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Servitising industrial regions

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Abstract

The paper will explore the evolving role of service sectors in relation to manufacturing activities within local systems of production. It will discuss whether issues related to spatial proximity have shaped the value chains of manufacturing activities. Territorial servitisation is here defined as the symbiotic recoupling between services and manufacturing that impacts on their relative value creation contribution to both value chains and to consumers. We present empirical evidence from the UK by means of employment data at NUTS 2 level and by 5- digit sector level.

JEL codes: R11, L84

Keywords: servitisation, regional economies, manufacturing, KIBS.

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1. Introduction

Regional studies and economic geography have always focused on the dynamics of regional development considering manufacturing as well as services, the latter receiving particular emphasis in urban economies. However, the recent debate on servitisation captures a very different phenomenon that has developed in both the supply chain management discipline - looking at new strategies that firms can adopt to manage their competitive advantage - and in the innovation literature, focusing on knowledge intensive business services.¹ The firm-centred approach that has so far largely been adopted has precluded consideration, however, of some interesting developments that this paper tries to address. Indeed, firms (even large firms) do not operate in isolation. Rather, they operate in intersecting systems, chains and networks, all with a territorial and spatial dimension. This holds for both manufacturing and service firms whose location is decided by centripetal forces that create agglomerations of activities in particular places (Becattini et al 2009; Porter, 1990; De Propris, 2006; De Propris et al 2009; Chapain et al 2010, Boschma and Fornahl, 2011). The servitisation of manufacturing (Dimache and Roche, 2013) points to a *contamination* of service practises and strategies to manufacturing. The stress is on how manufacturing is moving from a product-based business model to a service-based business model: the so-called product-service system (*ibid*). Servitisation is part of a new manufacturing model that is emerging and linked to the adoption of new enabling technologies such as artificial intelligence, internet-of-things, cloud technologies, green/bio-technologies. Recent scholarly debate has been unpacking this ‘production organisation revolution’ (Marsh 2012; Rifkin, 2013,) with the result that it is timely and crucial to understand in depth what form this model will take in advanced economies and how it can contribute to a growth and jobs agenda (in line with Gebauer and Binz, 2018). Indeed, the core of this new manufacturing model is that it can enable the development and anchoring of manufacturing activities in a high-cost economy such as that of the EU, and regions therein (Veugelers 2017). Conceptualised first as a product-service innovation strategy and as a new business model, recent contributions have looked at servitisation in supply chains.

This paper is positioned in such debates and aims to shed further light on servitisation as a systemic phenomenon. In particular, the novelty of the paper is twofold. Firstly, it conceptualise four modes of servitisation depending on the spatial scale of service-manufacturing interactions and the governance of transactions (whether internalised or outsourced functions); one of these is territorial servitisation, defined as the symbiotic recoupling between services and manufacturing with a bounded spatial dimension. Secondly, empirically, we want to test if the UK presents evidence of territorial servitisation. We map employment in high, medium and low-tech manufacturing industries, as well as in knowledge intensive services (KIS) and knowledge intensive business services (KIBS)² in the UK over 2010-2015. The main finding is that there are regions in the UK where employment in KIBS and high-tech manufacturing is growing above average and these are regions with globally competitive advanced manufacturing industries; however, overall services and manufacturing

¹ See the special issue in Strategic Change in 2014, or in Industrial Marketing Management in 2017.

² We use the classification provided in EC (2012).

appear to be strategically decoupled. In other words, urban areas see higher concentration of KIBS while non-urban areas have greater a concentration of high or medium-tech manufacturing. This suggests that in some sectors, firms could be benefiting from territorial servitisation but elsewhere there seems to be evidence of ongoing strategic decoupling between the two.

The paper proceeds as follows: section 2 reviews the recent literature on a new model of manufacturing and servitisation. Section 3 introduces the conceptual framework. Sections 4 present the methodology and data, with the main findings being discussed in Section 5. Some concluding remarks end the paper.

2. The servitisation of manufacturing

Servitisation is a relatively new concept that is redefining the relationships between services and manufacturing. In the current literature, servitisation enables firms “to gain competitive advantage by differentiating their offering or creating consumer dependency” (Vandermerwe and Rada, 1988); and it pushes consumers to overcome the need to own products but rather to hire or lease them. In other words, the relationship between producer and consumer does not end with the sale, but is extended and weaved in a long term relationship where the product is substituted by a use-oriented service or a result-oriented service (Dimache and Roche, 2013). This means that manufacturing firms need to access competences that would naturally reside outside a manufacturing production process. In this vein, Spring and Araujo (2013) draw on Penrose (1959) and the resource-based view to explain how firms access such new expertise. More broadly, there is a stream of contributions that has looked at how firms strategically decide to differentiate their product from competitors by creating a competitive advantage that is based on the service attached to the product (Baines et al 2014). Since services differ greatly, those that feed into a servitising strategy are crucially advanced services such as those linked to digital technology (Vendrell-Herrero et al 2017). To access such competences, manufacturing firms need to expand their capabilities upstream through co-design and downstream with leasing, renting, maintenance and upgrading propositions.

In so doing, the choice for firms is between internalisation and outsourcing such advanced services. There are arguments in favour of the in-house provision of innovative product-service capabilities (Veugelers and Cassiman 1999), but recent contributions have also looked at servitisation as a strategy that forces firms to change the organisation of their supply chain as firms access advanced service provision from partners, suppliers and intermediaries (Bigdeli et al 2017). Small and medium sized firms’ internal capabilities are often limited and they benefit from accessing strategic resources such as knowledge intensive business services (KIBS) externally (Corrocher and Cusmano, 2014); namely by servitising through outsourcing innovative service to dedicated KIBSs (Bustinza et al 2017). For manufacturing firms, value creation in product-service development rests on competences housed in service firms they partner with. Alliances between manufacturing firms and KIBSs can deliver for the former “higher product service innovation” (Bustinza et al 2017: 4). KIBSs indeed can be defined as

“those types of an industrial manufacturer's product-related services that create knowledge for the purpose of developing a customized solution to satisfy a customer's needs” (Kohtamäki and Partanen, 2016). Kamp and Parry (2017) distinguish between industrial servitisation and digital servitisation as distinct pathways firms can embark on to digital technology upgrade. Service-related value creation therefore runs along the relationship between supplier and customer (B2B). KIBSs become not only an additional segment in the manufacturing value chain, but their role alters the nature of the whole value chain. “Services supply chains” (Ellram et al 2004) or “supply chains for servitised products” (Johnson and Mena, 2008) describe the emergence of production processes where services underpin an element of co-creation between suppliers and buyers (B2B) to deliver solutions that satisfy customers (Kohtamäki and Partanen, 2016). Adding a layer of services to a product allows a manufacturing firm to differentiate its product from competitors; Cusumano et al (2014) argue this is an important strategy in particular when firms operate in mature markets dominated by price competition.

There is an embryonic debate on the territorial dimension of servitisation. Vendrell-Herrero and Wilson (2016) suggest that more research is needed to better understand the link between servitisation and territorial competitiveness. Their invitation is that policy recommendations can be formulated only if a spatial scale can be introduced as relevant to intervene. Servitisation through KIBSs requires manufacturing firms to identify, contact, access and relate to such providers. The literature on KIBS presents no clear cut solution on whether KIBSs need to be co-located or not with the manufacturing firms they serve; although there is some evidence both in favour of co-location (Rodriguez, Camacho, and Chica, 2012) and against it (Gallego and Maroto, 2015; Shearmur and Doloreux, 2012). Within the 1990s and early 2000s’ debate on the knowledge economy, innovation started to be seen as a complex system rather than a linear process (Kline and Rosenberg, 1986; Ashiem, 2011; Davids and Frenken, 2017). Shearmur and Doloreux (2013) argue that *tertiarisation* was what allowed manufacturing firms to have an injection of knowledge – of the market, of new products, of new processes. Somewhat critically, there is however a difference between *tertiarisation* and servitisation; the former can be associated with the expansion of the service sector in advanced economies, while the latter suggests a different integration between services and manufacturing. This paper addresses issues related to the *territorial* dimension of servitisation.

3. Modes of servitisation

The interplay between services and manufacturing has evolved over time. In advanced economies, manufacturing tended to be the cornerstone of economic progress: it generated the greatest productivity gains thanks to its innovation potentials, it employed a variety of skills and a large labour force, and produced tradable goods that allowed economies to conquer global market shares (Piore and Sabel, 1984). Whereas services had an **ancillary role** and they were either housed inside corporations in specific departments, or developed and supplied by specialist firms (Dicken, 2015). In the post-Fordist period, the decomposability of the

production process along its components meant a fragmentation of production to power the entire production process with great flexibility (Ruigrok and Van Tulder, 1996). Services were given greater visibility in industrial clusters (Porter 1990) and industrial districts (see latest Becattini et al 2009) and acknowledged as being part of the external supply chain but still with ancillary functions (see the ‘anatomy of the California wine cluster’ by Porter, 1998 for example).

Since the 1980s and 1990s, the globalisation of production through global value chains has caused a **functional strategic decoupling** between low value creating manufacturing and high value creating services. This run in parallel to a spatial decoupling of manufacturing relocated to lower cost economies and services retained in advanced economies. A large literature on global production networks (Coe et al 2008), commodity chains (Gereffi and Korzeniewicz, 1994), and global value chains (Gereffi and Fernandez-Stark, 2011) has documented such trends. Meanwhile, a large literature on the knowledge economy (Lundvall and Johnson, 1994; Acs et al 2002), the creative economy (Florida, 2002) and KIBS (OECD, 2006) and *tertiarisation* (Montresor and Vittucci Marzetti, 2011) is testimony of the importance placed on services within advanced economies almost as self-standing industries.

The very recent debate on servitisation makes a completely different proposition with respect to the above as services maintain a key role as value creators but no longer in contrast to manufacturing but in a sort of **symbiotic recoupling**. The term ‘servitisation’ is suggested as the hybridisation of manufacturing with services. The functional and spatial recoupling between manufacturing and services can occur via an expansion of knowledge intensive business functions inside the firm or through outsourcing strategies. The new manufacturing model sees therefore servitisation redrawing the boundaries between services and manufacturing through a symbiotic recoupling between the two. Both are followed by location decision choices that depend of access and availability.

We would argue that the symbiotic recoupling between manufacturing and services is fundamentally driven by technological change and the nature of a new competition. Firstly, as already mentioned, servitisation is a business strategy that allows manufacturing firms to adopt a business model that has been usually associated with the service sector (Bustinza et al 2015). Selling the product is replaced by renting or leasing it so that consumers actually pay for the utilisation, the function, or the utility they extract from the product – without owning it. Indeed, without owning the product, consumers in fact access and pay for a service. They do not buy a CD but they pay for music listening; they do not buy a car but pay for a mobility solution. This has implications for the pre and post-sale relationship between the firm and the customer. There are famous example of this such as Roll Royce, Kone and Spotify (Neely, 2008; Huikkola et al 2016; Vendrell-Herrero et al., 2017). Once the relation between supply and demand is altered, the nature of the product also changes. This requires innovation in design, production and supply. This leads onto a second crucial change in the competitive environment: customers requesting personalised products. For example, there are untapped market niches for personalised, customised and innovative products. These need to be produced in small batches or even as unique pieces. Such niche markets require customers to co-innovate or even co-produce with the manufacturer or the maker (Anderson, 2012). Technology such as 3D printing

is now available to enable innovators and inventors to become manufacturers and further to connect directly with markets –without any intermediary (Barnatt, 2013). Closer interaction between manufacturers and customers translates into more distributed consumption of distributed manufacturing, with end-point production (Veldhuis et al. 2017). Finally, the digital revolution is argued to have a disruptive effect on the process of production, as well as on the nature, use and consumption of products. Some of the main technologies often associated with Industry 4.0 (Schwab, 2016) include internet-of-things, space technology, GPS, mobile technology, cloud technology or sensing are starting to be adopted in factories as well as by users and consumers as products and services. This involves the possibility to digitally design, 3D print a customised product before it is actually manufactured has huge implication for the producer and the consumer (examples of applications of new technologies can be found in Mussomeli et al 2016). Greater awareness of the impact of automation and digital technology on manufacturing industries has already triggered a debate on what these will look like in the future (De Propriis, 2017; OECD, 2017; McQuivey, 2013; Schwab, 2017; Ross, 2016); whereby it will be increasingly difficult to mark a clear line between manufacturing and services.

Technological change and a new competitive environment are therefore expected to drive a process of territorial servitisation. The latter is one of the four possible modes of strategic recoupling between manufacturing and services. Such modes are identified depending on the governance of transactions (internalised or outsourced function) and the spatial scale of service-manufacturing interactions (co-location and distance). The framework offered here allows for each governance mode to have advanced services located either near the manufacturing firm or far away (see Table 1 below). In other words, firms' strategic decision on how and where to servitise might be constrained or empowered by contextual factors as well as internal ones.

Table 1 Modes of servitisation

We refer to *servitised innovation* when servitising functions are internalised in the firm as part of its product development and innovation (Baines et al 2011) or co-located with main manufacturing capabilities. They could involve upstream (i.e. digital product design) or downstream (inventories management across retail or cloud based production management) activities, but require a high level of knowledge control, dedicated knowledge creating competences. In the *servitised global factory* (Buckley and Ghauri, 2004), servitising functions are internalised in the firm's multinational and modularised organisation with specific hubs servitising the whole production or parts of it as part of its product development and innovation. They could be involving upstream (i.e. digital product design) or downstream (inventories management across retail or cloud based production management) activities and still require a high level of knowledge control, dedicated knowledge creating competences targeting different markets. The *servitised Global Value Chains* mode has servitising functions sourced externally from globally specialised KIBS with knowledge complementarity between manufacturing and KIBS enabling co-innovation over product development solutions and co-innovation over upstream and downstream servitising solutions. Finally, *territorial servitisation* implies that servitising functions are sourced externally from dedicated service suppliers – i.e. dedicated

KIBS - which are co-located with manufacturing firms and embedded in a pool of specialised KIBS. These synergies enable the co-innovation of product development solutions and the co-innovation of upstream and downstream servitising solutions thanks to knowledge complementarity between manufacturing and KIBS.

We would argue therefore that **territorial specialisation** describes the spatial convergence of manufacturing and service firms that signals a move towards of symbiotic recoupling with a bounded spatial dimension. The presence of a critical mass of firms with dedicated capabilities in advanced business services allows the nearby-located manufacturing firms to be aware of, access, co-design and embed service competences and products in their value chain. We will test this hypothesis empirically with secondary data on Britain.

4. Methodology

Drawing on Vendrell-Herrero and Wilson (2016), in this paper we consider servitisation strategies that imply reliance on KIBS as a way of operationalising our empirical investigation. In our empirical investigation, we aim to find out if the highly mature KIBS and KIS sectors in Britain contribute to develop instances of territorial servitisation in conjunction with high tech manufacturing sectors.

We constructed a database using secondary data provided by the UK statistical office (ONS). We used employment data by NUTS-2 regions for Great Britain (excl. NI). Data is broken down by five-digit sector classification. Fine-grained sector and spatial data can provide a detailed map of economic activities. We used data for the discrete years 2010 and 2015. Due to data constraints consistent data before 2010 and after 2015 were not available. We broke down the employment data in four groups of sectors: 1) high to medium tech manufacturing; 2) medium to low tech manufacturing; 3) knowledge intensive services (KIS); and 4) knowledge intensive business services (KIBS). Groups 1, 2 and 3 are based on the Eurostat classification of 'High-tech industry and knowledge-intensive services', whilst KIBS sectors include Computer & Related Activities; R&D; and Legal, Technical & Advertising (EC, 2012)³. KIS industries include Knowledge intensive high tech services; Knowledge intensive Market, Services (excluding Financial intermediation & high-tech services; Knowledge intensive financial services; Other knowledge-intensive services (EC, 2012). Employment data was used to calculate location quotients (LQs) (De Propriis, 2005) and growth differentials. The location quotient measures the industrial concentration of a particular industry in terms of employment density with respect to the national average. The data allowed us to map the above

³ Since EC (2012) uses a definition of KIBS sectors based on NACE rev 1.1 classification; correspondence tables provided by Eurostat have been used to obtain a definition of KIBS sectors based on NACE rev. 2 which is consistent with data we collected. Conceiving KIBS as a subset of KIS (EC, 2012), when applying correspondence tables, we excluded from KIBS all the NACE rev. 2 activities not included in KIS according to the Eurostat classification of 'High-tech industry and knowledge-intensive services'. Furthermore, to avoid overlap between KIS and KIBS sectors, we excluded from KIS the activities included in KIBS sectors.

sector groups to visualise local agglomerations and changes over time and to understand what the relationship in Britain between service industries and manufacturing might be over time.

5. Findings

Overall, in Britain we find evidence of a trend towards territorial servitisation in regions that have advanced manufacturing industries, although KIBS and KIS do not appear yet to co-locate with high tech manufacturing sectors. We identify a number of regions which have at the same time fast growing KIBS and fast growing high tech manufacturing sectors. In our conceptual framework these are areas where a move towards territorial servitisation is possible from situations where firms are involved in either servitised innovation or a servitised Global Value Chain.

In particular, we find that KIBS in Britain are concentrated in less than a dozen hot spots: these are Gloucestershire/Wiltshire; Cheshire; Outer and Inner London; Hampshire & Isle of Wight; Bedfordshire & Hertfordshire; Surrey East & West Sussex; North-eastern Scotland; Berkshire/Buckinghamshire (see Figure 1a&b). In 2015 these regions had a LQ above 1, meaning that they concentrate KIBS above the national average. This can be seen in the two maps below, where the distribution of employment in KIBS is visualised using quartiles (see Figure 1a&b). The regions in the top quartile are stable with Cheshire, Aberdeen, and a *doughnut* around London stretching from Cambridge to Oxford consistently showing to benefit from the most concentration of KIBS. The KIBS sectors show significant positive signs of change in the West Midlands, Teesside & Durham, Kent and Dorset & Somerset.

Figures 1a&b - KIBS Quartiles

To address some of the considerations above, we analyse what synergies can be detected between KIBS, KIS and manufacturing sectors. We plot data on the distribution of KIBS vs the distribution of manufacturing sectors to uncover whether they tend to co-locate (detailed maps are in Figures A1a&b, A2a&b and A3a&b in the Appendix). We plot the LQ of KIBS against high-tech manufacturing, low-tech manufacturing and KISs. A first observation is that very little changes between 2010 and 2015, despite the fact that in 2010 the UK was just coming out from a long recession (five quarters of negative growth between 2008-09) and over the same period, manufacturing showed signs of life captured by employment and exports rising (Bailey and De Propris, 2014). Secondly, Inner London remained an outlier with LQ of 2.13 for KIBS and 1.06 for KIS in 2015. This has been evidenced by a number of studies that have looked at the centripetal forces of London in attracting high value services (De Propris et al 2009) some of which overlapped with creative industries. Thirdly, neither high-tech manufacturing nor medium-tech manufacturing appear to co-locate with KIBS. Scatterplots show a negative relationships between these pairs of variables. In particular, taking the 2015 data, and considering the co-location of KIS-KIBS, the only NUTS with LQs equal to or greater than one for KIS and KIBS are in Inner and Outer London, SurreyEast&WestSussex

and Hampshire&Isle-of-Wight (see Figures A3a&b).⁴ We find that NUTs where KIBS tend to co-locate with high-to-medium tech manufacturing sectors include Bedfordshire&Hertfordshire, Cheshire, Surrey&WestSussex, Hampshire and Gloucestershire&Wiltshire (Figures A1a&b). On the other hand, KIBS co-locate with medium-to-low tech manufacturing sectors only in North Eastern Scotland (Figure A2a&b).⁵

What we find is significant in understanding the current and prospective transition of the UK manufacturing industries towards adopting a new manufacturing model that embodies territorial servitisation. On the one hand, the UK is in a phase where services and manufacturing are strategically decoupled. In other words, urban areas see a high concentration of KIBS while non-urban areas have a more or less lively concentration of high or medium-tech manufacturing. In particular, the main urban catalyst is London and around it in the South East (De Propris et al 2009). Therefore manufacturing has yet to upgrade to the point where it integrates so much service content in its value chain that co-location is inevitable. On the other hand, some of the most manufacturing intensive regions have large firms that play the role of a regional anchor that can help the region capture value (Bailey et al, 2018). These large multinationals firms coordinate value chains that stretch locally, nationally and even globally. Some knowledge intensive business *functions* might be still internalised either locally or through the value chain elsewhere, or knowledge intensive business *services* may be outsourced either to providers located in the large cities or overseas. In the UK, the hypothesis is that given the attraction power of London, it is not unconceivable that the density and quality of the KIBS competences outside London is just emerging and still relatively embryonic (Chapain et al 2010). This might mean that the KIBS sector is underdeveloped outside London. This will suggest that some regions are currently experiencing a ‘servitised innovation’ with servitising competences residing inside the firm.

Overall, we find that the provision of KIBS in well-developed hubs such as London and Manchester is sufficient to satisfy the relatively geographically close manufacturing demands. This interpretation of the findings might suggest that the idea of ‘co-location’ might have both a regional and a national connotation depending on the level of maturity of the KIBS cluster. If we consider the West Midlands as an example, we see that it presents a LQ greater than 1 for high-tech-manufacturing and low-tech-manufacturing, a LQ equal to 1 for KIS and lower than 1 for KIBS. Anecdotaly, we know however that companies like JLR are recruiting and “more than 1,000 of the new 5,000 engineering recruits would be electronic and software engineers” (*The Guardian*, 2017). Digital technologies are core to a business model based on customisation and servitisation and in the case above such competences will be internalised rather than sourced locally from KIBS.

Our findings trigger two considerations worth developing. A first consideration is that territorial servitisation requires a critical mass of servitising competences to develop and be pooled at the regional level; in the absence of a such pool, firms able to internalise such functions

⁴ In 2010, Inner and Outer London and Gloucestershire & Wiltshire had both LQ for KIS and KIBS equal to or greater than 1.

⁵ We calculate all LQs without London and the negative relationship between KIBS and both high-to-medium tech manufacturing and medium-to-low tech manufacturing remains valid.

will do so. The issue is that a smaller firm will not be able to do the same and might have to outsource servitising competence to KIBS outside the region or they might miss the chance to servitise all together. The second consideration is that further research needs to be done to understand what drives the thickening of territorial servitisation: is it the emergence of demand for servitising competences? Is it a trickle down from major urban hot-spots? The most likely hypothesis is that territorial servitisation will have to include some urban catalysis that can pull a critical mass of KIBS, albeit with some degree of specialisation. Equally repulsive forces can be found between KIBS and low-tech-manufacturing, which to some extent is to be expected with the exception of Northeastern Scotland where we find an above average concentration of low tech manufacturing likely to be connected to the oil industry for which the NUTS of Northeastern Scotland and the Highlands&Islands also have a LQ greater than 1.

Beyond static co-location, the growth dynamics of the two sectors is also important. We find that the growth rates of KIBS and High/Medium tech manufacturing sectors are inversely related: in places where KIBS are growing, hi-tech manufacturing is shrinking and the other way round. Figure 2 below shows the scatterplot of the growth rates of KIBS and hi-tech manufacturing between 2010 and 2015. The vertical lines in red show the average KIBS and high-tech manufacturing growth rates for Britain and mark the four quadrants. KIBS' employment average growth was 21.9% and employment in high-tech manufacturing industries grew at about 1%. We construct a table with NUTS allocated across four quadrants depending on whether they have above or below average growth rates for both indicators (detailed information is presented in Table A2 in the Appendix). Quadrant 1 contains all NUTS that have experienced above average growth rates for both KIBS and manufacturing sectors; in other words in these regions KIBS and high-tech manufacturing tend to co-evolve: these regions comprise the West Midlands, Yorkshire, Greater Manchester, Kent and Dorset&Somerset. This has implications for how the territorial servitisation of UK manufacturing might gather pace. These are actually regions that are experiencing a manufacturing renaissance and at the same time have started developing KIBS from a flourishing of new firm formation in the digital sector (NESTA, 2010; Chapain et al, 2010) since the early 2000s, such as the serious game cluster in Coventry in the West Midlands (Athey et al 2007). For instance, Mateos-Garcia et al (2014) argue that although the greatest concentration of gaming firms are in London, South East and South West, the serious games cluster around Coventry (in the West Midlands) is consolidated. Quadrant 2 groups NUTS whose economies are linked to London and are therefore experiencing KIBS growth due to spillovers from London overheating, but see no significant growth in the manufacturing sector. Exceptions are Shropshire&Staffordshire that have industries that are shifting from mass manufacturing to niche manufacturing. The latter is closer to creative industries with a high content of design and digital technology – such as the Potteries in Staffordshire (Barzotto *et al* 2017 mimeo). Equally, the North East (Tees Valley & Durham, and Northumberland & Tyne and Wear) are experiencing an economic renewal away from an irreversible manufacturing decline. The emergence of a potential cluster in KIBS is a sign of a dynamism that however needs to link with complementary industries to develop and consolidate.

Figure 2 - Growth rates KIBS - High/Medium tech manufacturing industries 2010 -2015

Consistent with the conceptual framework presented here, the twinned growth of the high tech-manufacturing and KIBS sectors in a regional economy could provide the foundation for territorial servitisation. Territorial servitisation might also be detected in regional economies where there is a growing KIBS sector and a relatively slow growth of the high tech-manufacturing sector: this can be due to the outsourcing of servitising competences to local providers leading to a contraction of manufacturing activities or to new firms being formed already positioning themselves on the service side of the ‘statistical classification’ although actually operating in the hybrid overlap between services and manufacturing. In other words, regions in Quadrants 1 and 2 are of particular interest in the context of identifying regional economies which present preconditions where territorial servitisation can grow. The latter can support the transition of regional industrial capabilities to the new manufacturing model.

6. Conclusion

In this paper we explore what territorial servitisation might mean in the context of regional studies that look at the possible growth trajectories of regional economies characterised by an historical albeit declining manufacturing presence. The emergence of a new manufacturing model offers a unique opportunity to such regions to draw on their manufacturing heritage whilst recasting the business model in particular in relation to the balance between manufacturing and services. Territorial servitisation is defined here as the hybridisation of manufacturing with services. The functional and spatial recoupling between manufacturing and services can occur via an expansion of knowledge intensive business functions inside the firm or through outsourcing strategies. The new manufacturing model sees therefore servitisation redrawing the boundaries between services and manufacturing through a symbiotic recoupling. Such a definition is mounted on a conceptual framework that presents two novelties. Firstly, we examine how changes in the organisation of production due to technology and globalisation have changed the interplay between manufacturing and service sectors. We identify three phases through which services and manufacturing redraw their relationship: from services having an ancillary role during Fordism, to a decoupling from manufacturing in the post-Fordism to early 2000 and finally to the current symbiotic recoupling of manufacturing with servitisation. We identify modes of servitisation depending on the geography and governance of firms’ involvement with advanced business services, and defined territorial servitisation. The second novelty is to test the concept with an empirical investigation using UK employment data at the regional level (NUTS 2) between 2010 and 2015. We find that neither high-tech manufacturing nor medium-tech manufacturing appear to co-locate with KIBS; possible explanations are that either the UK is in a phase where services and manufacturing are still going through a *strategic decoupling*, or some of the most manufacturing intensive regions have large firms (regional anchors) and they are internalising servitising competences (*servitising innovation*). A reflection from this is that territorial servitisation requires a critical mass of servitising competences to develop and to be pooled at

the regional level; in the absence of such a pool, firms able to internalise such functions will do so. The other main finding concerns the growth dynamics of the two sectors. We find that the growth rates of KIBS and High/Medium tech manufacturing sectors are inversely related. This suggests a substitution effect.

Our findings have significant policy implications. The upgrading of manufacturing to the new manufacturing model requires a process of servitisation to be kicked off; this means a recoupling of services with manufacturing that redefines the manufacturing process, the business model and the product. Policy can intervene to support the thickening of KIBS in regional economies characterised by manufacturing dynamics via incubators and accelerators especially in relation to digital applications. The geographical scale for such intervention can be at the city-region level; dense urban functional areas should be able to accommodate manufacturing and KIBS. Our findings have limitations and open the door to further research. Further case studies are needed to better understand the evolution or co-evolution of manufacturing activities with servitising capabilities in KIBS.

REFERENCES

- Acs ZJ, de Groot HLF, Nijkamp P (2002) *The Emergence of the Knowledge Economy*, Springer-Verlag, Berlin Heidelberg.
- Anderson C. (2012) *Makers, The New Industrial Revolution*, London: Random House Business Books.
- Ashiem B., Boschma R. and Cooke P. (2011) Constructing Regional Advantage: Platform Policies Based on Related Variety and Differentiated Knowledge Bases, *Regional Studies* Vol. 45 , Iss. 7.
- Athey G., Glossop C., Harrison B., Nathan M. and Webber C. (2007) *Innovation and the city. How innovation has developed in five city-regions*, NESTA, London.
- Bailey D. and De Propris L. (2014) Manufacturing reshoring and its limits: the UK automotive case, *Cambridge Journal of Regions, Economy and Society*, Volume 7, Issue 3, 1 November 2014, Pages 379–395.
- Bailey, D and A De Ruyter. (2015) Plant Closures, Precariousness and Policy Responses: revisiting MG Rover ten years on, *Policy Studies*, 36(4), 363-383.
- Bailey, D, G Bentley, A de Ruyter and S Hall. (2014) Plant Closures and Taskforce Responses: An Analysis of the Impact of and Policy Response to MG Rover in Birmingham, *Regional Studies, Regional Science*, 1(1), 60-78.
- Bailey, D, Pitelis, C and Tomlinson, P. (2018) A place-based developmental regional industrial strategy for sustainable capture of co-created value, *Cambridge Journal of Economics*, <https://doi.org/10.1093/cje/bey019>

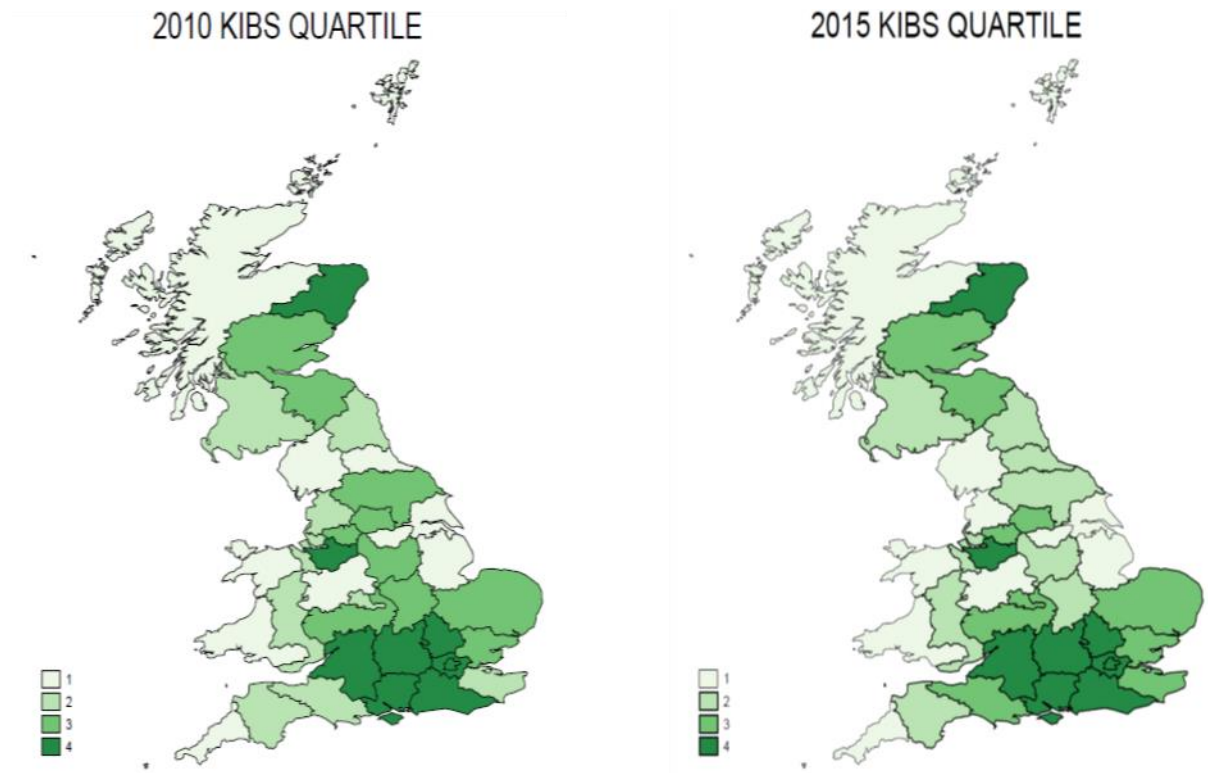
- Baines T. and Lightfoot H. W. (2014) Servitization of the manufacturing firm; Exploring the operations practices and technologies that deliver advanced services, *International Journal of Operations & Production Management*, 2014, Vol.34(1), p.2-35.
- Baines T., Lightfoot H., Smart P., (2011) "Servitization within manufacturing: Exploring the provision of advanced services and their impact on vertical integration", *Journal of Manufacturing Technology Management*, Vol. 22 Issue: 7, pp.947-954,
- Tim Baines Tim, Ali Ziaee Bigdeli A.Z., Oscar F. Bustinza O.F., Victor Guang Shig V.G., James Baldwin J., Keith Ridgway K., (2017) "[Servitization: revisiting the state-of-the-art and research priorities](#)", *International Journal of Operations & Production Management*, Vol. 37 Issue: 2, pp.256-278
- Barnatt C. (2013) 3D Printing, The Next Industrial Revolution, Explaining the future.com.
- Becattini, G., Bellandi, M., and De Propris, L. (Eds.) (2009). *A Handbook of Industrial Districts*. Cheltenham: Edward Elgar.
- Boschma R. and Fornahl D. (2011) Cluster Evolution and a Roadmap for Future Research, *Regional Studies* Vol. 45 , Iss. 10.
- Buckley, P. J. & Ghauri, P. N. (2004) Globalisation, Economic Geography and the Strategy of Leeds University Business School Multinational Enterprises. *Journal of International Business Studies*, Vol. 35, No. 2, ,pp 81-98.
- Bustinza O.F., Bigdeli A.Z., Baines T. and Elliot C. (2015) Servitisation and competitive advantage, *Research Technology Management*, Sept-Oct., pp53-60.
- Bustinza, O. F., Gomes, E., Vendrell-Herrero, F. and Baines, T. (2017), Product–service innovation and performance: the role of collaborative partnerships and R&D intensity. *R&D Management*. doi:10.1111/radm.12269.
- Chandler A. D. (2009) *Scale and Scope. The Dynamics of Industrial Capitalism* , Harvard University Press, Cambridge, Massachusetts.
- Chapain, C., Cooke, P., De Propris, L., MacNeill S. and Mateos-Garcia J. (2010) *Creative Clusters and Innovation, Final Report, November 2010*. http://www.nesta.org.uk/events/assets/features/creative_clusters_and_innovation_report [accessed 21/05/2017].
- Corrocher N. and Cusmano L. (2014) [The ‘KIBS Engine’ of Regional Innovation Systems: Empirical Evidence from European Regions](#), *Regional Studies*, Volume 48, 2014 - Issue 7.
- Cusumano, M. A., Kahl, S. J. and Suarez, F. F. (2015), Services, industry evolution, and the competitive strategies of product firms. *Strat. Mgmt. J.*, 36: 559–575.
- Davids M. and Frenken K. (2017) Proximity knowledge base and the innovation process: towards an integrated framework, *Regional Studies*, <http://dx.doi.org/10.1080/00343404.2017.1287349> .
- De Propris L. (2005) Mapping local production systems in the UK: Methodology and application, *Regional Studies* Vol. 39 , Iss. 2.
- Bellandi M., De Propris L. and Santini E. (2018) An Evolutionary Analysis of Industrial Districts: The Changing Multiplicity of Production Know-How Nuclei, *Cambridge Journal of Economics*. <https://doi.org/10.1093/cje/bey012>.
- De Propris, L., Chapain, C., Cooke P., MacNeill S. and Mateos-Garcia J. (2009) *The Geography of Creativity, Interim report: August 2009*.

- <http://www.nesta.org.uk/assets/Uploads/pdf/Research-Report/Geography-of-creativity.pdf> [access 21/05/2017].
- Dicken, P. (2015) *Global Shift, Seventh Edition: Mapping the Changing Contours of the World Economy*, Guilford Publications.
- Doussard, M., Peck, J. and Theodore, N. (2009), *After Deindustrialization: Uneven Growth and Economic Inequality in “Postindustrial” Chicago*, *Economic Geography*, 85: 183–207.
- Gebauer, H, and Binz, C (2018) *Regional benefits of servitization processes: evidence from the wind-to-energy industry*,
- Huikkola, T., Kohtamäki, M., & Rabetino, R. (2016). *Resource Realignment in Servitization*. *Research Technology Management*, 59(4), 30-39.
- Jennequin H. (2008) *The Evolution of the geographical concentration of tertiary sector activities in Europe*, *The Service Industries Journal*, 28, 291-306.
- Jorge Gallego and& Andrés Maroto 2015 [The Specialization in Knowledge-Intensive Business Services \(KIBS\) across Europe: Permanent Co-Localization to Debate](#), [Regional Studies](#) Vol. 49, Iss. 4, 2015
- Kamp B. and Parry G. (2017) *Servitization and advanced business services as levers for competitiveness*, *Industrial Marketing and Management*, [Volume 60](#), January 2017, Pages 11-16.
- Kline, S., and N. Rosenberg. 1986. “An Overview of Innovation.” In *The Positive Sum Strategy*, edited by R. Landau and N. Rosenberg, 275–306. Washington, DC: The National Academy Press.
- Lundvall, B. And B. Johnson (1994), “The Learning Economy”, *Journal of Industry Studies*, Vol. 1, No. 2.
- Marsh, P. (2012) *The New Industrial Revolution*, London Yale University Press.
- Mateos–Garcia J., Bakhshi H. and Lenel M (2014) *MAP OF THE UK GAMES INDUSTRY*, NESTA, London.
- Montresor, S. and Vittucci Marzetti G. (2011) *The deindustrialisation/tertiarisation hypothesis reconsidered: a subsystem application to the OECD7*, *Cambridge Journal of Economics*. Vol. 35 Issue 2, p401-421.
- Mussomeli A., Gish D., Laaper S. (2016) *The rise of the digital supply network Industry 4.0 enables the digital transformation of supply chains*, Deloitte University Press, <https://dupress.deloitte.com/dup-us-en/focus/industry-4-0/digital-transformation-in-supply-chain.html>.
- Neely A. (2008) *Exploring the financial consequences of the servitization of manufacturing*, [Operations Management Research](#), December, Volume 1, [Issue 2](#), pp 103–118.
- NESTA (2010) *Driving innovation in cities. Learning from Greater Manchester*. London.
- OECD (2006) *Innovation and Knowledge intensive service activities*, Paris: OECD.
- OECD (2015) *The Future of the Productivity*, Paris:ODCD.
- Piore M., Sabel C. (1985) *The second industrial divide*, Basic Books, New York.
- Porter M. (1998) *Clusters and the New Economics of Competition*, *Harvard Business Review*, November-December.
- [Regional Studies](#) Vol. 48, Iss. 7,

- Richard Shearmur & David Doloreux (2013) Innovation and knowledge intensive business service: the contribution of knowledge-intensive business service to innovation in manufacturing establishments, *Economics of Innovation and New Technology*, 22:8, 751-774.
- Rifkin, J. (2013) *The Third Industrial Revolution: How Lateral Power Is Transforming Energy, the Economy, and the World*, Palgrave-MacMillan, Basingstoke.
- Rodriguez, M., J. Camacho, and J. Chica. 2012. "The Knowledge-Intensive Services – Regional Innovation Nexus: A European Perspective." *The Service Industries Journal* 32 (4): 605–618.
- Savic M. (2016) What role for knowledge-intensive business services (KIBS) in de-industrialized regions?, *Regional Studies, Regional Science*, 3:1, 445-454, DOI: 10.1080/21681376.2016.1243455
- Shearmur, R., and D. Doloreux. 2012. "Is There a Connection Between KIBS Clustering and KIBS Innovation?" In *Exploring Knowledge Intensive Business Services*, edited by E. Di Maria, R. Grandinetti, and B. Di Bernardo, 193–213. London: Palgrave MacMillan.
- Shin, N., Kraemer, K.L., Dedrick, J. (2012). Value Capture in the Global Electronics Industry: Empirical Evidence for the "Smiling Curve" Concept. *Industry and Innovation*, 19(2), 89-107.
- Tomlinson, P. R. and Branston, J. R. (2014) Turning the tide: Prospects for an industrial renaissance in the North Staffordshire Ceramics Industrial District, *Cambridge Journal of Regions, Economy and Society*. 7, 3, p. 489-507.
- Veldhuis, A. J., Glover, J., Bradley, D., Behzadian, K., Lopez-Aviles, A., Cottee, J., Downing, C., Ingram, J., Leach, M., Farmani, R., Butler, D., Pike, A., De Propriis, L., [Purvis, L.](#), Robinson, P. and Yang, A. (2017) Re-distributed manufacturing and the food-water-energy nexus: Opportunities and challenges. *Production Planning & Control*
- Vendrell-Herrero F., Bustinza O., Parry G. and Georgantzisd (2017) Servitization, digitization and supply chain interdependency, *Industrial Marketing Management*, Volume 60, January 2017, Pages 69-81
- Vendrell-Herrero, F., Myrthianos, V., Parry, G., & Bustinza, O. F. (2017). Digital dark matter within product service systems. *Competitiveness Review*, 27(1), 62-79.
- Vendrell-Herrero, F. and Wilson, J. R. (2017) "Servitization for territorial competitiveness: taxonomy and research agenda", *Competitiveness Review: An International Business Journal*, Vol. 27, Issue: 1, pp.2-11.
- Williamson, O. (1979). Transaction-Cost Economics: The Governance of Contractual Relations. *The Journal of Law & Economics*, 22(2), 233-261.
- World Economic Forum (2016) *The Future of Jobs, Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution*, Available at: http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf [accessed 12/01/2018].

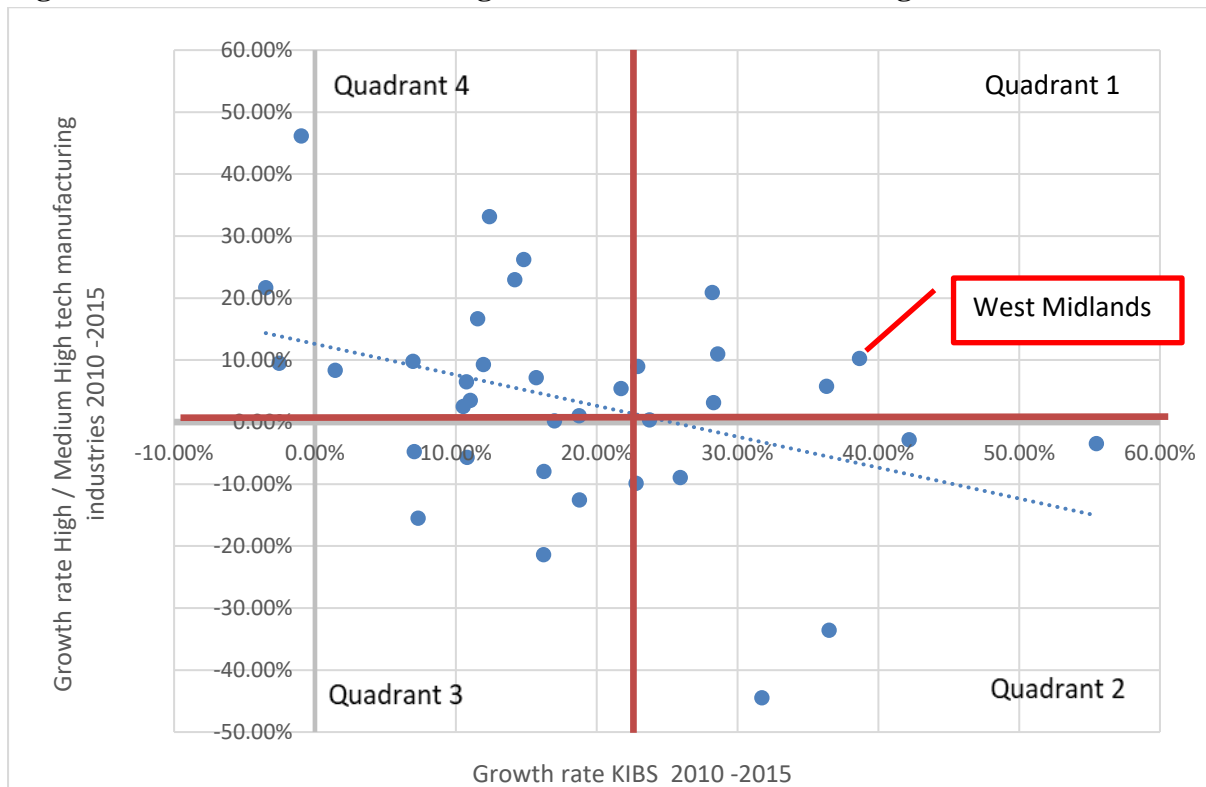
TABLES AND FIGURES

Figures 1a and b - KIBS Quartiles



Source: authors' elaboration with ONS data.

Figure 2 - Growth rates KIBS - High/Medium tech manufacturing industries 2010 -2015



Source: authors' elaboration with ONS data.

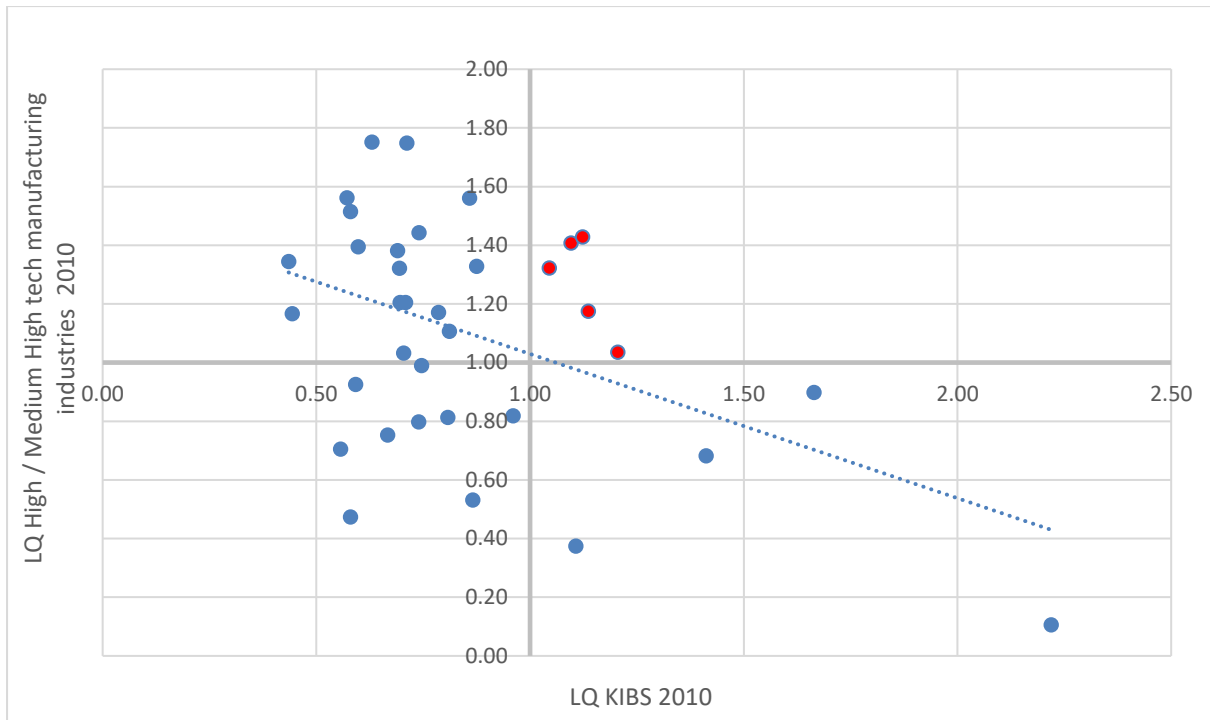
Table 1 Modes of servitisation

	Co-located	Distant
Internalised	Ancillary role of services (in large corporation)	Strategic decoupling from manufacturing (in multinational firms)
	Symbiotic recoupling Mark I servitised innovation	Symbiotic recoupling Mark II Servitised global factory
Outsourced	Symbiotic recoupling Mark IV Territorial servitisation	Symbiotic recoupling Mark III Servitised Global Value Chain
	Ancillary role of services (in local production systems)	

Source: Authors' elaboration.

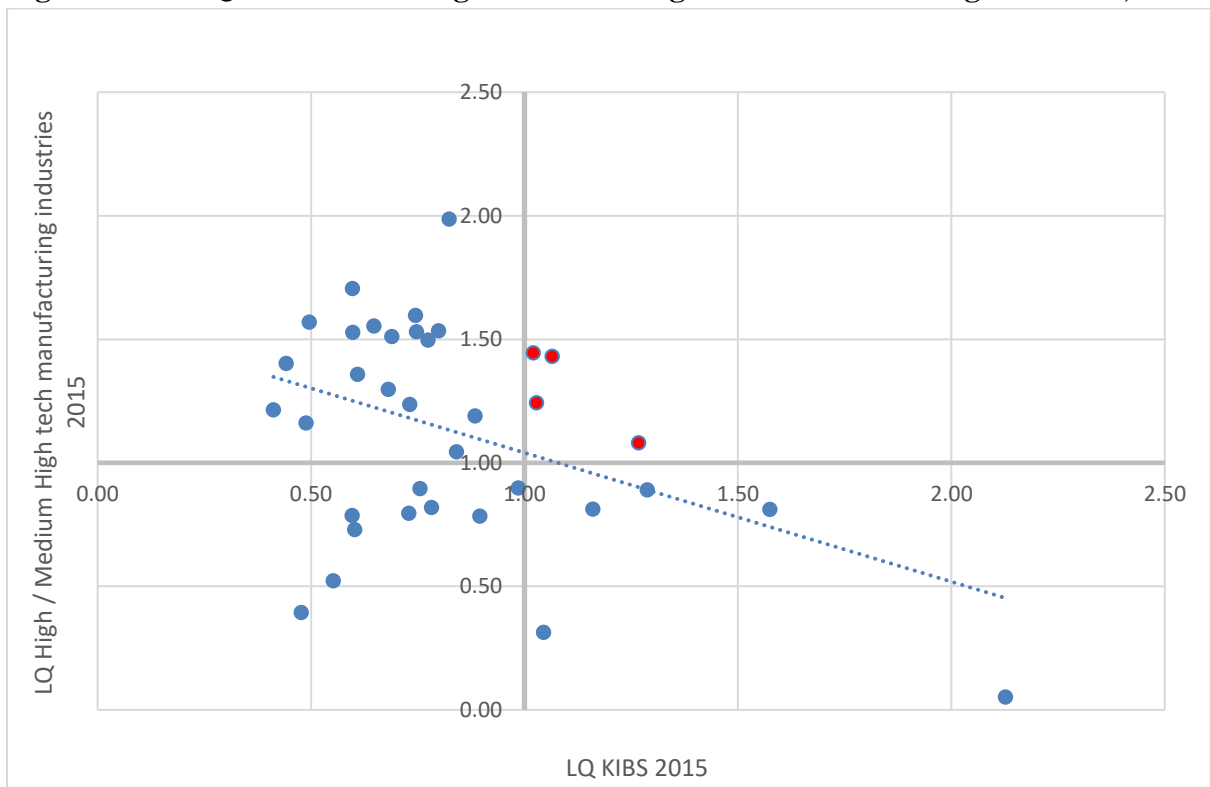
APPENDIX

Figure A1a. LQ of KIBS and High / Medium High tech manufacturing industries, 2010



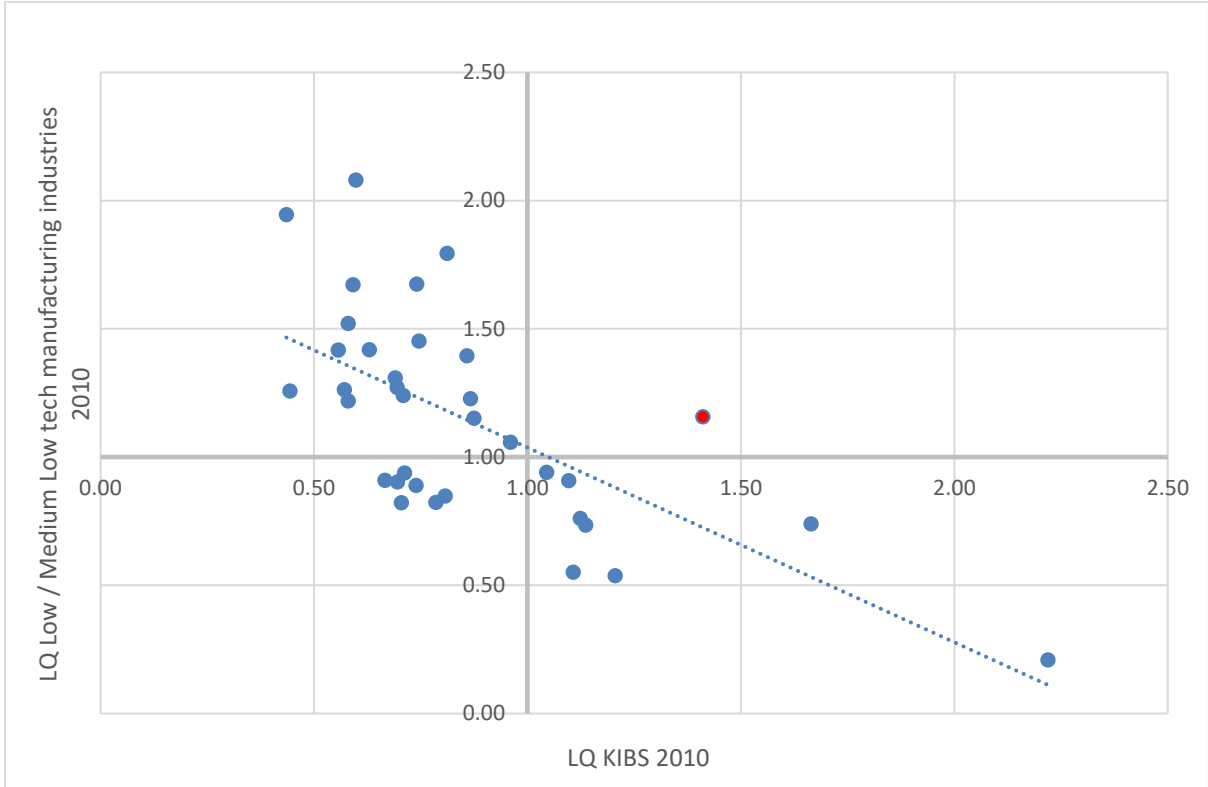
Source: authors' elaboration with ONS data.

Figure A1b. LQ of KIBS and High / Medium High tech manufacturing industries, 2015



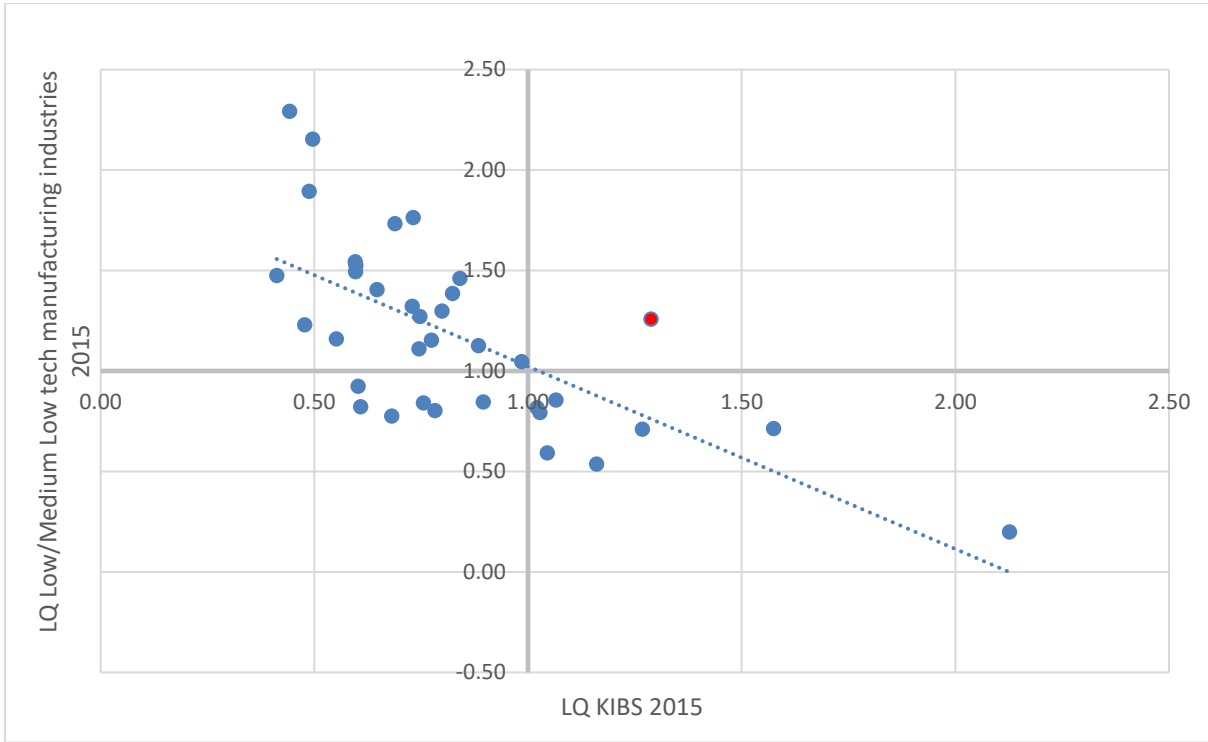
Source: authors' elaboration with ONS data.

Figure A2a. LQ of KIBS and Low / Medium Low tech manufacturing industries, 2010



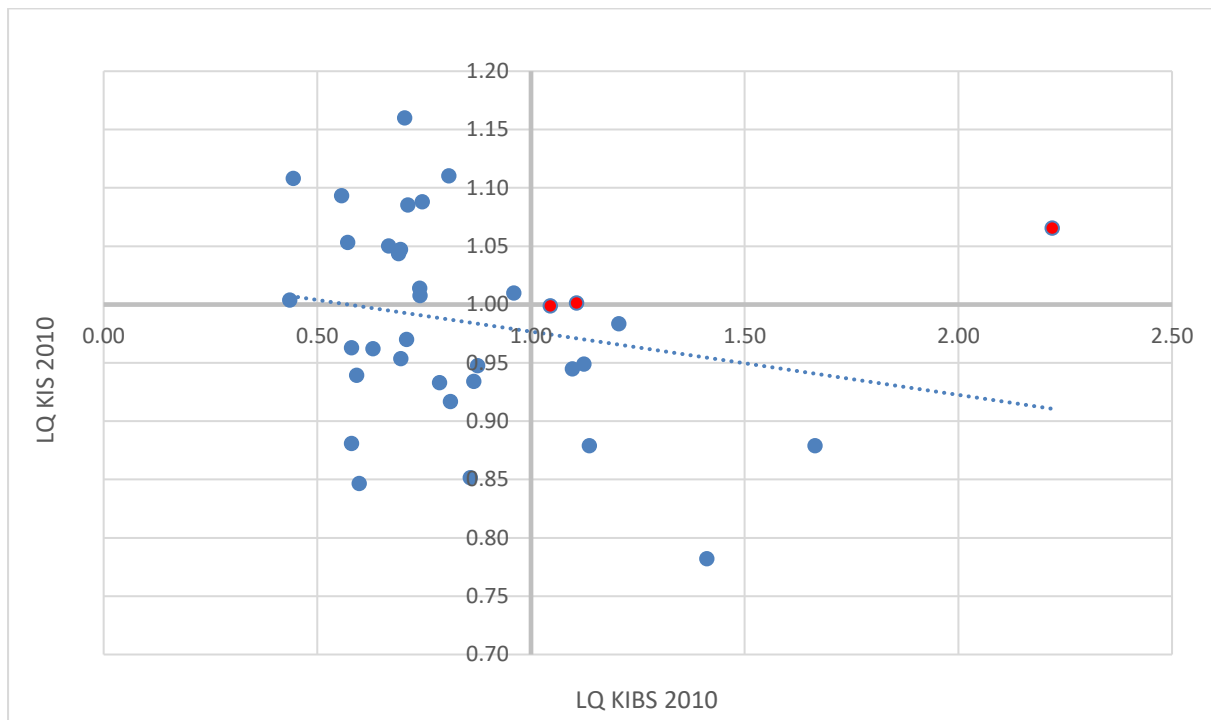
Source: authors' elaboration with ONS data.

Figure A2b. LQ of KIBS and Low / Medium Low tech manufacturing industries, 2015



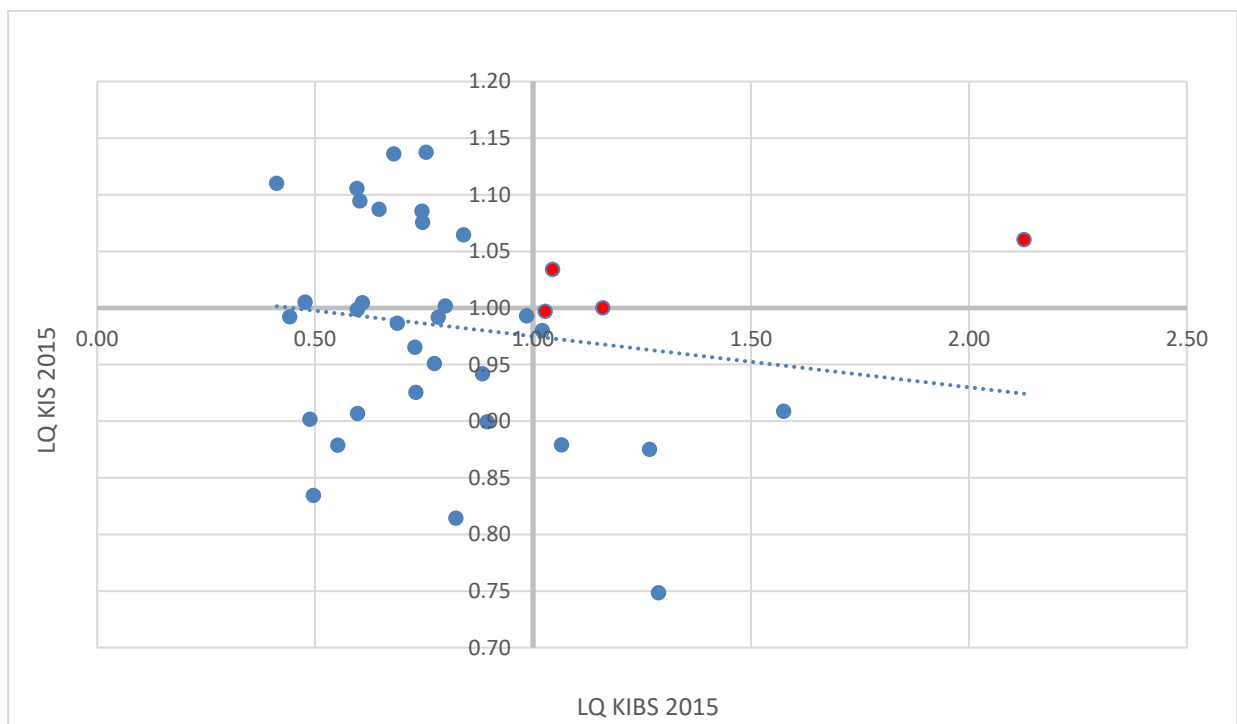
Source: authors' elaboration with ONS data.

Figure A3a. LQ of KIBS and KIS, 2010



Source: authors' elaboration with ONS data.

Figure A3b. LQ of KIBS and KIS, 2015



Source: authors' elaboration with ONS data.

Table A1. UK National growth rates

Sectors	2010	2015	Growth rates
KIS	10.762.115	11.084.535	3,00%
KIBS	2.688.295	3.277.950	21,93%
HIGH & MEDIUM/HIGH	767.015	774.475	0,97%
MEDIUM/LOW & LOW	1.585.755	1.600.295	0,92%
OTHER	11.416.410	12.355.590	8,23%
TOTAL	27.219.590	29.092.845	6,88%

Table A2. British regions and servitisation

	Below average growth rate KIBS	Above average growth rate KIBS
Below average growth rate High / Medium High tech manufacturing industries	QUADRANT 3 ukd4lancashire uki2outerlondon ukj1berkshirebuckinghamshireando ukj2surreyeastandwestsussex ukj3hampshireandisleofwight ukm3southwesternscotland ukm6highlandsandislands	QUADRANT 2 ukc1teesvalleyanddurham ukc2northumberlandandtyneandwear ukg2shropshireandstaffordshire ukh1eastanglia ukh2bedfordshireandhertfordshire ukh3essex uki1innerlondon
Above average growth rate High / Medium High tech manufacturing industries	QUADRANT 4 ukd1cumbria ukd6cheshire ukd7merseyside uke1eastyorkshireandnorthernlinc uke2northyorkshire ukf1derbyshireandnottinghamshire ukf2leicestershirerutlandandnort ukf3lincolnshire ukg1herefordshireworcestershira ukk1gloucestershirewiltshireandb ukk3cornwallandislesofscilly ukk4devon ukl1westwalesandthevalleys ukl2eastwales ukm2easternscotland ukm5northeasternscotland	QUADRANT 1 ukd3greatermancheter uke3southyorkshire uke4westyorkshire ukg3westmidlands ukj4kent ukk2dorsetandsomerset

Source: authors' elaboration with ONS data.