) between 1970 and 1986 is investigated for 9 countries and 12 industries, using a specialisation index of the exports (RCA, relating exports shares of an industry in a country to exports share of total manufacturing) and then calculating the coefficient of variation over the RCA across countries for each industry . The main result is that in six industries the dispersion of the RCA's increase, in six it decreases, there is no different pattern between heavy and light industries (among the heavy industries variation declined in basic metals, but increased in chemicals). Dollar & Wolff then investigate whether the change in comparative advantage of Japan is linked with productivity catching up and conclude that "unit cost differences among the industrialised countries were dominated by technological advantage....rather than differences in wage and capital costs" and that industries in which the US is losing comparative advantage is where they are overtaken in productivity (p. 149).

Among other studies referring to core and periphery patterns we may cite Hansen (1997), who shows that production in Mexico shifts to regions with good access to the US, and Bruelhart, Torstensen (1996) who show that integration first shifted production to the core while concentration has been falling since.

Specialisation of production and trade

Bruelhart (1995) investigates specialisation trends in production are measured for total manufacturing and for 18 two digit NACE industries, using employment data. As a baseline

[4]) In his model the relative strength of centripetal vs. centrifugal forces depend on industrial distribution, transport costs and level of economic development.

Bruelhart reports that the ratios of employment in manufacturing relative to the population had increased (the Gini rose by 21% between 1980 and 1990). Within the 18 two digit NACE industries the regional concentration rose in 14, with the largest increases in labour intensive industries (textiles, clothing, footwear, leather) and some in the IRS industries (motor, other vehicles, chemicals). The labour intensive industries had been among the most dispersed in 1980 , the IRS among the most localised (concentrated). High tech sectors are highly localised from the start of the investigation, but some show a rise others a decline of concentration. Bruelhart contrasts the European picture with that in the US in which labour intensive sectors are more localised and high tech less, hinting that the main burden of further integration in Europe may fall on the labour intensive sectors and specialisation maybe driven in Europe more by classical factors like endowments than by intra trade. Combining information on *concentration* with the *correlation* between concentration and centrality, Bruelhart suggests to distinguish three types of industries. The first is highly localised in the core and comprises typical IRS industries like chemical and motor vehicles. The second is relatively dispersed and located in the periphery as the textile related industries. The third is clustered, but without core periphery gradient, comprising high tech industries like office machinery and instruments.

Integration and specialisation in the EU

Several of the Single Market Studies commissioned by the EU relate to questions of convergence of sectoral and regional studies. *European Commission 1997* (1997A, Bruce Lyons, Economies of Scale) concentrates on the relation between economies of scale and industry types, distinguishing specifically between endogenous sunk costs industries (with three subtypes called 2A, 2R and 2AR, developed by Davies & Lyons, 1996) and industries with exogenous sunk costs (type 1 industries). Calculating the specialisation of industry structure by the standard deviation of relative trade balances (SD of (X-M)/S) the study finds that small countries are more specialised in trade than large ones, that specialisation had increased dramatically in Ireland, and somewhat in France, without clear picture for all the other countries. Breaking down the data according to industry types they find however that specialisation had decreased between 1981 and 1986 and increased between 1986 and 1991, with stronger tendency in industries which are either advertising or research intensive (and less in industries which are both advertising and scale intensive and those which are neither nor).

Sectoral specialisation and regional concentration as twin issues

Dalum, Laursen, Villumsen (1998) examines the export specialisation of 20 OECD countries between 1965 and 1992. They investigate as well sectoral specialisation[5]) as regional concentration[6]). They stress this distinction as an important one "since the two kind of processes might not in all cases move in the same direction, and are probably going to take place at different speeds " (p. 2), even if "the results are more or less by definition two sides of the same coin, p. 15). The empirical results show sigma-convergence: the standard deviation of the RCA are lower for 16 out of 20 countries in 1992 in relation to 1965 (with an unweighted mean of the relation 0.91) and for 55 out of 60 industries (average of the relation 0.85. Beta-convergence is seen in all 20 countries and in all 60 industries since the regression coefficient is significantly different from unity (also from zero, rejecting randomness as well as reversion of export structures). The results do not depend on the level of aggregation.

Laursen (1998) starts from the stylised facts that previous studies showed a slight de-specialisation of exports of 20 OECD countries in the period 1965 to 1992 (in the just referred paper), while technological specialisation is increasing. He uses OECD data on exports for 19 2-digit industries and a reclassified US patent statistic to investigate the question in a unified way. The initial specialisation is shown to be similar for exports and technologies by using specialisation ratios as indicators (a sort of RCA values comparing the national structures with OECD structure, but correcting for symmetry problems). His main finding is that countries de-specialise between 1972 and 1990 as seen from a beta-convergence test as well as from a Chi-square test, this result is stronger for exports than for technology. He adds evidence in a panel approach, differentiating between sectoral specialisation of countries (country wise across sectors) and regional divergence (as contrary of beta-convergence, sectorwise, across countries). Laursen finds that specific sectors (food, non-ferrous metals etc) and catching up countries had higher turbulence in their shares. Trade specialisation as well as technological specialisation are path dependent in the sense that

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[5]) They call it specialization (de-specialization) of countries: this is a vector of 60 industry RCA's for one country in one year.

[6]) They call this convergence (divergence) of sectors: they use a vectors for each industry comprising the 20 country export data, more exactly the RCA's as elements).

they are correlated between seven three years intervals, but this time trade specialisation patterns are more stable than technological specialisation patterns.

Amiti (1998) analyses the specialisation of EU countries between 1968 and 1990, using GINI coefficients. Specialisation is reported to increase in six countries (Belgium, Denmark, Greece, Italy and the Netherlands), no significant change is seen in the Netherlands, specialisation is declining in three countries (France, Spain, UK). Regional concentration is reported to increase in 17 out of 27 industrial sectors. Using GINI coefficients means to use one of the indicators on relative specialisation, the period covered is essentially the pre Single Market period.

Concentration of industries: absolute versus relative measures

Haaland et al 1999 confront the empirical concentration pattern of European industries (across countries) with determinants proposed by different strands of theories. Heckscher-Ohlin Theory predicts- assuming lumpiness of endowments – that industries which employ factor intensities different from the mainstream one should specialise, Ricardian theory implies that differences in labour productivity within an industry (and across countries) lead to specialisation, while new trade theory implies that IRS and home market effects explain specialisation. They make the distinction between absolute concentration (shares of leading countries, an indicator which could come also from the fact that the share of the leading countries is large relative to market size) and relative concentration (relative shares as compared to country size, an indicator which is independent of the size of the "leading country"). Some industries, notably textile, apparel, railroad machinery, show a high degree of relative concentration only (they are concentrated in small countries), other industries like cars, electrical apparatus, TV set, communication an machinery are concentrated in large countries, but do not show high rates in relative concentration. The data used are 35 sectors for 13 EU countries, calculations were made for 1985 and 1992. On average concentration rose by 11.4 % in the average of industries. The main explanation for concentration econometrically are demand effects, they have a robust influence even after trying to cope with heteroscedasticity, and cumulative causality. This is in line with new trade theory, but the result could also come from Heckscher Ohlin plus trade costs. Input- output linkages measured by sales to the own industry are important too.

Knarvik et al. (1999) investigates the location of production in EU countries between 1970 and 1992. This is an interim report on a lager project, and it focus on conceptual issues specifically on the possibility to build three types of indicators. The first are absolute indicators of concentration which are influenced by the position of large countries, the second are relative indicators which highlights development in smaller countries, the third are locational indicators which report how closely related in space industries are. The paper calculates relationships between the three classes of indicators, demonstrating that the differences are important and further studies should be careful that the indicators should be chosen in relation to the questions which should be investigated (some indicators correlate negatively). The first analytical results show that high tech industries and increasing returns to scale industries are concentrated in central and high wage locations. Lower technology and lower return industries are more diversified, but a process of clustering of these industries in peripheral low wage economies is underway.

3.3 Related issues

Specialisation and concentration in European Regions

Most of the studies about "regional concentration" use data about countries instead of regions. Molle 1997 investigates regional concentration for NUTS2 regions and 17 branches of industrial and non-industrial activities. He finds that regional concentration is decreasing for most industries and that regions de- specialise between 1950 and 1990. However this tendency had been very pronounced up to 1980 and then stopped or decelerated. His indicators are a similarity index (which summarises absolute differences between a region an the total area) and a specialisation index).

Specialisation in Quality

European Commission 1997 (CEPII) focus on the question whether European Integration had foster intra EC trade on inter or intra base, and in the later case whether countries are specialised in upmarkets or in downmarkets. The study disentangles total trade into (i) one way trade (which is assumed if one bilateral trade flow, does not reach 10% of the other, e.g. import < 10% of exports for a specific good between Germany and France) and two way trade otherwise. The two way trade is split into (ii) two way trade in similar products if the unit values do not differ by more than 15% for one product and one bilateral flow and (iii) two way trade in differentiated products

otherwise. The analysis is extremely valuable since it provides data for 12 million bilateral flows form 1980 to 1994. The results show a decline in one way trade from 43.6 % to 38.5 % (EU12), roughly in line with an increase of the usual Grubel Lloyd measure of IIT, which increases, however flattening a little between 1991 and 1994. Among the two components of two way trade the horizontally differentiated products are the smaller part and it is stagnating, while vertical differentiation supply the largest share, it increases over time and it parallels the increase of the GL-estimate.

Countries with higher GNP per capita have lower shares of one way trade. Portugal and Greece have the highest shares of one way trade. Denmark is an exception as a high income country with 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 once more be split into the markets in which exports are higher valued (upper quality segment) and where they are lower valued. Some countries are specialised in certain industries over the whole price/quality spectrum (Denmark for agriculture, Greece for textiles), most countries are specialised in different quality segments, with Germany as the outlier, supplying in all its important industries the higher quality segment.

The most important finding of this study for the focus of our report is that countries seem to be specialised at least for some important part not "in industries, but rather in quality ranges in industries". This hints to the importance of productivity differences and or to that of skills, and may indicate that specialisation according to factor intensities may not be all important. Investigating specialisation and dispersion (now along quality lines) was not the focus of the study, but the data at least indicate that the quality differences do not fade away quickly. Some of the leading countries (France, UK) show over-proportional declines in one way trade, some of the lagging countries (Greece) could not reduce their high share of one way trade. Two way trade in vertically differentiated products increased strongly in France, Germany and UK. The authors conclude firstly that adjustment costs of European Integration could be high (usually increasing horizontal differentiation is seen as easy and less costly than changing specialisation) and secondly that specialisation along the quality spectrum might have cumulative effects over time (p. 85).

Intra-industry trade and specialisation

Bruelhart (1995) investigates the relevance of the new theories of trade and of economic geography by investigating the importance of scale economies, product differentiation and imperfect competition. He specifically is interested in the question whether the trend of rising shares of intra- industry trade had stopped, starting from the theoretical prediction that the process of industrial concentration following from decreasing transaction cost plus IRS should stop the increase of the share of intra-industry trade. He shows empirically that the general trend of rising Intra Industry Trade is "in some instances slowed down, and even started to decline, during the 80´s". IIT is measured on the three digit SITC level, using 2398 industrial goods for calculation, for Intra EU trade only. IIT is an important phenomenon covering more than 50 % of *intra*-trade. The weighted average of IIT is found to be still rising, however the unweighted average decreases between 1985 and 90, and three major countries (France, Italy, UK) show stagnation or decrease. Additional evidence in favour of his theoretical model of the new geography type is that the IIT is smaller in industries with significant economies of scale, and the reversal from increase to decline is earlier here. In high-tech industries IIT is also high (less in line with a theory relying on plant economies of scale). Strong tendencies for IRS industries and less for research intensive are reported, if industries are clustered according to an OECD classification based on the major production input used. Bruelhart then investigates the relation between intra industry trade and centrality. The rate of IIT is higher in countries in the centre (EU countries are ranked according to a distance measure of Keebl), but over time IIT decreases in the central regions. The author interprets the negative relation between change in IIT and centrality tentatively as catching up of periphery with respect to intra trade.

Other variables and concepts of concentration

Archibugi, Pianta (1992, 1994) find convergence of aggregate (national) S& T indicators as R&D intensity, patent intensity and bibliographic indicators. However at the sectoral level they found increasing technological specialisation. The same does Cantwell (1989, 1991). leading to the discussion whether technological specialisation and sectoral specialisation might go in different direction (with specialisation in the former and de –specialisation in the latter). Technological specialisation may come from cumulative innovation (Dosi et al.) and may be very persistent.

Davies, Rondi, Sembinelli (1998) report that neither concentration (now defined in a industrial organisation type way as the share of largest *firms* in each industry) has changed in Europe between 1987 and 1993, nor geographical concentration. In terms of the location of production, the leading firms appear to have dispersed their operations across more, rather than fewer, member states (p. 47). However, multinationality (the number of countries in which the leading firms operate have increased), which could mean 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 very strong yet. Trade increased fastest in industries seen as sensitive to the SEM (catching up from low values), multinationality did not rise here more than proportionate (it had been high here before). Multinationality increased fastest were it was low, in advertising intensive industries and in those with low trade intensity. This could be interpreted as a convergence of the degree of multinationality.

Home market effects

A series of articles tackles the problem of spatial concentration following from idiosyncratically large demand for the products of a specific industry. It highlights that specific high demand in a country leads in models of increasing returns plus monopolistic competition (IRS+MC) to an export surplus, while in competitive models with CRS it would lead to an import surplus. In increasing return models, demand differences are "magnified" (i.e. production differences are larger than demand differences), they constitute home market effects and spatial agglomeration. Davis and Weinstein have estimated magnification effects empirically for Japanese regions (1999) and for OECD countries, allowing industries to be categorised according to one or the other paradigms. Bruellhart and Trionfetti (1999) criticise that the test used by Davis and Weinstein is not discriminating correctly between the paradigms, if there is also a preference for home products (Armington assumption). They use a two stage procedure, estimating first the home bias in a gravity approach and then the relevance of the market structure resp. of economies of scale. They give a full list of home biases for countries and industries. The result for the relevance of the paradigms is, that 20 out of 29 industries are IRS industries (as they stress not all of the results seem plausible, so the result that the leather is an IRS industry, while transport equipment does not exhibit increasing returns to scale).

Globalisation and industry structure

The literature on globalisation is booming. Saeger (1997) shows that globalisation (in the sense of imports from developing countries) leads to decreasing shares of manufacturing in developed countries and to increasing output shares of developing countries, this is evidence on some sort of convergence of sector shares between these groups. The Competitiveness Report 1998 had shown that though the developing countries make specific inroads in some industries, the triad is increasing its surplus versus developing countries. The share of labour intensive industry in trade is decreasing in the developed countries, with the European Union lagging in this tendency relative to US and Japan. The literature assumes and gives some evidence that the process of globalisation will drive out labour intensive/low wages industries in high wage countries. However, there is to our knowledge no comprehensive study available which shows whether this process leads to more intra European specialisation by driving out of Europe the low wage industries at different speed, or whether the process of globalisation leads to more dispersion in Europe since all low wage industries decline, making the other parts of manufacturing more similar.

Table 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

3.4. Specialisation and competitiveness

No comprehensive empirical investigation is available on the topic whether higher specialised countries or those with a more dispersed structures (across industries or locations) are better for

growth, employment creation and competitiveness. Pasinetti (1981) had argued that the extent to which the specialisation structure of a country is similar to that of countries operating at the technological frontier, determines the catching up capacity. Early literature on the norm structure of industries had suggested that countries supplying according to the norm should grow faster, where the norm was defined by income and supply conditions. A reverse argument is that in order to catch up a country must change its production in the direction to make use of spillovers and or high tech (high tech industries usually have the highest value added per worker, these argument is for example presented in Dalum, Laursen, Villumsen 1998 p. 5). Another way to think about the connection of specialisation and competitiveness would be to confront advantages of specialisation like increased productivity with the risks of specialisation like being prone to specific industry shocks and being stuck in a low growth industry. Lau (1992) presents the argument that increasing return to scales lead to concentration and this fosters competitiveness. The more general line of thinking is, that there is an ongoing series of changes in the environment, like integration, globalisation, new technological opportunities, new organisational trends and changing demand trends, and those countries will be more competitive, whose industry and whose institutions have the higher speed of adaptation to the new trends.

4. Proposal for a systematic approach in future studies

The literature provides no consensus as far as the concepts are concerned, neither about the indicators which should be used. It is therefor no surprise that the evidence found does not give a consistent picture. We try in this chapter to define the concepts of specialisation and concentration, to propose indicators which could be used for both research questions and to summarise which hypotheses could be investigated.

4.1 Defining specialisation and (geographical) 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 the industries 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**" [7]. 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).

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

[7]) 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.

4.2. Indicators on specialisation and concentration

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.

4.3 Hypotheses about changes in the degree of specialisation and concentration

The literature about theoretical models prediction on the determinants of specialisation and concentration is surveyed in a twin working paper by Wolfmayr- Schnitzer 1999. Here we want to summarise in a synoptic table some of the main hypothesis. As we see there are counteracting trends working which will partly lead to more specialisation partly to dispersion. It is clearly up to the empirical data to decide which trend will be stronger.

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

5 . Conclusions:

Predictions by different models

No "state of the art" exists up to now in the literature on convergence of structure. The reason for this is the lack of a coherent theoretical literature. Different models exist in the old and new trade theory, furthermore in New Economic Geography, additionally industrial economics supply hypothesis on the characteristics of market (see Wolfmayr-Schnitzer, 1999). Many of the indicators used to measure specialisation and concentration were developed in industrial economics to calculate the concentration of firms or in welfare economics to assess the distribution of income among persons.

Specialisation of countries versus geographic concentration of industries

The literature suggest that it is important to distinguish between the specialisation of countries (whether countries offer a few products or a broad spectrum) and the geographical (regional) concentration of industries (whether a large share of outcome is produced in a few countries or production is dispersed). The two questions are connected, in fact these are two perspectives to look at the same data. Technically the specialisation vector and the concentration vector are two marginal distributions of one three dimensional distribution. However given the small number of countries and large number of industries, secondly their unequal size, and finally the fact that the analyses usually resort to one indicator to characterise the whole distribution will in some cased produce conflicting results, if specialisation and concentration is investigated.

Absolute versus relative measures

The literature secondly suggests, that it is important to distinguish between absolute indicators and relatives. The share of the largest 3 countries is an indicator on the absolute concentration, since the countries with the absolute largest shares are taken. This type of indicator highlights the role of large countries in general, since they have the highest shares in many industries. Other indicators measure the share of countries in an industry relative to a norm, usually the share of the country in total manufacturing. This type highlights the role of small countries, first since it eliminates the bias in size and secondly since small countries often get a very large share in an industry relative to its size (due to indivisibilities of plants).

A broad agenda of high policy concern

Specialisation as well as regional concentration can be measured for many variable, most commonly specialisation is investigated with respect to exports, exports relative to imports, value added and employment. A complete analysis should very carefully present the issue to be investigated and to try to show the robustness of the result by using a broad set of indicators. Nevertheless the question of specialisation is one of high and rising policy concern. It is of high political importance whether the deepening of the integration process will shift activities towards the core, leaving the periphery slow growing industries, or not. It is of high policy concern whether increasing specialisation of countries yield industry structure, which increase the danger of asymmetric shocks, these are demand shocks effecting countries differently, which have a common currency.

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