Specialization in the Euro Area: A Vertically Integrated Sector Perspective and the Role of Knowledge Intensive Business Services

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PRELIMINARY DRAFT

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Abstract

The imbalances among countries belonging to the European Monetary Union (EMU) have been analysed under several angles in recent years, (i.e. productivity growth, institutional characteristics, labor market policies, external trade balance, etc…), but often neglecting the evolution of economic and productive structures. In this work we aim to fill this gap analyzing the countries specialization through the differences in the inter-industrial linkages that affect economic systems competitiveness and production processes. We use the input-output subsystem approach exploiting the latest WIOD release (2018) to investigate the role of business services, with a special focus on KIBS, in shaping the EMU countries productive structures through their integration in the manufacturing sectors. The results show that disparities are growing in the composition of productive structure and they are even more pronounced when we consider intersectoral dynamics; in particular, when KIBS are addressed to satisfy the manufacturing final demand and when we control for manufacturing subsystem technological intensity.

Keywords: European Monetary Union, Convergence, Divergence, Input-Output, Knowledge intensive business sectors

JEL: F45; O14; P5.

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1. Introduction

In recent years, the attention of scholars and policy makers mainly focused on "monetary integration" and its consequences for the European Monetary Union (EMU) countries, while less attention has been paid to "real disintegration" (Bagnai and Mongeau Ospina, 2017).

The studies on imbalances among EMU countries analyse such phenomena under several angles (i.e. productivity growth, institutional characteristics, labor market policies, external trade balance, etc…), but often neglecting the evolution of economic structures. Put it another way, the phenomena of nominal and real divergence/convergence have been the object of several works, but the structural divergence/convergence among EMU countries still is an under-researched issue. Among the few contributions on this topic Palan and Schmiedeberg (2010), for example, provide evidence for European countries about structural divergence/convergence looking at intersectoral (agriculture, manufacturing, services) and inter-industry (for branches of agriculture, manufacturing and services) dynamics. The results point to a persistent intersectoral convergence, while the results at industry level are mixed, but showing a trend toward divergence for high-tech industries. Finally, two works of the European Central Bank (ECB) (MPC, 2004; Mongelli *et al.*, 2016) show the changes in the economic structure in European countries, pointing out not only the relevance for the transmission of monetary and fiscal policies, but also their crucial role as factors determining the degree of resilience in front of negative phases of the business cycles and the potential productivity growth.

As the European Commission puts forward, in order to strengthen the EU competitiveness, exiting from a long and deep recession, a renaissance of the European industry is needed (EC, 2014a). The central role of manufacturing has been re-recognized by several authors that highlight its importance in sustaining productivity growth, employment and innovation (e.g. Stöllinger et al 2013; Pianta 2014; Mazzucato et al 2015). Indeed, the industrial policy has recently gained renewed attention at the EU level. As stated by the European Commission (2013) "industrial policy needs to steer structural change towards higher productivity in manufacturing and better positioning of EU enterprises in the global value chain based on comparative advantages in knowledge and technology intensive products and services" (EC 2013, p.3). The role of manufacturing in sustaining EU competitiveness should be considered within a framework of increasing integration between manufacturing and services (EC 2013). The EU industrial renaissance passes through the role of business services and in particular of Knowledge Intensive Business Services (KIBS) (EC, 2014a; EC, 2014b) in manufacturing. Despite this crucial role of KIBS in potentially triggering the EU industrial renaissance little is known about the dynamic of their integration in manufacturing.

This phenomenon (manufacturing/KIBS integration) cannot be caught by a traditional perspective. In fact, the latter approach adopts a horizontal perspective that considers economic sectors as divided from one another and no interdependence is assumed (Syrquin, 2010). Hence, it offers a partial understanding of the phenomenon at stake. Indeed, as reported by the (Malosse, 2015) traditional statistical indicators based on the sharp separation between services and manufacturing are not able to grasp the complex nature of the value chains, calling for new measurement approaches.

Because of the gap in the literature and of the flaws in the current perspective of analysis the present work has a twofold value added. On the one hand, we aim at filling the gap in the literature about the changes in the productive systems of the EMU member countries in the 2000s. On the other hand, we address this topic by adopting a methodological approach that is different from the traditional analysis. Specifically, following Pasinetti's input-output subsystem approach, the paper analyses countries' productive structures through the differences in the inter-industrial linkages that affect economic systems competitiveness and production processes. The subsystem is an analytical representation of the economic structure that represents all the activities that are directly and indirectly needed to satisfy final demand for a specific good or service. Therefore, this perspective completes the information on the way in which the organization of the manufacturing system is changing and it allows us to specify a 'causal' relationship that involves intermediates linkages and the role of 'integrated' KIBS, as inputs, in generating the manufacturing final demand.

In previous works, the subsystem approach has been essentially used to measure the extent of the outsourcing process in manufacturing and to test the deindustrialization hypothesis (Montresor and Vittucci Marzetti, 2011; Ciriaci and Palma, 2016; Sarra et al, 2018; Di Berardino and Onesti, 2018). Consequently, this paper is the first study that adopts the subsystem approach to investigate inter-country structural convergence.

In order to empirically address our objective, we use the WIOD database (latest release) that covers a time span from 2000 to 2014 and we measure the evolution of subsystems specialization using the Krugman

specialization index and looking at convergence/divergence trends among 19 EMU countries. The results show that disparities are growing in the composition of productive structures and they are even more pronounced when we consider intersectoral dynamics; in particular, when KIBS are addressed to satisfy the manufacturing final demand and when we control for manufacturing subsystem technological intensity. In fact, different models of integration emerge between large and small countries and core and peripheral ones.

The reminder of the paper is organized as follow. The next section has the objective of providing a review of the background literatures that constitute the foundation of the present work and span from the Optimal Currency Area (OCA) theory, which helps in understanding the determinants of the convergence/divergence processes, to the works on the integration among manufacturing and services, in order to analyse the vertical integration processes in the different countries examined. Section 3 describes the methodological approach and section 4 show the results and provide comments and interpretations. The last section is left to preliminary remarks.

2. Background literature and research questions

In investigating the convergence/divergence processes among EMU countries there is consensus on the nominal convergence experienced by them since the Euro inception, especially for price stability and long term interest rate (Toader and Gidiu, 2012), but at the same time it cannot be neglected that the process of real convergence stopped at the end of the 90s and started declining with the Great Recession and the sovereign debt crisis. As stressed by Galletti "[…] nowadays, a widespread consensus exists over the claim that nominal convergence, i.e. convergence in nominal variables like inflation and interest rates, was not followed by real and structural convergence." (Galletti, 2018, p.8).

Since the settlement of the EMU, the predictions on its survival and prosperity expressed by scholars were largely at the antipodes: the optimists stressed the fueling role of a single market/single currency for the Euro countries' growth and integration (e.g. Gaspar and Mongelli, 2003; EC, 1990); the sceptics (e.g. Krugman, 1993; Lane 2006) predicted a process of divergence across Euro countries, mainly driven by institutional heterogeneity, asymmetric countries' behaviours (Bolthon and Carlin, 2013) and lack of labour market flexibility.

While the attention of many scholars was focused on real and nominal convergence, less attention has been paid to the structural convergence (Palan and Schmiedeberg, 2010), which influences in the long run the real convergence (Alexoaei and Robu, 2018) among countries. Heterogeneity in productive structures among countries can be a potential catalysing factor for an (un-)even growth, triggering a real divergence process.

A fundamental element of many EMU economic structures is the manufacturing sector, which still has a crucial role in the economic growth of EMU countries, as recognized by the European Commission (EC, 2013). Hence, the decline in industrialization needs to be challenged. To this end a way is to recognize the important role that business services, and KIBS in particular, may play in sustaining an industrial renaissance for the EU and also for the EMU countries. How mapping the KIBS integration in the EMU area is one of the main objectives of this work. The mapping cannot be done without including in the analysis the vertical integration perspective of the economy. The traditional analytical view of productive structures 'disparities' mainly focused on a «horizontal» perspective of the economy is not sufficient, since it considers economic sectors as divided from one another and no interdependence is assumed. In particular, it does not account for the shifting boundaries between markets, and in-house firms' activities (Franke and Kalmbach, 2005) can overestimate or underestimate the role of manufacturing and services in the economic system as a whole (Di Berardino and Onesti, 2018).

Intermediate inputs and a vertical perspective of the economy comprises an interesting strand of the literature, attracting a growing number of scholars. The concept of vertically integrated sectors, identified by Pasinetti (1965, 1973), is based on the fact that final goods stem from vertically integrated production, which involves different sectors. Within this view the 'subsystem' is an autonomous, vertically integrated production system that includes all the factors that directly and indirectly contribute to satisfying the final demand in manufacturing. Hence, this empirical framework emphasizes demand-driven growth, in which inter-industrial relationships are identified according to the linkages between final goods and all the inputs to production. This approach indicates that each sector is considered on the basis of its contribution to the production of final goods. With this methodology it has been shown that direct effects in manufacturing have a smaller role compared to the indirect effects that derive from the linkages within the production system.

This paper is the first contribution that adopts the subsystem approach to investigate inter-country structural convergence.

In order to deepen the analysis we apply the specialisation index to the subsystem approach with the aim of identifying whether the degree of specialisation increases when using a subsystem approach instead of horizontal based approach. Looking at the manufacturing sector we then pose the following question:

Q1. Are the disparities in the composition of manufacturing productive structures among 19 EMU countries growing?

Subsequently, by applying the Krugman specialization index to the input-output subsystem approach we are able to capture the change in the extent of vertical integration between the manufacturing sector and the KIBS looking at the changes of the productive structure through the lens of the subsystems. Hence, we can answer the following question:

Q2. The changes in productive structures are more evident when a subsystem approach is applied than when the traditional sector-based approach is used?

A second main aim of the work is to investigate and measure the relation between the manufacturing subsystem and the KIBS, since it is pivotal in sustaining the re-industrialisation process as argued above. Many authors show that inter-sectoral interaction tends to be more intense between manufacturing and knowledge-intensive sectors (e.g. Kox, 2004; Francois *et al*., 2015; Ciriaci and Palma, 2016). Furthermore, it has been argued that many manufacturing activities are required by the service sector to improve efficiency and innovation through the optimization or the substitution of some employment functions. For instance, Ciriaci and Palma (2016), using OECD data for some European countries for the period 1995-2005, demonstrate the existence of a strategic relationship between knowledge-intensive business services (KIBS) and manufacturing subsystems, dominated by technologically advanced subsystems. Therefore, the studies on technological change have identified the services as the key to capture structural transformations (e.g. Montresor and Vittucci Marzetti 2011; Di Berardino and Onesti, 2018) and the intersectoral linkages as important for the industrial development, which may depend on the quality of the services adopted (Gallouj, 2002). However, the empirical literature on the effects of the transition to a service-based economy has not always relied on an accurate measure of the phenomenon. For instance, the traditional approach does not allow researchers to distinguish producer services from consumer services. It is based on an arbitrary classification of service categories that does not accurately reflect the impact of producer services on the economy, which hinders reliable analysis (Cheng and Daniels, 2014). The subsystem approach to Input–Output analysis is helpful in addressing these issues. In particular, it allows researchers to measure the amount of increased employment in services that feeds either final demand or intermediate demand, avoiding the inaccuracies related to imputation based on their prevailing destination adopted by the traditional approach.

In the following, we explore the contribution of KIBS to the manufacturing and industrial composition by technological intensity. Looking at the manufacturing subsystem and their industries subsystems we then pose the following question:

Q3. What does it happen when we consider the role of 'integrated' KIBS and we control for manufacturing subsystem technological intensity?

3. Data and Methodological framework

In Pasinetti's approach, an important distinction is made between «sector or industry » and «subsystem». Pasinetti's subsystem feature a generalization of the concept of subsystem elaborated by Sraffa. As Sraffa stressed (1960; p.89): «the commodities forming the gross product can be unambiguously distinguished as those which go to replace the means of production and those which together form the net product of the system».

Following a method illustrated by Pasinetti (1973) we use I-O tables to define an "operator" which is independent from the relative prices, and able to decompose a vector that expresses an entity classified for sector (based on a classification compatible with that of the I–O matrix) in a square matrix in which the same

entity is remapped from the "sector" or "branch" to a "sub-system" (or "vertically integrated sector" or "block"). The subsystem is an aggregation that analytically represents all the activities used (directly or indirectly) to satisfy the final demand for a specific good or service, given the stock of fixed capital. By classifying each sector according to the final product, the subsystem identifies the contribution of every single sector or industry within each process of production.

The data used in the paper were obtained from the Word Input–Output Database (WIOD, 2018). The WIOD is a time-series of national symmetric input–output tables (industry x industry) that cover 40 countries and a time span from 2000 onwards (Dietzenbacher *et al.*, 2013; Los *et al.*, 2015; Timmer *et al.*, 2015). The availability of specific socio-economic accounts (SEAs) in the WIOD database, which are entirely complementary with the sectoral classification of national input–output tables, are perfectly suitable for the analysis of the changes in the production structure because that contain data for number of employment, hours worked and value added for each sector of the economies.

4. KIBS integration in manufacturing and convergence in EMU: where do we stand?

4.1 Production structures of EU19 countries

We start the analysis with an evaluation of the characteristics of the production structure and of the changes that have taken place since 2000. We break down the production structure of the overall Euro zone into seven industry groups: agriculture, manufacturing, public utilities, construction, market services (and KIBS inside it) and non-market services. Table 1 presents some interesting facts in this respect and highlights many differences in the productive composition obtained with a sectoral and a subsystem approach using data on number of employees, hours worked or value added (Montresor and Vittucci Marzetti, 2011; Ciriaci and Palma, 2016, Di Berardino and Onesti, 2018). This because the subsystem approach enables a deeper evaluation of the contribution of several activities to the economy as a result of intersectoral flows.

Table 1. Productive structure composition by sectors and sub-systems (EU19)

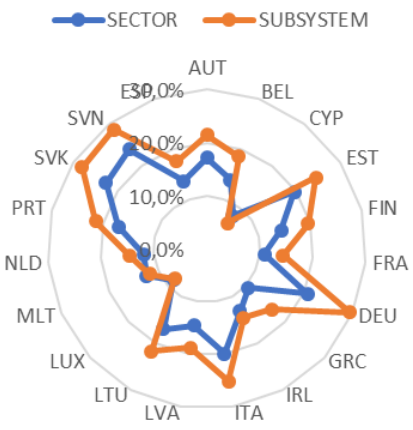
	Sector					
	Employment		Hours Worked		Value Added	
	2000	2014	2000	2014	2000	2014
A	4.9	3.5	2.4	2.0	2.4	2.0
M	17.4	13.9	20.5	16.3	17.2	16.4
PU	1.2	1.1	1.5	1.5	2.8	2.7
C	7.4	6.0	7.8	5.9	6.6	4.9
MS	40.3	44.2	38.5	42.9	48.7	51.0
KIBS	*11.0*	*10.6*	*9.9*	*13.5*	*11.5*	*12.9*
NMS	28.9	31.2	29.3	31.4	22.3	23.0
	Subsystem					
	Employment		Hours Worked		Value Added	
	2000	2014	2000	2014	2000	2014
A	3.0	2.2	1.7	1.5	1.8	1.6
M	24.6	20.5	25.7	21.7	24.4	22.5
PU	1.2	1.3	1.4	1.5	2.0	2.0
C	9.6	7.4	10.1	7.4	9.0	6.7
MS	30.4	35.0	29.5	34.2	37.4	41.2
KIBS	*4.3*	*5.8*	*4.1*	*6.8*	*4.6*	*7.2*
NMS	31.2	33.6	31.7	33.8	25.3	26.0

The sectoral approach reveals an 'underestimation', when compared to the subsystem approach, in the ability to capture employment, hours worked and value added in manufacturing. Indeed, if we use a subsystem approach, the weight of manufacturing becomes higher and exceeds 20 percent in all aggregates

considered. This evidence is to be considered at the light of the renewed interest in industrial policies aimed at the renaissance of manufacturing in Europe and supports the idea that a strong and modern industrial structure is fundamental for boosting economic growth and strengthening Europe's global competitiveness. In fact, following the subsystem approach the aim of Horizon 2020 program about the weight of value added in manufacturing in the European countries would be already reached (EC, 2014). The large outsourcing of manufacturing and the general reorganization of production are associated with a "minor deindustrialization process" if we compare it to the sectoral traditional approach: the economic transition to services is accompanying the deindustrialization process, but in this trend it should be considered the increasing vertical integration between services and manufacturing that can be attributed to the greater complexity of managerial functions, on the one hand, and to strong vertical decentralization by manufacturing firms, on the other.

Considering the hours worked, which has several advantages as stressed by Portella-Carbó (2016), as they are directly comparable over time and among countries and are not related to institutional arrangements, social conventions, or the length of the working day (i.e. part-time work) and focusing the attention on the manufacturing system we can look at each of the EU19 countries by manufacturing share in the economy (Figure 1) in order to capture the differences between the weights of manufacturing in the sector and subsystem approaches. As we expected, the sub-system approach gives almost everywhere a higher weight for manufacturing than the sector approach, and in the largest countries and manufacturing-oriented economies this gap is even more evident.

Figure 1. Share of manufacturing in each EU19 countries: sector and subsystem approaches. Hours worked. 2014 (percentage values).



Note: see Appendix for the legend of countries.

4.2 Specialization in the EU19 countries

The renewed interest in industrial policies that aim at the renaissance of manufacturing in Europe need to take some cross-country differences into account for the effectiveness of the industrial policy. To this end the present section examines the cross-country differences in manufacturing specialization between the EU19 countries through the implementation of specialization and concentration indices to the subsystem approach. In so doing we overcome a shortcoming of the current empirical literature (see among others Palan and Schmiedeberg, 2010), which usually neglect inter-sectoral linkages. Due to the availability of consistent input-output data over a long time horizon 2000-2014, we can overcome this restriction through the first time adoption of the subsystem approach to the KSI (Krugman Specialization Index), in order to understanding

how much of the specialization process is explained by interlinkages among different activities[1]. Specialization is a growing force in the manufacturing among EU19 countries, as shown in Table 2. Indeed, the results by applying the KSI show an increasing trend in specialization over time, which potentially implies a diverging trend among the EU19 economies. The specialization process over time seems to be even more evident when we abandon the sector approach in favour of the subsystem one.

Table 2. KSI (Krugman Specialization Index), SKSI (Subsystem Krugman Specialization Index) and CV (coefficient of variation) in EMU 19 countries by sector and sub-system manufacturing (2000-2014). Hours worked.

Manufacturing	2000	2014	deviation 2000-2014 2000=100
KSI	0,730	0,800	109,6
SKSI	0,884	1,122	126,9
Sector CV	0,232	0,292	125,9
Subsystem CV	0,229	0,335	146,3

If we calculate the specialization index by country it emerges that Germany is the only country that does not show a general decrease in manufacturing specialization: the German leadership consolidation in manufacturing is evident also looking at the SKSI. Decomposing our manufacturing subsystems in Low-Tech (LT), MediumLow-Tech (MLT), MediumHigh-Tech (MHT) and High-Tech (HT) industries (OECD 2003) and looking at MHT-HT sectors, since several authors (Ciriaci and Palma, 2016; Sarra *et al.*, 2018) show that inter-sectoral interaction tends to be more intense in the medium/high-tech and high-tech manufacturing subsystems, we find that Germany, unlike other countries, increases the SKSI also for the HT-MHT industries, from 0.177 to 0.187, confirming again its leadership in the eurozone manufacturing activities. These differences are the foundation of the real divergence between the economic systems that we are experimenting in the Eurozone, with its corollary of asymmetric reaction of countries to exogenous shocks, supporting the Krugman hypothesis (Krugman, 1993).

4.3 KIBS integration in the manufacturing subsystem

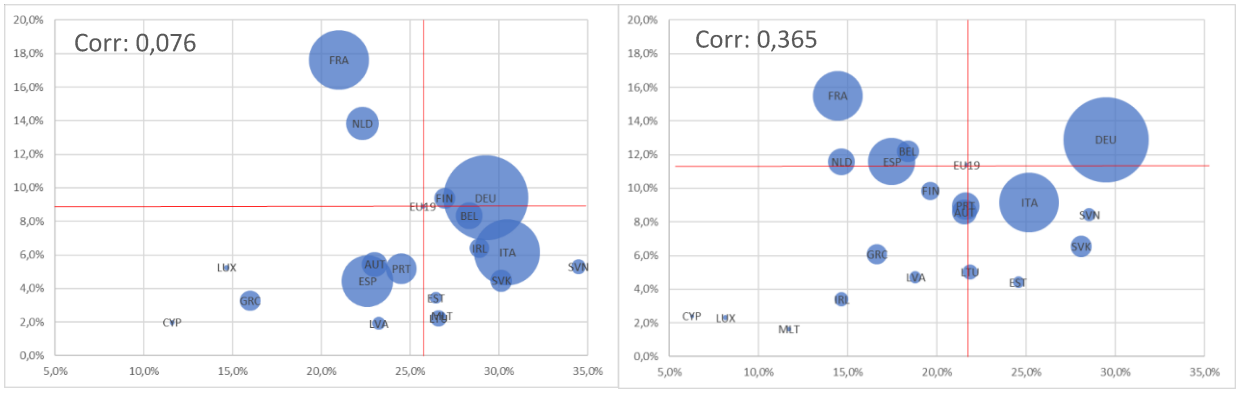
A further advantage of the input-output subsystem approach is that it allows us to focus on manufacturing/KIBS integration with the aim to point out the different models of manufacturing specialization emerging in the EMU countries. The degree of integration of KIBS into manufacturing can be assessed through the share of direct and indirect inputs of KIBS in the production of final goods. The following figures report the degree of KIBS vertical integration in the manufacturing subsystem in the nineteen EMU countries in 2000 (left graph) and 2014 (right graph): considering respectively the manufacturing subsystem as a whole (figure 2), the low-tech manufacturing subsystem (figure 3) and the high-tech manufacturing subsystem (figure 4). The axes defining the four panels in the middle of the graph represent the average values of the EU19, by considering manufacturing subsystem in a "pseudo-EMU area" consisting of the sum of 19 countries (Montresor and Vittucci Marzetti, 2011).

Figure 2 illustrates the degree of KIBS vertical integration in the manufacturing subsystem as a whole. The extent of this integration and the weight of manufacturing subsystem differ significantly among countries. The main considerations we can draw from the comparison of left and right panel concern the distribution of the countries relatively to the axis defining the EMU averages of KIBS integration and the averages of manufacturing subsystem weights on the economy. In the left panel (2000) the countries are closer in terms of manufacturing subsystem weights, especially the largest countries in the EMU area and, consequently, their distribution was more vertically oriented (the main differences in the productive systems were to search in the integration of KIBS into the manufacturing subsystems). In 2014 (right panel), on the

1 The Subsystem Krugman Specialisation Index (SKSI) is: $\Sigma |$ $\_$ $|$ where $V^{i}_{k}(t)$ is the share of subsystem i in country k at time t based on hours worked and $^{i}(t)$ is the share of subsystem i in the European union less country i.

contrary, the dispersion of the countries over the horizontal line indicates that while the gaps in terms of KIBS integration are closing over time (divergence in the weights of the manufacturing subsystems).

Figure 2. KIBS integration in the manufacturing sub-system(% of hours worked)

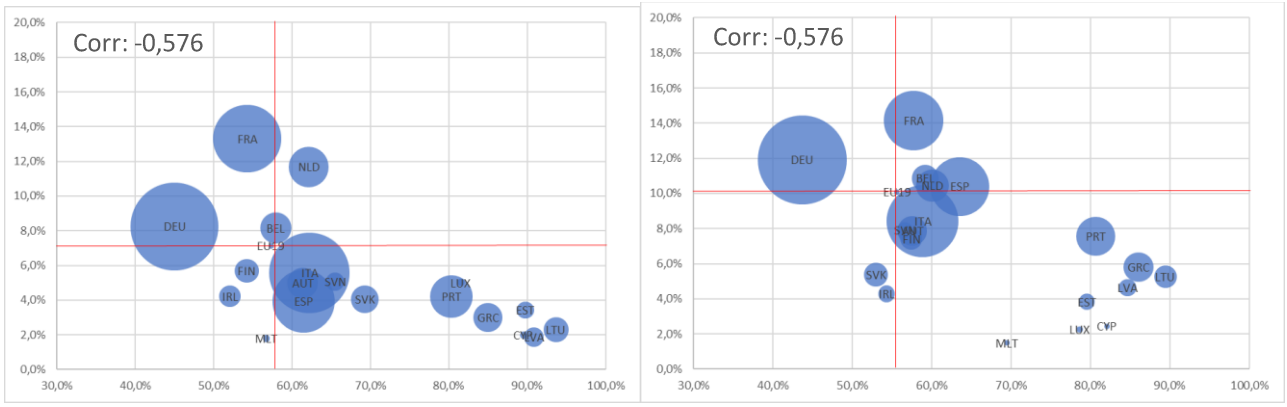


2000 2014

Note: x = Share of Manufacturing subsystem; y = Integration of KIBS in Manufacturing subsystem; size of circles: represents the size of each country's manufacturing subsystem in the total manufacturing subsystem in EU19 in 2014, calculated in terms of total hours worked; Corr is the correlation between KIBS integration and manufacturing systems weights.

When we turn our attention to the subsystems disaggregated in LT-MLT and HT-MHT we notice several differences accompanying the development over time of the integration of KIBS in the manufacturing systems. Figure 3 reports the KIBS integration if we consider only the LT-MLT manufacturing subsystems. As we can see there is a negative relation between the weight of the LT-MLT subsystems on the total manufacturing subsystems and KIBS integration: the higher the LT-MLT share, the lower the KIBS integration. Low tech industries do not develop over time a sensibly higher KIBS integration and the picture of the 2000 is quite similar to that of 2014, except for some small relocation of countries.

Figure 3. KIBS integration in the manufacturing sub-system for LT and MLT industries (% of hours worked)



2000 2014

Note: x = Share of LT-MLT manufacturing subsystem on total manufacturing subsystem; y = Integration of KIBS in LT-MLT Manufacturing subsystem; size of circles: represents the size of each country's manufacturing subsystem in the total manufacturing subsystem in EU19 in 2014, calculated in terms of total hours worked; Corr is the correlation between KIBS integration and manufacturing systems weights.

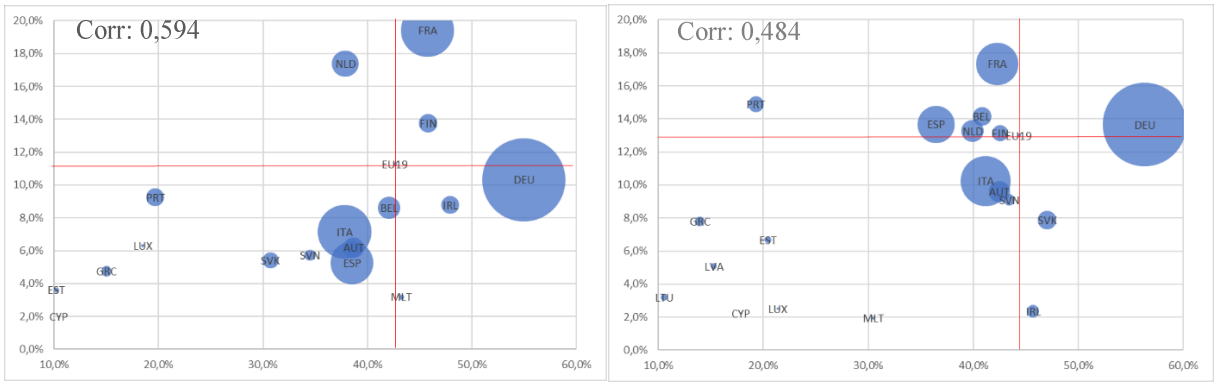
A further lesson we can infer from the countries movement over time is that the gap among big (central) and small (peripheral) countries is increasing.

Finally, the correlation between the KIBS integration and the weight of manufacturing systems reinforces over time confirming that the business services play a leading role in the development of the manufacturing sector, as shown in different studies (Ciriaci and Palma, 2016), and they could contribute to improve the competitiveness of the manufacturing sector and of the overall production system.

The evidence is substantially different when we concentrate on HT-MHT subsystems (Figure 4), which show a positive relation with KIBS integration: the higher the HT-MHT subsystems share in the overall manufacturing, the higher the KIBS integration. From 2000 to 2014 we observe some 'radicalization' in the manufacturing subsystems development in the EMU area. In 2014 is quite evident the hegemonic role of Germany: it is the leading manufacturing country, as a whole and especially in the HT-MHT industries, and it is the only country that is able to locate in the top-right panel, given the high level of KIBS integration in HT-MHT industries. This dominant German model contrasts with other two 'models' which are led by the following large countries respectively; Italy, on the one hand, and France with Spain, on the other. Italy is located in the bottom-left panel, showing a lower than average share of HT-MHT industries coupled with a lower than average KIBS integration. Traditional manufacturing industries, largely LT-MLT, are the core of the Italian manufacturing as well known, requiring low levels of KIBS integration. France and Spain on the contrary are able to locate in the top-left panel, showing a higher than average KIBS integration, while maintaining a lower than average share of HT-MHT. These two countries are experiencing over time a rather evident de-industrialisation process which is 'compensated' by the development of a strong integration of the KIBS into manufacturing subsystems.

Finally we can also notice a diverging path between large (central) and small (peripherical) countries, in terms of manufacturing weight, as the gap between the top-right block of countries and the bottom-left one widens from 2000 to 2014.

Figure 4. KIBS integration in the manufacturing sub-system for MHT and HT industries (% of hours worked)



2000 2014

Note: x = Share of HT-MHT manufacturing subsystem on total manufacturing subsystem; y = Integration of KIBS in HT-MHT Manufacturing subsystem; size of circles: represents the size of each country's manufacturing subsystem in the total manufacturing subsystem in EU19 in 2014, calculated in terms of total hours worked; Corr is the correlation between KIBS integration and manufacturing systems weights.

4.4 A disaggregated subsystem approach: industries specialization

In order to get a more detailed framework regarding the trend of specialization, table 3 shows the SKSI for each 19 manufacturing industries (WIOD 2018 ISIC rev. 4 classification). The changes in subsystems' specialization are relevant for the transmission of monetary policy and for the (a)symmetric

reaction of countries to exogenous shocks and KIBS integration is vital for the future of EMU industrialization. The results by applying the SKSI show an increasing trend in specialization among the industries subsystems over time. Such a growing specialization occurs if we consider the integration of KIBS into each subsystems: as many as 11 countries show an increase of SKSI both from the point of view of manufacturing specialization and from the point of view of the integration of KIBS in each industry.

Indeed, the manufacturing industries with the higher degree of specialization are generally HT intensive and tend to be more integrated with the KIBS.

Table 3. SKSI in EMU 19 countries by manufacturing industries subsystems (SKSI MAN) and integration of KIBS in each manufacturing industry subsystem (SKSI INT) (2000-2014). Hours worked.

	SKSI MAN		SKSI INT		
	2000	2014	2000	2014	**TREND → MAN/KIBS**
Manufacture of food products, beverages and tobacco products	1,576	1,802	0,758	0,810	+ +
Manufacture of textiles, wearing apparel and leather products	1,583	0,802	0,633	0,584	--
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0,610	0,644	0,454	0,524	+ +
Manufacture of paper and paper products	0,288	0,229	0,765	0,972	-+
Printing and reproduction of recorded media	0,127	0,177	0,547	0,810	+ +
Manufacture of coke and refined petroleum products	0,266	0,704	1,401	2,032	+ +
Manufacture of chemicals and chemical products	0,495	0,529	1,443	1,354	+ -
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0,214	0,490	1,380	1,086	+ -
Manufacture of rubber and plastic products	0,263	0,285	0,663	0,832	+ +
Manufacture of other non-metallic mineral products	0,207	0,262	0,875	0,909	+ +
Manufacture of basic metals	0,487	0,412	0,977	0,910	--
Manufacture of fabricated metal products, except machinery and equipment	0,449	0,505	0,481	0,554	+ +
Manufacture of computer, electronic and optical products	0,739	0,445	2,081	1,281	--
Manufacture of electrical equipment	0,388	0,432	0,749	0,901	++
Manufacture of machinery and equipment n.e.c.	1,080	1,124	0,798	0,924	++
Manufacture of motor vehicles, trailers and semi-trailers	1,433	1,392	1,225	1,145	--
Manufacture of other transport equipment	0,284	0,357	1,650	1,889	++
Manufacture of furniture; other manufacturing	0,365	0,566	0,468	0,558	++
Repair and installation of machinery and equipment	0,267	0,239	0,725	0,737	--
TOTAL INDUSTRIES SKSI	**11,122**	**11,396**	**18,074**	**18,812**	**++**

5. Preliminary remarks

This study has focused on structural divergence/convergence among EMU countries through the analysis of the integration between manufacturing and KIBS in terms of hours worked. We address two main gaps: one concerning the scarce presence of works on changes in the economic structures of the EMU countries; one regarding the measure of KIBS integration in manufacturing. The paper is based on the last release of WIOD database and covers a long period (2000-2014) by adopting a vertical perspective (subsystem approach) of the production structure. We measure all the activities that need to be integrated to create final production in a specific branch. By classifying each sector/industry according to final goods, the subsystem identifies the contribution of every single sector/industry within each production process and illustrates the extent to which the organization of the economy influences final production.

Preliminary results show that disparities are growing in the composition of productive structure and they are even more pronounced when we consider intersectoral dynamics, by confirming the Krugman position about the increasing specialization among EMU countries.

Looking at the sub-systems seems to be crucial in understanding how the productive structures move and develop, since it is possible to capture inter-industries linkages (one of the pillar of smart-factory) and to inform policy makers about the important role of value chains traditionally neglected if compared to the role of sectors.

When we focus on the KIBS integration we notice the emergence of diversified models of integration, whose heterogeneity is mainly appreciable when looking at the following pairs of countries: large vs large; small vs large; small vs small. Differences among large countries spread out along the two axis considered in the representation of the economic structure used (share of manufacturing on total economy and weight of hours worked in KIBS on the total hours worked in the manufacturing subsystem); the main difference between large and small countries can be measured on the share of manufacturing subsystem, lower in small countries than in large ones; among small countries, again the difference is mainly on the share of the manufacturing subsystems, since the integration of KIBS is still on low level for almost all of them.

The disaggregation by technological intensity shows a positive relation between KIBS integration and technological intensity over time. The main difference among countries are here on the small vs small pair: small countries are more differentiated than large ones. However, also the diverging process between large and small countries should not be neglected.

Given the evidence provided we can stress the following priorities in terms policy.

1. The EMU endogenous forces did not push the member states toward a process of less specialization and structural and real convergences. On the contrary, the Krugman hypothesis (Krugman, 1993) seems to hold: specialization of EMU countries tends to increase in the last decades. If this is the case, as our results seem to imply, the EMU is likely to experience low degrees of business cycle synchronization, with the fierce negative consequences already experienced during the Sovereign Debt crisis for some EMU countries given the incomplete nature of the monetary union (De Grauwe, 2016). This call for (no longer postponable) fiscal union and risk sharing policies.

2. Given the importance of the interlinkages between manufacturing and business services in sustaining the industrial renaissance it is crucial to promote best practices to reinforce manufacturing/services relations: e.g. easing the access to KIBS also for manufacturing SMEs that need such kind of services but are not able to access to them because of lack of skills, competencies, funds, etc…).

3. Reinforce the manufacturing sectors since they are pivotal actors, as recalled in the introduction, for productivity growth, employment and innovation. For some countries, lagging behind the leaders (e.g. Germany) in terms of manufacturing/KIBS integration, there might be the need to strengthen the pre-requisites that allow to exploit the potentiality of manufacturing/KIBS integration: e.g. policies to foster ICT adoption and implementation may guarantee faster and higher levels of KIBS integration in manufacturing.

4. Targeted industrial policies for specific countries/regions to foster manufacturing growth in those sectors that better integrate KIBS. The already implemented ‘Smart Specialization Strategies’ seem to proceed in the right way.

Appendix:

AUT	Austria	FIN	Finland	LUX	Luxembourg
BEL	Belgium	FRA	France	LVA	Latvia
CYP	Cyprus	GRC	Greece	MLT	Malta
DEU	Germany	IRL	Ireland	NLD	Netherlands
ESP	Spain	ITA	Italy	PRT	Portugal
EST	Estonia	LTU	Lithuania	SVK	Slovakia
				SVN	Slovenia

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