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Regional labour flows between manufacturing and business services: Reciprocal integration and uneven geography

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Abstract

This article uses Statistics Sweden's full-population geo-coded register data for Swedish workers and their labour market moves, between 2010 and 2014, to analyse regional flow patterns of employees between manufacturing, general business services and knowledge-intensive business services (KIBS). The findings generally show that labour flows between manufacturing and services have important bi-directional features, even with manufacturing generally declining. There is no staff exodus from manufacturing to services, but rather an exchange suggesting skill interdependencies, especially between high-tech manufacturing and KIBS. However, there are strong geographical dimensions to this, emphasising a reinforcement of the spatial division of labour patterns. In trend terms, the decline of manufacturing is rather similar across all regional types; however, business services are growing much faster in metropolitan regions. The labour flow between manufacturing and KIBS is more likely in metropolitan regions, but far more often additionally involves geographical mobility, either between or towards the metropolitan regions. Thus, the major challenge facing less dense and peripheral regions is not necessarily the decline of manufacturing per se, but that (a) the low levels of transition into business services are insufficient to make up for employment losses in manufacturing and (b) the fact that there is considerable out-migration of experienced and skilled workers from manufacturing, who are joining the growing numbers of business services in metropolitan regions.

Keywords

Economic geography, labour mobility, regional divergence, relatedness, sector integration

Labour mobility and patterns of regional structural change

Structural change since the 1970s has, for many economies in Europe and North America, been concentrated on the decline of manufacturing and the growth of business services. This structural change towards service-based economies has coincided with dramatic changes in the location patterns of economic activities. In many European countries, a new period of increasing regional disparity started in around 1990, or slightly earlier (Enflo and Henning, 2016; European Parliament, 2007). The aim of this article is to investigate the link between recent regional divergence and

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structural change, on the one hand, and the labour flows and resource integration between manufacturing and business services, on the other. This is analysed using Swedish employer–employee matched micro data originating from Statistics Sweden, covering the period between 2010 and 2014.

So far, few geographical studies, if any, have mapped how movements of employees between manufacturing and business services are linked to the current regional divergence process. Overall, the understanding of the role of services in regional economies has been lagging behind that of manufacturing for a long time (Glasmeier and Howland, 1994; Lundquist et al., 2008a). The literature still struggles to rectify this bias, and recent advances are paving the way for new opportunities. A better conceptualisation and measurement of regional structural change and the importance of inter-sectoral labour flows is being assembled in geography (Andersson et al., 2020; Martynovich and Lundquist, 2016; Neffke et al., 2018), with theories about localised labour, skills and skill-relatedness between industries now being increasingly emphasised as key frameworks for understanding regional economic change and regional branching (Boschma et al., 2008; Boschma and Frenken, 2011; Neffke and Henning, 2013; Timmermans and Boschma, 2013).

This paper most straightforwardly adds to the literature on recent structural change and its spatial outcomes (Martynovich and Lundquist, 2016; Neffke et al., 2018). Consistent results show how processes of regional structural change and regional divergence are linked, on the micro level, by processes of worker mobility across industries and regions. The service transition tends to reproduce and even reinforce the spatial inequalities of urban hierarchy structures, rather than erode them.

The empirical evidence also emphasises the resource integration taking place between high-skill manufacturing (HI-M) and knowledge-intensive business services (KIBS) in contemporary economies. This has theoretical consequences for two sets of rapidly expanding geographical literatures. Firstly, the evolutionary literature concerned with regional growth and branching processes needs to more carefully consider the effects of resources transcending traditional boundaries between manufacturing and services, when assessing the effects of related environments on regional growth and branching. Secondly, while the literature on regional manufacturing–service integration so far has constructively addressed issues of the integration of products and services in consumer offerings and service exchanges, it has had little to say concerning what kind of similar inputs or resources the sectors jointly require (Bryson and Daniels, 2010). Given the increasing interest among both scholars and policy makers for the role of skilled labour and knowledge as a core resource for growth (McCann and Ortega-Argilés, 2015; Neffke and Henning, 2013), a better account of the extent and scope of labour sharing between manufacturing and services, and the movements of this key resource in space, is highly warranted.

Previous findings

Location and co-location

At first sight, the transition from manufacturing to services may not seem much of a critical issue for regional economies. Firstly, in the scientific literature, many ideas regarding how manufacturing and business services are linked and interdependent have been circulating during recent years (Brenner et al., 2018; Garcia-Milà and McGuire, 1998; Muller and Doloreux, 2009; Neffke and Henning, 2013). Secondly, researchers have abandoned the view that services are merely complementary and subordinate to manufacturing, realising that services can nowadays be a part of the economic export base of regions and in their own right motors of structural change (Begg, 1993; Hansen, 1990, 1994; Muller and Doloreux, 2009; Stabler and Howe, 1988). Thirdly, organisational change in firms and the outsourcing of previously in-house service activities must surely account for parts of the shift from manufacturing to services (Lundquist et al., 2008a; Stutz and Warf, 2012).

However, for geographical reasons, the transition is more important than it might seem. In contrast to the historically rather dispersed location patterns of manufacturing industries (Lundquist et al., 2008b), the concentration and limited propensity of services to grow in rural and peripheral locations was noted early on (Glasmeier and Howland, 1994; Hermelin,

2007; Keeble and Nachum, 2002; Wood, 1991). The literature on the locational factors of business services frequently mentions market size, client proximity and access to qualified labour. Larger markets will provide more opportunities for firms to achieve the division of labour (Hansen, 1990), but business service firms also need knowledge of their clients' needs, something that is facilitated by geographical proximity (Illeris and Philippe, 1993; Keeble and Nachum, 2002). This provides arguments regarding the overall importance of city agglomerations to these industries (Glasmeier and Howland, 1994; Illeris and Philippe, 1993; Keeble and Nachum, 2002; Power and Lundmark, 2004; Simmie and Strambach, 2006), even though such arguments are not completely unrivalled (Illeris and Philippe, 1993; Keeble and Nachum, 2002).

In contrast to the rather recent literature on business service location, the locational choices of manufacturing industries have been one of the seminal issues of economic geography throughout its history. Explanatory factors regarding the location of different manufacturing industries have ranged from the factor access costs of Weberian location theory, via an emphasis on agglomerations and clusters (Buenstorf and Klepper, 2009; Porter, 2000; Rosenthal and Strange, 2003), to the modern eclectic diffusion theories stressing long-term shifts in location due to the different requirements of firms undergoing different phases of their industrial development (Duranton and Puga, 2001; Lundquist and Olander, 1999; Neffke et al., 2011b).

There is a slow convergence of the theories on manufacturing and business service location. While educational levels in both manufacturing and business services have been increasing during the last decades (Henning et al., 2017), recent research has emphasised the importance of localised skills in terms of being one of the most fundamental regional resources accessible to both manufacturing and business service firms alike (Neffke et al., 2018).

Manufacturing and business services

In an ever-expanding body of literature following the growing acknowledgement post-1980s that services play an important role in economic development (Garcia-Milà and McGuire, 1998; Glasmeier and Howland, 1994; Illeris and Philippe, 1993; Wood, 1991), and in respect of the intensified discussion about the blurring of sector boundaries between manufacturing and services (Begg, 1993; Bryson and Daniels, 2010), a subtle divergence can be noted in research into the relationships between manufacturing and services.

One line of research in this field looks specifically at the empirical links between manufacturing and the service industries – for example, input–output linkages and knowledge flows – albeit from the point of view that manufacturing and services are essentially distinct industries or sectors, with different roles to play in the growth process (Capasso et al., 2017; Brenner et al., 2018; Castellacci, 2008; Garcia-Milà and McGuire, 1998; Lundquist et al., 2008a). While theories about competitiveness creation in clusters have long been making this point (Porter, 1990), studies of manufacturing–business service interaction have made their interdependencies immediately apparent (Howells, 2004; Muller and Zenker, 2001).

Post-1980s' empirical trends have, however, added to the confusion surrounding the distinction between manufacturing and services. While outsourcing and externalisation constitute a well-known explanatory factor regarding the growth of business services during recent decades (Glasmeier and Howland, 1994), this does not suffice for many economies. It has also been argued that an increasing level of complexity in production and economic transactions, coupled with changing business practices, have provided reasons for the increasing demand for specialised services (Glasmeier and Howland, 1994; Hansen, 1990, 1994).

New perspectives on the integration of manufacturing and services now complement previous findings (Bryson and Daniels, 2010). Muller and Doloreux (2009) conclude that, while KIBS were previously seen as a deliverer of specialised services, they are now regarded as co-businesses interacting with their clients. In essence, KIBS have themselves been upgraded from followers to actual proponents of change (Shearmur and Doloreux, 2017; Simmie and Strambach, 2006). Very recent research stresses how manufacturing and services are *related* in

sharing the same or similar resources, for example by sharing share a partial dependence on the same type of skills in the labour force (Neffke and Henning, 2013; Nikulainen and Pajarinen, 2013), and how regional flows of labour between establishments and industries impact economic performance (Boschma et al., 2014, 2008; Diodato and Weterings, 2014; Eriksson, 2011; Fitjar and Timmermans, 2017; Otto et al., 2014; Timmermans and Boschma, 2013). While Brenner et al. (2018), for example, find no causal effects on regional growth patterns between manufacturing and KIBS, they do find shorter run regional labour sharing effects between the sectors. In an economy where skills, knowledge and human capital are commonly seen as key resources for the success of firms and regions (Florida, 1995; Neffke et al., 2018), the essential theoretical differences between manufacturing and business services seem to be slowly eroding.

As a consequence, the integration of manufacturing and business services should also mean that related service activities constitute relevant employment alternatives for workers exiting the (employment-wise) shrinking manufacturing sectors. Recently, in combining insights from evolutionary economic geography with labour economics, a stream of articles has sought to define which factors of regional economies affect the probability of workers being re-employed (Dawley et al., 2014; Diodato and Weterings, 2014; Hane-Weijman et al., 2018; Neffke et al., 2017; Nyström, 2017; Nyström and Viklund Ros, 2017; Shuttleworth et al., 2005). The overarching conclusions are that, in particular, regional employment opportunities in the same industry that the individual left, or in related industries, matter to regional re-employment probabilities. This discussion complements previous findings in the labour economics literature, which have especially highlighted individual factors, such as age, education and skills, as affecting the re-employment probabilities of redundant workers and job mobility (Fallick, 1996; Oesch and Baumann, 2015).

In summary, while the literature increasingly agrees on the importance of skills and labour to contemporary growth and the overall importance of service–manufacturing interaction, less well investigated is the significance of the link between recent regional divergence, structural change in labour flows and resource integration between manufacturing and business services.

Empirical approach and data issues[1]

Our empirical analysis relies on geo-coded individual data derived from the registers of Statistics Sweden, containing information on all the individuals working in Sweden. This analysis is restricted to two points of measurement, 2010 and 2014, between which the industry classifications are consistent (SNI2007/ NACE Rev.2). We follow workers who have a Swedish establishment (plant) affiliation with an industry code in 2010 and 2014, who have a salary and who are not above the retirement age of 65 or under 18 in 2010. We are able to record the geographical location, education and income of these individuals.[2]

Business services are defined here as those mainly serving a business-to-business market (Hansen, 1994; Lundquist et al., 2008a).[3] These services may be of a general nature, or be in the form of KIBS. Consequently, two business service sectors are distinguished: KIBS and other business services (OSER). This distinction is reminiscent of that of Castellacci (2008), although OSER does not have a clear equivalent in Castellacci's taxonomy. However, it is suggested that OSER includes services that supply 'supporting infrastructure' in Castellacci's (2008) terminology. In this paper, these include, among others, security, cleaning, office services and staffing agencies. The literature has developed a wide agreement concerning which industries should empirically be defined as KIBS. In previous revisions of NACE, this corresponded to NACE 72 (computer and related activities), 73 (R&D) and 74 (other business activities), for example, legal services, accounting, technical testing and technical consultancies (Muller and Doloreux, 2009). This is adhered to here, but adaptations have been made to the new NACE revision.

Inspired by Henning et al. (2017) and by Johansson (2017), two sets of manufacturing industries are also distinguished: that is, low-skill manufacturing (LO-M) and HI-M. These labels reflect the fact that formal education levels and average salaries

are higher in HI-M than in LO-M. This paper defines LO-M as, for example, the manufacturing of wood products, textiles and furniture. HI-M includes pharmaceuticals, electronics, machinery and cars.[4]

As a regional indicator, the regional labour market (LA-region) location of the establishment that individuals are mainly affiliated with is used. From here, the industry affiliation of the individuals is also derived. The LA-regions are defined by Statistics Sweden on the basis of commuter patterns (rev. 2014). The labour markets are then grouped into three sets of regions, according to the typology used by the Swedish Agency for Economic and Regional Growth (2011: 19): that is, countryside regions (41 regions), dense regions (29 regions) and metropolitan regions (three regions).[5]

In our empirical analysis, two types of worker mobility are in focus. Firstly, we track whether or not workers change their main industry affiliations between any of the manufacturing and service sectors between the measuring points of 2010 and 2014. We call this a *sector flow*. Secondly, we track whether or not this move is associated with *regional mobility* (as measured by the location of the establishment with which the individual is associated, or their region of residence). Throughout the paper, employment and flow numbers are rounded up/down to closest 100.

Findings: Manufacturing–business service links, integration and regional change

During the period investigated in this paper, 2010–2014, the total level of employment in manufacturing and extraction activities in Sweden fell by 31,000 employees, then accounting for 12% of overall employment. During the same period, business services increased by 54,000, then accounting for 11% of overall employment.[6] The more detailed sectors of the manufacturing industries and business services that are investigated in this paper each employed between 5% and 7% of the entire Swedish workforce in 2010. HI-M is not so well represented in the countryside regions and has a bias towards the dense and metropolitan regions. LO-M has a location emphasis in the dense regions. The most striking regional concentration patterns pertain to services, with a clear hierarchical representation in metropolitan – dense – countryside regions. This is especially noticeable for KIBS, with an approximately 70% location to the three metropolitan regions. Not only have the metropolitan regions a greater share of the growing services, they are also losing less in the declining sectors than the other regional groups.[7]

Flows

In Sweden, the total sector flow as regards manufacturing → business services, across the measurement points of 2010 and 2014, is 27,400 workers. Sector flows in the other direction, that is, business services → manufacturing, account for 24,500 workers. Although there is some evidence of 'de-industrialisation', by means of a higher flow as regards manufacturing → business services (about 3000 workers net), flows between manufacturing and business services are largely bi-directional, instead representing the integration of manufacturing and business services in labour market terms.

Figure 1(a) shows in detail the size of sector labour flows across the measuring points in 2010 and 2014. The highly skill-driven combination of HI-M → KIBS displays by far the highest sector labour flow of all the candidate manufacturing → service combinations (9000 workers). However, once again, sector flows in the direction of business services → manufacturing are not far behind their manufacturing → business services counterparts in absolute terms, in any of the sector combinations. In one instance, that is, the flows between service and manufacturing, OSER → HI-M, the numbers actually exceed the counter direction flows.

One important question here is whether or not flows are larger than what can be expected from any arbitrary normal labour flow in an economy, in a way representing the integration of the sectors by the use of similar skills. The directional *skill-relatedness* between the different sectors is calculated as inspired by the skill-relatedness method, and the theoretical arguments of Neffke and Henning (2013) and Otto et al. (2014). When this value is more than 1, this is generally taken as an indication that the two sectors are partially dependent on the same worker resources

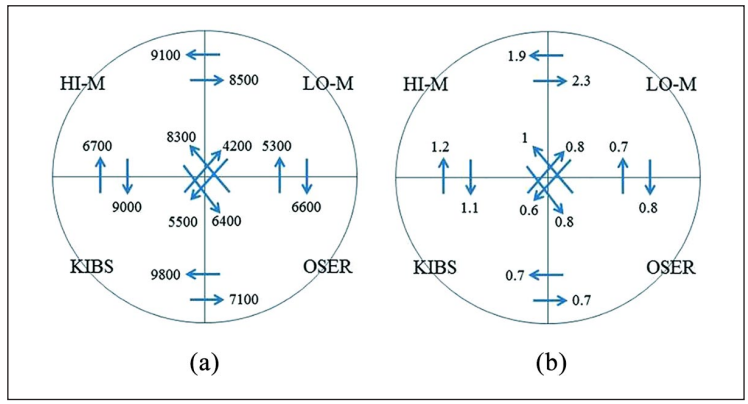

Figure 1. (a) Labour flows between sectors (directional, number of individuals). (b) Skill-relatedness between sectors. The number of observations is rounded up/down to the closest 100. Source: Author's elaboration of data from Statistics Sweden. HI-M: high-skill manufacturing; LO-M: low-skill manufacturing; KIBS: knowledge-intensive business services; OSER: other business services.

for their operation: they are *skill-related* (Neffke and Henning 2013).[8]

Figure 1(b) displays this directional skill-relatedness. The flows are in most cases slightly lower than would be expected from a random assumption. In fact, many of the manufacturing ↔ business service sectors do not qualify as skill-related. However, while the strongest links by far are those between the manufacturing sectors themselves, the mutual resource dependencies, in terms of shared skills, are strong between HI-M and KIBS, in both directions. The OSER → HI-M relatedness link is also above 1. Integration, in terms of the resource dependence of labour between manufacturing and business services, is particularly pronounced in the high-skill sectors. KIBS is much more related to HI-M than to either LO-M or OSER. In addition, the service sector generally seems to be more heterogeneous in terms of skill dependencies than manufacturing is internally, as it has far lower within-skill-relatedness.

Spatialities

Figure 2 describes the share of workers making up a particular flow in a particular region (measured at the outset of 2010, and not taking into account whether the flows implies regional mobility or not). For example, the leftmost section reflects workers leaving HI-M, and calculates the shares moving into LO-M in metro regions, dense regions and countryside regions. This can be interpreted as a *revealed industry transition probability* in the different regional groups.

The clearest regional differences in terms of transition probabilities and flow intensities are displayed for within-manufacturing labour flows, and for flows between HI-M and KIBS. The inter-manufacturing probabilities of HI-M and LO-M are highest on both the middle and low levels of the regional hierarchy in countryside and dense regions. The indications are similar for labour flows between OSER and manufacturing. By contrast, transition probabilities between HI-M and KIBS are far higher in metropolitan regions than in other regional groups. This also goes for the transition probabilities between OSER and KIBS, and to some extent also between LO-M and KIBS. Other transition probabilities show smaller spatial differences. Labour flows from manufacturing into KIBS have a much higher probability of taking place in metropolitan regions, while within-manufacturing flows and transitions from OSER to manufacturing have a bias towards the rest of the regional system. While moves into the growing and highly skilled KIBS sectors are concentrated in metropolitan regions, they have a far lower probability of taking place further down the regional hierarchy. Instead, these regions specialise in intra-manufacturing moves, as well as flows from services to manufacturing.

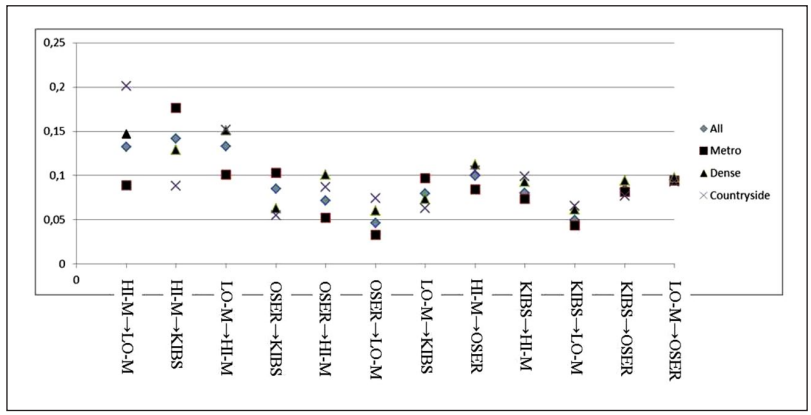

Figure 2. Revealed transition probabilities of making different industry moves, per regional group and for all regional groups. Sorted from left to right using standard deviation. Source: Author's elaborations of data from Statistics Sweden. HI-M: high-skill manufacturing; LO-M: low-skill manufacturing; KIBS: knowledge-intensive business services; OSER: other business services.

The descriptive results also suggest that the regional absorptive capacity of the labour market in the metropolitan regions is much more highly developed as regards the manufacturing → KIBS transitions than in the other regions. However, it is likely that such moves also involve the self-selection of individuals, which has much more to do with personal characteristics, for example, age, education and income, and less to do with spatial settings. From the previous literature, we already know that geographical mobility varies highly between categories of individuals (Boman, 2011; Eriksson et al., 2018). Younger (Lundholm, 2007) and better educated and paid workers are generally more likely to move regionally (Eriksson et al., 2018).

In order to take this into account, a series of logit regression models is specified to which the individual level variables of male/female, age, salary and educational level are added as controls. The results (shown in detail in Appendix 6) confirm the descriptive geographical patterns of manufacturing ↔ business service transitions previously identified. In regressions, those leaving manufacturing in metropolitan regions still have a significantly higher probability of entering KIBS after individual controls are applied. For other manufacturing ↔ business service combinations, the geographical differences are not at all as clear.

Table 1. Percentages of sector labour flows between 2010 and 2014 involving regional mobility. Regional mobility is defined in terms of (a) flow to establishments in another region and (b) residential change to another region. Source: Author's elaboration of data from Statistics Sweden.

Sectors	% involving regional move (establishment)	% involving regional move (residence)
LO-M → KIBS	33%	14%
LO-M → OSER	27%	14%
HI-M → KIBS	28%	11%
HI-M → OSER	27%	12%
KIBS → LO-M	22%	9%
OSER → LO-M	23%	11%
KIBS→ HI-M	24%	9%
OSER → HI-M	21%	10%
All labour flows	25%	13%

HI-M: high-skill manufacturing; LO-M: low-skill manufacturing; KIBS: knowledge-intensive business services; OSER: other business services.

Table 1 records what proportion of the manufacturing ↔ business services labour flows actually involve regional mobility. This is investigated both in terms of a change of region in a person's establishment affiliation (column 2), and in terms of a change of residence region (column 3). Turning first

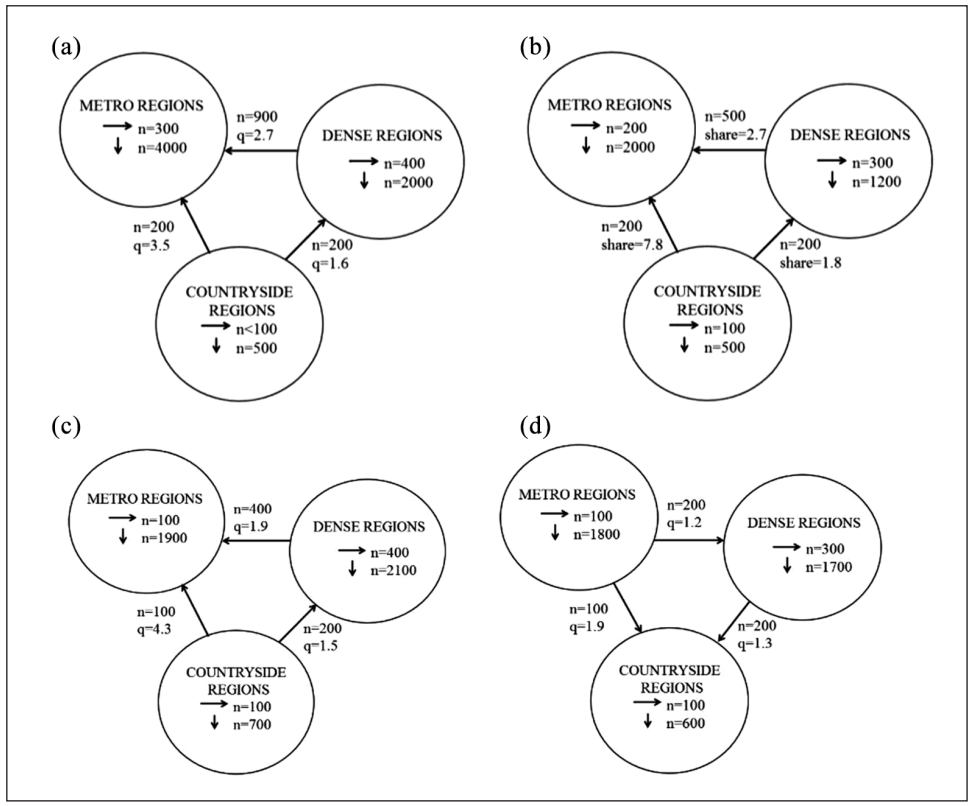

Figure 3. (a) HI-M → KIBS. (b) LO-M → KIBS. (c) HI-M → OSER. (d) OSER → LO-M. Proportions of flows are the relationships between inflows/outflows. The number of observations is rounded up/down to the closest 100. Source: Author's elaboration of data from Statistics Sweden. HI-M: high-skill manufacturing; LO-M: low-skill manufacturing; KIBS: knowledge-intensive business services; OSER: other business services.

to regional mobility, in terms of the location of the establishment, about 30% of the manufacturing → business services labour flows involve a regional move. This is generally far above the economy flow average (last row). Numbers regarding the direction of business services → manufacturing, on the other hand, are lower and generally slightly below the average for the economy. A similar pattern is reflected in the residence moves, even though the proportions are, as expected, far lower. Again, the labour flow of manufacturing ↔ business services shows a distinct spatial mobility component. Manufacturing → business services flows are often, and far more often than the average, associated with a spatial move.

To investigate the geographical destination of the regional moves in more detail, Figure 3(a)–(d) break down the geographical mobility indicators by regional types. The selected indications concentrate on the spatial mobility categories that show consistently highly significant spatial patterns: (a) HI-M → KIBS; (b) LO-M → KIBS; (c) HI-M → OSER; (d) OSER → LO-M. In the figure, → within the circles records the number of workers moving between two regions within the same regional group (between metropolitan regions, for instance), while ↓ denotes the number of sector switchers staying within their original regions. Arrows between regional groups display the main directions of flows, while the relationship between in- and outflows is displayed below that (as a simple quota (q), where the largest flow serves as the nominator).

Figure 3(a) shows the regional geographies of HI-M → KIBS flows. About 4000 workers stay in

their metro regions, while 300 move between the metro regions. Two hundred workers move from a countryside region to a metro region while completing the HI-M → KIBS flow. This number is more than three times higher than when workers move from a metro region to a countryside region. In three of the cases, (a) HI-M → KIBS, (b) LO-M → KIBS and (c) HI-M → OSER, dense and countryside regions are clear net exporters of experienced workers from manufacturing industries entering the business services sectors. Only in the case of OSER → LO-M are flows opposite, indicating diffusion, but the numbers of workers involved here are comparatively low.

Characteristics of movers

The final issue of this investigation is whether the distinct geography of the service transition towards ever-stronger high-skill service sectors, in high-absorptive capacity metropolitan regions, is also being driven by the re-allocation of not only experienced but also more skilled workers from lower parts of the regional hierarchy.

Two final logit regressions indicates that this is largely true for our case as well (Table 2), where those moving into business services (Model 1) or manufacturing (model 2), in a metropolitan region, are defined (=1) among a population of all those leaving manufacturing and moving into business services (vice versa for Model 2) in metropolitan regions (excluding stayers), as well as in dense and countryside regions. The experienced workers moving into the metropolitan regions and entering services are younger and better educated, and have slightly higher salaries (Model 1). This is also true for the experienced workers leaving the service sectors to enter manufacturing in the metropolitan regions (except salary, Model 2).[9]

Table 2. Logit regression coefficients with specific transition as the respondent variable. *$p < .05$, **$p < .01$, ***$p < .001$. Independent variables at their 2010 values. Descriptives in Appendix 3. Source: Author's elaboration of data from Statistics Sweden.

	1	2
	Into services in metro	Into manufacturing in metro
Male/female	0.033	0.022
	(0.05)	(0.07)
Age	−0.026***	−0.020***
	(0.00)	(0.00)
Education	0.305***	0.224***
	(0.02)	(0.03)
Salary	0.000**	0.000
	(0.00)	(0.00)
Constant	−1.927***	−2.690***
	(0.11)	(0.17)
N	15,789	11,995
Log-likelihood	−7334.428	−3472.129

Note 1: Male (0), female (1).
Educational level is min 1 and max 7, where 1 is elementary education less than 9 years; 2 is 9 years of elementary school; 3 is upper secondary school for maximum 2 years; 4 is upper secondary school for 3 years; 5 is post upper secondary school education for less than 3 years; 6 is post upper secondary school education for 3 years or longer (normally a university degree); and 7 is a PhD.
Salary is net annual salary in SEK (100s).

Discussion and conclusions

The results of this paper add a complementary view to the traditional narrative of the general service transition that has been taking place in western economies since the 1980s (Schön, 2010). There is not only a general shift towards services, but also a reciprocal resource integration taking place between, foremost, HI-M and KIBS. These sectors are bi-directionally co-dependent on partly the same types of skills.

However, the resource integration is not a spatially neutral process. The results show a striking geographical pattern in the labour market moves of individuals between manufacturing and services. This links the micro-level resource integration between the sectors to the current macro patterns of regional divergence in western economies, and involves a double whammy for lower hierarchy regions. The transition from manufacturing to business services has a far lower probability of taking place in regions other than metropolitan ones. Not only do business services, as previously documented, have a higher chance to endogenously grow in metropolitan regions (Hane-Weijman et al., 2018; Lundquist et al., 2008a), but also, to make matters worse for the smaller regions, many of the experienced manufacturing workers who are obviously

attractive to business service firms have a higher chance to migrate and take jobs in the metropolitan regions. There are upwards-directed labour filtering effects in the regional hierarchy, to the devastating effect of the labour markets of peripheral regions.

By providing detailed evidence and a resource-based explanation, this complements previous findings made by Martynovich and Lundquist (2016), who concluded that the regional expansion of the service sectors is accompanied by high levels of regional labour pull, while stability in the regional system is provided by the manufacturing sectors.

On a more general level, while these findings substantiate and underline the labour sharing aspects between the manufacturing and KIBS sectors emphasied by Neffke and Henning (2013) and Brenner et al. (2018), the results also add a resource-based aspect to the already existing geographical literature on manufacturing and services integration. While this literature has especially focused, thus far, on the integration of products and services in consumer offerings (Howells, 2004) and service exchanges (Shearmur and Doloreux, 2017), it has stayed surprisingly silent on the issue of resource sharing (Bryson and Daniels, 2010).

These results also have implications for the burgeoning literature in economic geography concerned with the importance of industry-transcendent resources for regional diversification and branching (Boschma, 2017; Boschma and Frenken, 2011; Lawson, 1999; Neffke et al., 2018). This industry-transcendent resource base, in our case consisting of experienced labour, is not static but partially fluid over space and changes dynamically over time, for example with migration. In the case of this paper, this change is to the benefit of the metropolitan regions, and will in the long run deprive the skill-resource base of smaller and more peripheral regions.

To understand these evolutionary aspects of contemporary growth, it is pivotal to consider regional cross-industry high-skill service and manufacturing resources and how they allocate in space. Regional resource bases frequently reciprocally transcend and defy traditional industry classifications across manufacturing and services. This argument partly downplays the validity of using standard industry classification systems, as frequently done in the past to assess the impacts of related industry structures on growth and the prospects of manufacturing diversification paths into related industries (Eriksson, 2011; Essletzbichler, 2015; Frenken et al., 2007; Guo and He, 2017; Neffke et al., 2011a). Also, because the statistics on technology and product categories outside manufacturing are clearly inadequate, the findings derived in this paper imply that even sophisticated regional technological capability indicators, based on patenting (Kogler et al., 2013; Montresor and Quatraro, 2017) and product structures (Boschma et al., 2012, 2013; Neffke et al., 2011a), run the risk of underestimating the regional importance of complex technologies developed in the intersection between manufacturing and KIBS.

In this vein, as this paper deepens insights into the capability dynamics manifested in labour flows across industry and services (Neffke and Henning, 2013), it provides a natural complement to other progresses made in measuring inter-industry relatedness, such as transaction linkages-based approaches (Essletzbichler, 2015; Howell et al., 2018). While this paper studied only one type of resource integration between industry and services and its locational consequences, it also opens up to a range of studies concerning other commonalities in resource use, for example concerning infrastructure or financial capital, and the spatialities of those in a manuservice economy.

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Data availability statement

The individual-level datasets analysed in this study are constructed by Statistics Sweden and are made available to researchers by permission from Statistics Sweden only. A fee applies. By law, the author of this study cannot share the data. Interested researchers must approach Statistics Sweden directly.

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Notes

1. Appendices referred to in the paper can be found in the supplemental online material.
2. Data sources are further described in Appendix 1.
3. No distinction is made between producer services and business services, but the term "business services" is preferred.
4. Detailed descriptives in Appendix 2.
5. Regional descriptives can be found in Appendix 3.
6. Overall employment in manufacturing and extraction activities was 564,000 persons in 2014. In business services, it was 534,000 (RAMS, Register-based labour market statistics, Statistics Sweden. www.scb.se).
7. A regional overview of the industries can be found in Appendix 4.
8. Technical aspects are described in Appendix 5.
9. Descriptives in Appendix 6.

Supplemental Material

Supplemental material for this article is available online.

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