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Nicole Palan

Structural Change and Convergence

An Empirical Analysis of Production Structures
in Europe

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List of Abbreviations

<i>aCDI</i>	Average Crude Diversification Index
AR	auto-regressive
AUT	Austria
<i>b</i>	employment share
BEL	Belgium
CC	Central European Club
cswSHE	country- and sector-weighted Heterogeneity Index
cwSHE	country-weighted Heterogeneity Index
CYP	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
<i>DIV</i>	Diversification Index
<i>E</i>	Employment
EC	European Community
EEC	European Economic Community
EFTA	European Free Trade Association
ESP	Spain
EST	Estonia
EU	European Union
FIN	Finland
FBT	Food, Beverages and Tobacco
FR	France
GATT	General Agreements on Tariffs and Trade
GRC	Greece
GVC	Global Value Chain
<i>HHI</i>	Hirschman-Herfindahl Index
HR	Human Resource
HUN	Hungary
<i>I</i>	Industries
ICT	Information and Communication Technologies
IRL	Ireland
IRS	increasing returns to scale
IT	Italy
<i>iSHE^N</i>	Index of inter-industry Heterogeneity
<i>ICDI</i>	Index of Least Diversity
LVA	Latvia

LTU	Lithuania
MA	moving average
MLT	Malta
NEG	New Economic Geography
NC	Northern European Club
<i>N</i>	Countries
NLD	Netherlands
<i>O</i>	Ogive Index
OECD	Organization of Economic
POL	Poland
PRT	Portugal
<i>RDI</i>	Refined Diversification Index
R&D	Research and Development
<i>S</i>	Sectors
SC	Southern European Club
<i>SEI</i>	Shannon Entropy Index
<i>SHE</i>	Index of Structural Heterogeneity
<i>sSHE^N</i>	Index of inter-sectoral Heterogeneity
SVK	Slovakia
SVN	Slovenia
SWE	Sweden
swSHE	sector-weighted Heterogeneity Index
UK	United Kingdom
US	United States
<i>T</i>	Theil Index
WTO	World Trade Organization

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1 Objectives and Motivation

The starting point and main motivation to conduct this research project was the interest of effects of European integration on the economies of European countries. Therefore, this research project deals with research questions at the cross-road between structural change and international economics. In other words, it deals with changes of the location patterns of industries as well as with changes in the specialization patterns of countries due to economic integration. This topic is of particular interest with regard to the economic developments in Europe since economic integration via the Single Market and the adoption of a single currency has led to a gradual removal of trade and production barriers. The removal of these barriers is likely to have major effects on both the relocation of industries and the competitiveness of countries, causing changes in specialization patterns. Due to enhanced possibilities of international trade and the well-functioning of a common currency union, it seems to be highly relevant whether countries are economically drifting apart and whether markets are flexible enough to absorb growing specialization and concentration patterns. Moreover, the innovations in the information and communication technologies have altered the way goods are being produced, to which degree the production can be outsourced and fragmented between countries. The development of global value chains in this respect are likely to have altered not only the ways in which international trade is organized but also affected the specialization and concentration patterns of countries all over the world (Baldwin 2012).

The contribution of this research project is in a field of research that has evolved only recently. A sound economic analysis and understanding of the forces at hand are yet limited. Whereas the convergence of income levels has been widely studied in the literature (e.g. Easterlin 1960, Borts and Stein 1964, Williamson 1965 and Theil 1967), structural convergence has received far less attention, although studies indicate that income and productivity convergence do not necessarily imply structural convergence and even if so, the process of structural convergence is much slower than convergence of productivity levels due to agglomeration and path-dependent economic development (Fagerberg 2000 and Gugler and Pfaffermayr 2004).

Anderton et al. (1992) distinguish between three separate concepts of structural convergence. First, structural convergence can stand for the assimilation of economic institutions, legal practices and organizational frameworks in which firms operate. Second, structural convergence can be understood as the assimilation of costs and prices, inflation and exchange rates. Third, structural convergence can be understood as real convergence, i.e. the reduction of differences

with regard to working conditions and living standards, but also with regard to employment shares, unemployment rates and labour productivity levels. In this research project, we focus on this third branch of structural heterogeneity only.

European economic integration has led to a gradual removal of trade and production barriers. According to economic theory this should result in global efficiency gains and an increase in the competitiveness of Europe, by allowing the exploitation of advantages stemming from economies of scale and differences with regard to factor endowments (Ohlin 1933, Krugman 1991a and Krugman 1991b). However, the welfare gains for each single country (and region respectively) depend crucially on the direction the reallocation of economic activities takes. Models of new economic geography and trade (Krugman 1980 and Helpman and Krugman 1985) have in recent years shown that in contrast to classical models, integration need not make all regions and countries involved gain, but could likely favour economic centers at the cost of periphery regions. Economic integration would thus increase economic concentration and increase the disparities within the European Union. This development would contradict one of the central pieces of European economic policy, which is the aim to achieve economic cohesion between the member states of the European Union and their regions (art. 158 and 160 of the treaty establishing the European Community). Moreover, the European Commission expected that the effect of European integration above all would be the rise of intra-industry trade but not a rise in specialization. This is the opposite proposition of Krugman's thesis, whereby economic integration would automatically increase specialization of countries and the concentration of industries (De Grauwe 2009).

The aim of this project is to study the forces leading to economic (de-)concentration of industries and (de-)specialization of countries. First, an extended literature review reports both theoretical and empirical findings with a special focus on developments regarding Western European Countries.

Second, we identify the most common indices used in the empirical specialization and concentration literature. We then compare their characteristics, advantages and shortcomings. We aim to evaluate to what extent these two factors drive the empirical results. In order to unravel the differences between the most common specialization indices, both absolute and relative indices are applied to European employment shares and then discuss the origins of different outcomes and analyze the important characteristics of individual indices.

Third, we give evidence whether European integration has so far led to more heterogeneity between the core and periphery regions, i.e. whether high-tech, high-skill industries have moved to the favourable core, with only traditional and local production remaining at the periphery as theory would predict (Krugman 1991 and Ottaviano and Thisse 1999). In this respect we are also in-

terested whether clubs of countries that are characterized by similar economic structures emerged over time. Then, we assign individual countries to clubs, i.e. groups of countries which share common features, and analyze the development of clubs and their individual countries over time. By doing so, we can distinguish between economic late-comers and front-runners and reproduce the structural change which occurred in each sub-sample. Fourth, we examine whether economic integration has altered the location of industries and are above all interested in the development of service industries since empirical studies tend to focus on manufacturing industries only and since we should distinguish between traditional and tradable services. Furthermore, we study the interdependencies of industry characteristics such as increasing returns to scale the degree of inter- and intra-industry linkages on the concentration level. Last, we focus on the transition of formerly centrally planned economies and investigate the convergence towards the Western European Countries.

In particular, we address the following research questions:

1. What are the major driving forces of (de-)concentration and (de-)specialization patterns according to economic theory? Are these results in line with empirical findings? This is of special relevance, since a deep insight into the processes leading to concentration and specialization are needed in order to establish a successful economic policy for the European Union, especially for (structurally) lagging countries.
2. Which kind of statistical tools are available to study concentration and specialization developments? What are the characteristics of a good specialization measure? Having defined them, what kind of (dis-)advantages are connected with each of the single methods investigating concentration and specialization, respectively?
3. Has economic integration altered the location of industries in Western Europe? If so, which industries are affected the most and which characteristics do these industries share? Which countries are able to attract high-growth industries and thus are likely to grow better in the future, offering better job opportunities for workers?

We do thus not cope with changes in economic structure that are related to the changes in the distribution of production factors in different sectors or countries explicitly. Moreover, we are well aware of the impact of institutions and the change thereof on the development of economic systems – as Nelson (2005) put it institutions have to be understood as “an integral part of any structural changes in the economy”. We do not deal with issues related to institutional changes or with the integration of formerly Eastern European Countries into the European Union, to name just two examples, in the book.

2 Literature on Concentration and Specialization Patterns

Before turning to the causes and consequences of concentration, agglomeration and specialization it is necessary to define these concepts: Agglomeration can exist at various levels of space and we can either study this phenomenon at the urban, regional, national or international level. Moreover, agglomeration can be found for single industries as well as for whole economies. Whereas industrial agglomeration is associated with the concentration of one industry, absolute agglomeration implies the concentration of overall production in limited space. One prominent example of industrial agglomeration at the city level is the textile industry around Prato, Italy or the automobile industry in Detroit, U.S.; its equivalent to the regional concentration of the computer industry in the Silicon Valley. At the national level, a good example is the exposure of Japan on high-tech gadgets. There are however also international agglomerations. In Europe, there exists the “hot banana”, reaching from Milan to London, spanning from Northern Italy, through Southern Germany and South-east France, Belgium, the Netherlands towards South-East England (Krugman 1991a). In this book, we will mainly focus on the development of industries at the national level as well as the specialization of countries. Since we are also interested in the transition of economies from industrial to service societies, we will explore the reasons for inter-sectoral heterogeneity shortly.

For the discussion of structural convergence, we have to distinguish two types of structural change: inter-sectoral and inter-industry change. The former refers to variations of employment shares between the aggregate sectors of an economy. The latter relates to changes of production structures within one of the aggregate sectors, for instance a change in the share of the textile industry of total manufacturing employment. The nomenclature of this distinction is not consistent across the literature; in the remainder of this book we will speak of sectors in the sense of the three aggregate sectors agriculture, manufacturing, and services, in contrast to industries, such as machinery or financial intermediation services.

2.1 Inter-sectoral Heterogeneity

Arguments for inter-sectoral convergence can be derived from the three-sector-hypothesis (Fisher 1939, Fisher 1952, Clark 1940 or Fourastié 1949) and the convergence hypothesis of Chenery (1960). According to these hypotheses, all

European countries should have undergone similar paths of economic development and should have reached a stage at which the tertiary sector is the largest in the economy. This process is due to developments both on the supply side (technological progress) and the demand side (changes in consumer preferences): In countries which were still characterized by large shares of agriculture in the 1970s, technical progress (above all a higher degree of mechanization) ought to have increased productivity in the primary sector, making more and more workers redundant in agriculture such that people move to manufacturing. Simultaneously, demand is considered to have reached saturation in the primary sector², leading to a reduction of the agrarian workforce as well.

While the agricultural sector is characterized by the extensive use of natural resources and thus falling economies of scale (Clark 1940), production in the manufacturing sector is characterized by increasing economies of scale and the fact that goods are more easily transportable as they are not so easily perishable compared to many service goods. Therefore at some point in time, there is excessive labour supply in the manufacturing sector and due to cross-sectoral labour mobility workers then move to the service sector. Imitation, knowledge transfer and mechanization are also likely to destroy employment in the manufacturing sector while employment in the service sector rises until it reaches equal levels in all countries, as incomes converge. Due to lower labour productivity than in other parts of the economy, the service sector causes rising employment in the tertiary sector as income per capita increases (Baumol 1967 and Baumol 2001). As Stiroh (2002) showed, the productivity growth in distributional services is especially low compared to manufacturing industries since possibilities for rationalization (by making use of technological advances) are limited. According to Fuchs (1980) the growth rate in the service sector however lags behind because skill-upgrading has been more pronounced in the manufacturing than in the service sector. Moreover, some part of increasing employment in the service sector can be attributed to outsourcing processes in the manufacturing industries, such that the effect of an increasing service sector is overrated. Thus the proportion of the tertiary sector has increased over time due to the increased division of labour. As more and more manufacturing firms do not have departments for R&D, marketing and market research, advertising, financing, transportation or insurances but outsource these services to specialized firms (Görgens 1975), the importance of intermediate producer services has risen substantially (Gershuny and Miles 1983). These processes have also altered the

2 The income elasticity for agricultural goods is low – ranging for most goods in between 0.1 and 0.2 for EU countries, some goods are characterized by negative income elasticity (Hill and Ingersent 1982).

structures within the service sector, transferring employment opportunities from the provision of personal services such as the health and social work industry towards the production or the use of services associated with the production or use of manufacturing goods such as R&D or Business Services. To explain structural change by developments on the demand side, Kuznets (1972) argued in line with Engel's law that the share of the agricultural sector is inversely correlated with per capita income, whereas the other sectors' shares are positively correlated. Thus a shift of consumer preferences towards services makes employment in the tertiary sector grow. Consequently, the difference in per capita income is one of the major determinants of inter-sectoral heterogeneity in production structures between countries, and income convergence is expected to first drive inter-sectoral and at later stages also inter-industry convergence. The expansion of the tertiary sector has boundaries, however. Due to the cost-disease in service industries (Baumol 1967), prices for services rise relatively faster than commodity prices. Appelbaum and Schettkat (1997) point out that if consumers' demand is not inelastic to changes in these relative prices, it is likely that they will substitute the consumption of legally provided services and will move to consume services provided by the shadow economy thus driving down official employment rates in the service sector. The rising employment share of services does not result from shifts in real demand but from the lower productivity growth. In this line of argument, both Klodt (1995) as well as Rowthorn and Ramaswamy (1997) show that industries with highest productivity growth lose importance due to declines in both output and employment whereas structural change makes less productive industries grow. Therefore differences in the productivity levels of countries can lead to a quite heterogeneous development of employment structures over time.

Building on the three sector hypothesis, one has to be aware of several caveats: In recent years the impact of industries associated with information and communication technologies (ICT) has risen dramatically, and the degree of heterogeneity between "classical" services such as real estate and knowledge-producing branches within the service sector has increased. It has therefore been argued that the three-sector-hypothesis should be complemented by a fourth sector (Porat 1976 and OECD 2005). Yet our data are too highly aggregated to allow for a fourth sector. As a consequence, we decided to work with three aggregate sectors and included ICT branches in the manufacturing or service sector respectively throughout the whole book. For this reason, we study the impact of the diffusion of information and communication technologies in the economy only through inter-industry convergence.

A second caveat is the rigidity of the sector classification. Fourastié (1949) pleaded for a constant redefinition of sectors when labour changes occur in in-

dustries. Since service industries in the classic definition only contain industries with low labour productivity, industries such as business services - which have been characterized by a sharp increase of labour productivity - should no longer be considered part of the service sector but rather part of the manufacturing sector. Today's nomenclature of sectors is more in line with Clark (1940), however, since the service sector today comprises both high and low labour productive industries. Thus, in investigating the processes of tertiarization we also have to pay attention to the heterogeneity between service industries and distinguish between traditional services and standardized services with potential for rationalization and automation (Jones and Kierkowski 1990, Jones and Kierkowski 2001 and Wolff 2007). We therefore have to keep in mind, that the reliability of the three-sector-hypothesis is weakened as soon as service industries other than personal ones are investigated.

A third caveat is that according to Fourastié (1949), the low productivity growth in service industries would lead to a rise in employment possibilities more than offsetting the loss of jobs in the manufacturing sector. Baumol (1967 and 2011), however showed that the employment shift from manufacturing to service industries is not only driven by differential productivity growth but also by the cost disease associated with the service sector. Therefore, the output share of services in final demand remains constant over time if measured in constant prices. Thus, to some degree the increase in the output share of services thus is a pure price effect resulting from the fact that services are measured at current prices and that wages in the service sector tend to rise more than an economy's average rate even though services in general are more technologically stagnant than manufacturing industries. If measures in employment shares are used, the transition from the manufacturing to the service sector should appear smaller than measured with output data.

Moreover, studies have provided empirical evidence that the income elasticity of the entire service sector does not differ markedly from unity. This is due to the fact that only part of the service sector is highly sensitive to income increases (Summers 1985, Falvey and Gemmell 1996). Therefore important arguments undermine the unconditional validity of the three-sector-hypothesis: As soon as service industries exhibit significant increases in labour productivity or income elasticities, the reliability of the three-sector-hypothesis is weakened and the structural change towards the service sector is overestimated.

Last but not least, during recent times it has been repeatedly argued that two phenomena make the distinction between services and manufacturing obsolete anyhow: First, the tertiarization of manufactured products and second, the implementation of information technologies in service goods. Therefore, the competitiveness of manufacturing firms increasingly depends on the quality of ser-

vices provided once a product is sold and thus firms in manufacturing more and more often produce services or sell services that are outsourced to specialized service firms providing more personalized intermediate services than traditional services in education, health and leisure associated fields (Grömling et al. 1998).

Information and communication technologies raise the productivity of production processes in service industries. Thus it is no longer true that there is generally only little potential for productivity growth in services – but that there are differences across industries within the service sector. Industries that use standardized inputs to produce standardized outputs can be characterized by economies of scale to almost the same degree as it is the case for manufacturing industries. It is especially industries that heavily rely on information as a source of commodity that can be characterized by economies of scale: whereas the production of the first unit entails high set-up costs, the costs of reproduction are very small such that information services can be delivered at virtually zero marginal costs to an almost infinite number of customers (Shapiro and Varian 1998). Moreover, the *uno-actu* principle no longer applies for many service industries, creating new possibilities to concentrate production in few places instead of providing them in every country. For other sorts of services, however, the proximity of supply and demand still is important and thus de-concentration processes remain prominent.

Hence, instead of assigning industries to manufacturing or services, it could be more adequate to group economic activities according to their input structure, even though this implies more detailed data requirements (Preissl 2007). In former days, the service sector used to comprise all industries that neither belonged to the agricultural nor to the manufacturing sector, thus the service sector constituted the rest of all industries. Another characterization of service industries was that services could neither be stored nor traded and thus supplier and customer of a service had to be at the same place at the same time in order to sell/consume a service.

For our investigation of European countries in chapter 5, we therefore expect to find inter-sectoral convergence processes has taken place since the 1970s. Countries like Greece, Portugal and Spain, which were characterized by a disproportionately high employment share in agriculture and relatively low labour productivity at the beginning of the investigation period in the 1970s, are expected to have undergone a period of extensive catch-up and transition towards industrialized and service economies. The convergence process is expected to slow down over time as catch-up potentials are exhausted. A certain degree of heterogeneity between countries will however remain due to differences in natural resources, country size, institutional frameworks, and cultural backgrounds (Chenery 1960 and Chenery and Syrquin 1975). Models of the

New Economic Geography (Krugman 1991a, Krugman 1991b and Puga 1999) especially suggest that the impact of differences in country size on divergence processes should not be underestimated. The degree to which manufacturing firms outsource services varies across countries. Whereas in Germany a major part of business services are still carried out within industrial firms, other Western European countries tend to buy the very same services from specialized firms, statistically located in the service sector. Thus, Germany ought to be more heavily specialized into the manufacturing sector than other countries of equivalent development.

2.2 Inter-Industry Heterogeneity

Regarding inter-industry heterogeneity the direction of development is less clear-cut, since there are many centrifugal and centripetal forces at work. Individual characteristics of industries and countries, as well as the initial distribution of the labour force, wage differentials, labour mobility and transportation costs determine the concentration of industries and the specialization of countries. In what follows, we therefore discuss the main forces of concentration and specialization, respectively.

First, however, it is necessary to clarify different concepts of concentration and specialization: Absolute industry concentration is defined as production (or employment) in one industry being clustered in one or a few countries (Aiginger and Davies 2004). The textiles industry for instance is heavily concentrated in Southern European Countries, whereas the wood industry is mainly located in Northern European Countries. Relative concentration refers to the deviation of a country's employment share in an industry from the average employment share of the reference group in that industry. Thus, industries that are characterized by a low degree of relative localization are more evenly distributed over space than industries showing high levels of relative concentration. Whereas industries that are absolutely concentrated also need to be relatively concentrated, the opposite does not need to be true³.

The same applies to the concept of absolute and relative specialization: Absolute specialization implies that a small number of industries exhibit high shares of the overall employment of a single country. Absolute specialization thus addresses the differences with regard to the industry mix of individual countries. Relative specialization refers to the deviation of a country's industry structure from the average industry structure of the reference group of countries.

3 For more details see Chapter 3.

This kind of relative specialization reveals for instance comparative advantages of countries. Absolute concentration can also imply that the overall economic output, i.e. the entire economic activity, takes place in very few locations only implying that not only one single industry is clustered but many industries are clustered in the very same location as this location offers advantages in production.

Turning to the factors that influence the increase or decrease of concentration and specialization respectively, we can identify a number of important push and pull features. Already Hirschman (1958) pointed out the necessity to identify the *pull* and *push forces* that either lead to a core-periphery structure or to an even pattern of industrialization across space. Regarding inter-industry convergence and divergence, the direction of development is less clear-cut, since there are both centrifugal and centripetal forces at work, depending on the individual characteristics of industries and countries, as well as on the initial distribution of the labour force, wage differentials, labour mobility and the degree of transportation costs. Globalization has altered the competitive dynamics of nations, firms, and industries - above all those that are internationally tradable and where technological imitations, the fast adoption of new technologies is possible as it is the case for the textile industry.

In the following we explain forces of relative concentration and relative specialization respectively. This distinction is necessary since these two forms of heterogeneity may but need not necessarily go hand in hand (Aiginger and Davies 2004). The description is limited, however, since we do not discuss the agglomeration of cities as in Thünen (1826) nor the problems associated with urban agglomerations or firm agglomeration as in Hotelling (1929).

2.2.1 Comparative Advantages

Advantages due to productivity differences were the first sources to be identified leading to international concentration and specialization patterns. Economic integration allows for a better exploitation of comparative advantages due to labour productivity (Ricardo 1817), factor endowments (natural resources, skills) and factor intensity differences in production (Ohlin 1933 or Balassa 1963) thereby enhancing advantages from the division of labour across countries. In this context, Weber (1909) distinguished between universal factors of location that are abundant in all production places and therefore do not have to be transported on the one hand and industry- or country-specific production factors on the other hand. The more important both country- and industry-specific resources are for an industry and the more these factors are localized, the more the

location of production is determined by these factors and concentrated in few locations. A good example for industry-specific concentration is the abundance with wood in Scandinavian countries that made this industry concentrate in these favourable countries. In recent decades, wage differences are likely to have determined the optimal location of labour-intensive industries such as the textile industry in low-wage regions in South-Asia. Changes in comparative advantages are thus likely to have effects on the location of industries, even more so if transportation costs are low and international competition between countries becomes fiercer. High wage countries are thus determined to specialize into high-productivity, high-tech and research-intensive industries in order to ensure further economic growth. Low wage countries on the contrary will tend to move into the production of labour- and probably resource-intensive industries. As both European and international integration processes take place at the same time, we have to distinguish between industries where competition comes from other high-wage countries such as the US and Japan or whether competition stems from South East Asian countries in order to be able to predict (de-) specialization patterns of individual countries according to comparative advantages. If the latter applies, then all Western European Countries are likely to be affected likewise and employment will drop in all countries. If competition stems from other highly industrialized countries however, we expect different effects on individual countries thus leading to increasing relative concentration and specialization. To give an example: As cost competitiveness in labour-intensive and low-skill industries of the Southern European Countries compared to extra-European low-cost countries decreased due to declining transport costs worldwide, the production of these industries is expected to have been transferred to extra-European countries. This implies that the ongoing globalization makes all European countries lose competitiveness in labour-intensive, low-skill, and low-technology industries in favour of low-cost countries outside Europe, and forces all European countries to shift production towards high-technology, high-skill and capital-intensive industries. Whether concentration or de-concentration processes prevail in such an environment, depends on two things: First, whether Western European countries specialize in the same high-skill and high-tech industries or whether they specialize in different industries. On the other hand, economic integration could lead to converging effects as well: While countries can have initial advantages due to different factor endowments, these benefits are expected to be arbitrated away either through capital, knowledge and technology flows to disadvantaged locations, where marginal returns are highest due to diminishing returns to economic activities. Second, the balance between concentration and de-concentration depends on whether all countries are affected by reallocation processes at the same time. It is possible that some countries come