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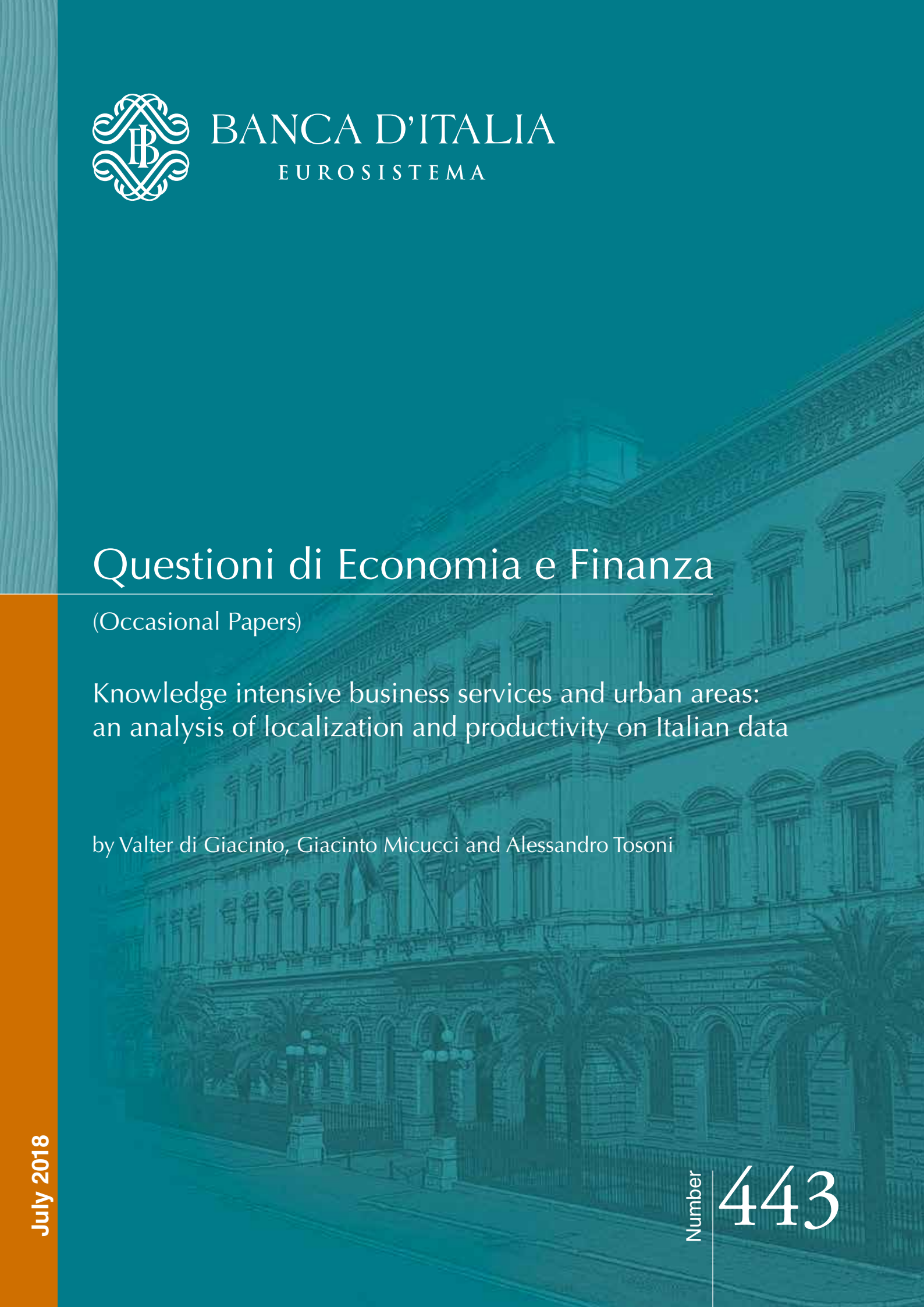

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(Occasional Papers)

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# KNOWLEDGE INTENSIVE BUSINESS SERVICES AND URBAN AREAS: AN ANALYSIS OF LOCALIZATION AND PRODUCTIVITY ON ITALIAN DATA

by Valter di Giacinto,* Giacinto Micucci** and Alessandro Tosoni*

**Abstract**

We analyse the geographic localization and the productivity of knowledge-intensive business services (KIBS) in Italy, using both census data and balance sheet data at the firm level. We find that KIBS are generally agglomerated in urban areas where they attain significantly higher labour productivity levels. Urban productivity advantages are found to be strongly associated with the local availability of human capital and to standard proxies of Marshall-Arrow-Romer and Jacobs agglomeration economies. Forward demand linkages and some factors impacting on the thickness of the local labour market also appear to be relevant. On the whole, the set of explanatory factors considered could explain the entire urban productivity premium estimated for Italian KIBS firms.

**JEL classification**: J24, L84, R30

**Keywords**: knowledge-intensive business services (KIBS); urban areas; agglomeration economies.

**Index**



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## 1. Introduction[1]

The most advanced economies have become subject to increasing tertiarization in recent decades and the service branches which have grown most are those involving intermediate inputs used by companies in their production processes (business services). The business services sector embraces many diverse activities. A commonly accepted criterion to classify business services is the one based on their knowledge content, to distinguishing the so-called knowledge-intensive business services (KIBS), a subsector of the whole set of knowledge-intensive services (KIS), from the rest (non-KIBS). Key aspects of KIBS include innovation and agglomeration.

KIBS (and the cities where they are located) are becoming increasingly instrumental in fostering innovation and the competitiveness of firms and countries. For a long time, research in innovation was concentrated on the manufacturing sector, in particular on high-tech industries. In recent decades this situation has changed and interest in knowledge-intensive business services has grown. The focus on the link between services and innovation partly originates from the efforts of Western economies and the European Union to become knowledge-based economies (European Commission, 2007 and 2012). In this respect, KIBS are likely to be one of the main engines of future growth within the European Union.

KIBS are of special interest because they are concerned with providing knowledge-intensive intermediate inputs to private (and public) organizations, a hallmark of competitiveness in the knowledge-based economy, and because of their particular production and innovation processes, which require close interaction with their clients and have the potential to spur innovation in other economic sectors.

At the same time, the particular innovation process involving KIBS is one of the main determinants of their geographic distribution. In general, the geographic distribution of the economic activities depends on productivity gains due to agglomeration economies: one strand of literature documented (Duranton and Puga,

[1] The views expressed in this paper are those of the authors alone and do not necessarily represent those of the Bank of Italy. The authors would like to thank Antonio Accetturo, Andrea Lamorgese, Sauro Mocetti and Paolo Sestito (Bank of Italy) for their helpful suggestions.

2004; Henderson and Ono, 2008; Jacobs, Koster and van Oort, 2013) that KIBS are frequently located in more urbanized areas.

In this paper we analyse the geographic localization and productivity of KIBS firms in Italy, using both census data and balance-sheet data at the firm level. More specifically, we address the following two research questions: i) to what extent does economic activity in the KIBS sector tend to be spatially concentrated in denser urban areas over and above the level observed for the entire set of tertiary activities? ii) Does an urban productivity premium exist in KIBS activity and if so, how does it compare with the urban productivity differential prevailing in the broader KIS sector and in the tertiary sector as a whole?

In a nutshell, we find that KIBS are frequently agglomerated in urban areas, where they attain significantly higher productivity levels (urban premium). Urban productivity advantages are strongly related to the local availability of human capital. Proximity to customers (as measured by forward demand linkages) also appears relevant, as are the cases of measures of labour market thickness and standard proxies of agglomeration economies.

The remainder of the paper is organized as follows. In Section 2 we provide an overview of the literature on KIBS and their impact on the innovativeness and productivity of regional economies. In Section 3 we provide some evidence on the level of urbanization and agglomeration of KIBS activities based on the analysis of Census data for the years 2001 and 2011. Section 4 describes the database utilized for the analysis of KIBS sector firm characteristics and performance and some preliminary descriptive statistics are shown. Section 5 is devoted to a regression analysis of the urban productivity premium in the KIBS sector. In Section 6 we analyse LLMAs' features and the productivity of urban KIBS firms. Section 7 summarizes and concludes.

## 2. Literature review

Within the field of innovation, the emphasis has traditionally been on manufacturing-related research and development. However, innovation in services is increasingly considered to be relevant for the competitiveness and growth of regional economies (OECD, 2005; Wood, 2009).

The activity of KIBS consists of the accumulation, creation, and dissemination of knowledge for the purpose of developing a customized service or product solution to satisfy clients' needs (Bettencourt el al., 2002; Shi, Wu and Zhao, 2013). The knowledge provided by KIBS can be divided into two categories: codified (or hard) knowledge and tacit (or soft) knowledge (Polanyi, 1967). While codified knowledge can be recorded and transferred by means of media and language, tacit knowledge is more informal and therefore harder to describe, only being acquired through informal learning processes, individual experience and opinion (Shi, Wu and Zhao, 2013). However, codified knowledge is more effective when supported by tacit knowledge: thus, KIBS combine various kinds of knowledge, both codified and tacit, in order to develop problem-specific solutions for clients.

In a sense, KIBS are transfers of knowledge and innovation to their clients, through repeated interaction and collaborative learning processes (Aslesen and Isaksen, 2010; Strambach, 2001; Zieba, 2013). It is reported that the resolution of the specific problems facing client firms often leads to the development of new knowledge (den Hertog, 2002).

In relation to the increasing interest in KIBS, scholars have analysed the locational pattern of KIBS. In any industry, the geographic distribution of the economic activities mainly depends on productivity gains due to agglomeration economies (see the reviews by Rosenthal and Strange, 2004, and Melo, Graham, and Noland, 2009): estimates of the elasticity of productivity with respect to city population range from 0.02 to 0.10 and vary across countries and sectors.

Agglomeration economies may benefit firms operating in the same industry (so-called 'localization economies', as in the case of the industrial districts; see Di Giacinto et al., 2013) or a wider range of industries in a given territory. Under this latter hypothesis (Jacobs, 1969), economic development is promoted through the overall agglomeration of economic activity ('urbanization economies'), rather than by specialization. In the case of KIBS, urbanization economies are, in principle, more relevant than for manufacturing, with regard to the importance of close interaction with their clients in the production and innovation processes.[2]

[2] The empirical analyses that have dealt with the role of agglomeration economies in the service sector (Combes, 2000; Acs and Armington, 2004; Desmet and Fafchamps, 2005; Di Giacinto and Micucci,

Agglomeration economies act through three main forces (Duranton and Puga, 2004): sharing (i.e. the possibility of sharing local public goods), matching (i.e. thick labour markets facilitate matching between firms and workers), and learning (i.e. face-to-face interactions between workers and firms generate localized knowledge spillovers).[3] The learning force appears to be especially relevant in the case of KIBS, due to their particular production and innovation process, as mentioned above.

Theories on agglomeration and economic geography have traditionally been tested on the basis of the location of manufacturing firms, and only more recently some contributions have focused on the business service sector (in particular on knowledge-intensive business services). The latter have shown that KIBS firms are more frequently located in more urbanized areas (Duranton and Puga, 2005; Henderson and Ono, 2008; Shearmur and Doloreux, 2008 and 2009). Based on this evidence, Duranton and Puga (2005) remarked the transformation of urban structure from mainly sectoral to mainly functional specialization. They offer an explanation, interrelated with changes in firms' organization: cities are shifting from specializing by sector — with integrated headquarters and plants — to specializing mainly by function — with headquarters and business services clustered in larger cities, and productive plants clustered in smaller cities.

The role of downstream demand linkages in fostering the local development of knowledge-intensive service activities has also been addressed in a recent article by Meliciani and Savona (2015), who provide evidence of a positive and significant impact of the local diffusion of the industries featuring a larger share of KIS services among their productive inputs.

Other important factors in determining KIBS location include their proximity to universities and knowledge institutions, as agglomerations of these services affect the potential for innovation and engagement in collective learning (de Bok and van

2009) provide mixed results on the relative importance of specialization versus urbanization economies. Micucci (2003) underlines the significant use of business services by firms located in Italy's industrial districts.

[3] The explanation based on agglomeration economies is prevalent in the literature, even if more recently, there has been increasing consensus around an alternative explanation based on firm selection, building on works by Melitz (2003) and Melitz and Ottaviano (2008); according to the firm selection theory, larger markets attract more firms and make competition tougher, thus leading less productive firms to exit the market. Empirical analysis by Combes et al., (2012) and Accetturo et al., (2013) suggest that a large share of the territorial distribution of economic activities is explained by agglomeration economies.

Oort, 2011; Jacobs, Koster and van Oort, 2013; Shi, Wu and Zhao, 2013; van Dijk and Pellenbarg, 2000).[4]

The greater local human capital endowments usually observed in denser areas represent another key factor cited in the literature in order to explain urban productivity. Abel, Dey and Gabe (2012) provide new evidence of the relationships between human capital, density, and urban productivity. They use detailed statistical models to gauge more precisely the effects of density and human capital, both separately and together, on the productivity of more than 350 U.S. metropolitan areas. The study's findings lead to several important conclusions about the role of density in urban productivity. First, it finds that density plays a considerable role in the productivity of metro areas. Specifically, doubling density increases productivity by an average of 2 to 4 per cent. Second, it notes that density plays a larger role in cities where levels of skill and human capital are higher. Metro areas with below average levels of human capital realize no productivity gains from density, the study finds, while doubling density in metros with above average human capital reaps roughly twice the average productivity benefits. Third, the study finds the effects of density to be even more substantial in industries with high levels of knowledge and creativity. It thus goes well beyond previous studies that look at economic output in the aggregate to obtain evidence of the effects of density and human capital on the productivity and performance of individual industrial sectors. The authors find clear evidence that both the effects of density per se and the density of skilled people are highest in knowledge-based and creative industries. This is particularly true in the information, arts and entertainment, professional services, and finance industries where 'the exchange of information and sharing of ideas are important parts of the production process.'

## 3. Employment dynamics and the spatial concentration of economic activity in the KIBS sector

In this section we exploit Census data for the years 2001 and 2011 published by the Italian statistical institute (Istat) to assess employment dynamics and the magnitude of agglomeration and urbanization of economic activity in the KIBS

[4] Jacobs, Koster and van Oort (2013), for the metropolitan area of Amsterdam in the Netherlands, show that KIBS are co-agglomerated with the presence of multinational enterprises.

sector. We then compare these with both the broader KIS sector and the entire set of tertiary activities.

Based on a recent contribution by Schnabl and Zenker (2013), we identify the KIBS industries on the basis of the two-digit NACE Rev.2 classification of economic activities. As suggested by the authors, we include in the definition of the KIBS industry the following NACE divisions: 62 (Computer programming, consultancy and related activities), 63 (Information service activities), 69 (Legal and accounting activities), 70 (Activities of head offices; management consultancy activities), 71 (Architectural and engineering activities; technical testing and analysis), 72 (Scientific research and development) and 73 (Advertising and market research).

The identification of the KIS sector is also based on the NACE Rev.2 at the two-digit level and follows Eurostat standards. [5] According to this definition, all the NACE divisions that we include in the KIBS sector are also included in the KIS sector.

As regards the spatial scale of the analysis, we focus on local labour market areas (LLMA), whose map was recently released by Istat for the years 2001 and 2011 by implementing a common methodology for workers' mobility data obtained from the population Censuses.[6]

In defining 'urban' LLMAs we adopt the methodology set out in Lamorgese and Petrella (2016), which is aligned with OECD standards. The classification system, which exploits both administrative and functional criteria, identifies urban areas as those LLMAs (first functional requirement: self-containment of commuting flows) which embed a single municipality or a group of adjacent municipalities (administrative requirement) with a high population density (at least 1,500 residents per square kilometer: second functional requirement). Within the set of the 611 LLMAs singled out by Istat according to the 2011 Census results, the application of

[5] See http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Knowledge-intensive_services_%28KIS%29.

[6] The Italian national statistical institute (Istat) defines LLMAs as sub-regional geographical areas where the bulk of the labour force lives and works, and where establishments can find the largest amount of the labour force necessary to occupy the jobs offered. Based on the 2011 Census data on worker commuting flows and using as a key variable the proportion of commuters who cross the LLMA boundary on their way to work, Istat has aggregated Italy's roughly 8,000 municipalities into 611 LLMAs spanning the entire national territory.

the above methodology leads to the identification of 74 urban agglomerations, which account for about 54 per cent of the Italian population.

In the ten years from 2001 to 2011 the number of workers employed in the KIBS sector expanded at a faster rate (22.3 per cent) compared with both other KIS activities (14.1 per cent) and the remaining (non-KIS) tertiary activities (18.2 per cent). At the end of the period, KIBS firms accounted for about 12.6 per cent of the service sector employment (12.2 per cent in 2001) and for slightly more than one third of the KIS sector. Within KIBS, the highest growth rate was attained by architectural and engineering activities (69.4 per cent), which has become the second KIBS subsector by employment share and contributes to slightly more than 20 per cent of total KIBS employment. The legal and accounting activities remain the largest KIBS industry, with an employment share of 35.4 per cent in 2001. In the 2001-2011 period employment contracted sharply in advertising and market research (-19.2 per cent) and, to a lesser extent, in information service activities (-4.3 per cent).

The average size of local productive units was comparatively small in the KIBS sector at the start of the period (2.3 employees; 3.4 other KIS industries and 2.8 in the remaining part of the service sector) and it further declined to 2.1 employees in the year 2011. In the same period, average size increased slightly in the non-KIS sector, to 3.1 workers. Within KIBS, average unit size is particularly small in professional activities (1.4 employees in architectural and engineering activities, technical testing and analysis; 1.7 in legal and accounting activities).

KIBS activities display a urbanization level broadly in line with other KIS but substantially higher compared to the overall service sector. The share of workers employed in productive units located in urban areas was equal to 71.0 per cent in 2011, compared to 64.3 in non-knowledge-intensive tertiary activities. However, the degree of urbanization of KIBS activities decreased by 2.7 percentage points in the period 2001-2011. In particular, the share of urban employment decreased in architectural and engineering activities (from 67.6 to 61.0 per cent), the least urbanized among the KIBS subsectors. High urbanization levels are, on the contrary, recorded in computer programming, consultancy and related activities and in

advertising and market research, where more than 80 per cent of workers are employed in urban areas (Table 2).

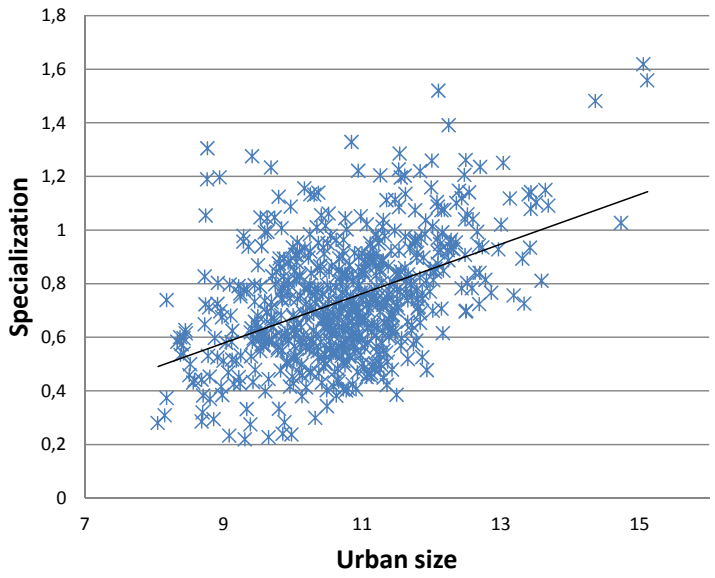
As regards the level of agglomeration, i.e. the tendency of economic activity in a given industry to cluster in specific areas over and above the level expected given the area size, in 2001 the aggregate KIBS sector displayed a value of the Ellison-Glaeser index (Ellison and Glaeser, 1997), measured at the level of local labour market areas (LLMA), which was slightly lower than the median value observed for the remaining KIS industries (about 0.008 and 0.011, respectively) but higher than that recorded for the other tertiary activities (about 0.003).

Agglomeration levels, however, appear highly differentiated across the KIBS subsectors. The most agglomerated industries are 'advertising and market research' (0.065), 'computer programming, consultancy and related activities' (0.036) and 'Activities of head offices; management consultancy activities' (0.030). In these industries, the spatial concentration of employment is close to the maximum levels recorded for the whole set of two-digit tertiary industries and appears to be essentially in line with the median intensity recorded in the manufacturing sector. By contrast, agglomeration tendencies appear to be negligible in architectural and engineering activities and in scientific research and development, whose geographical location closely matches the overall map of aggregate employment.

In the 2001-2011 decade the agglomeration of employment across LLMAs declined for the aggregate KIBS sector, to about 0.005, while the median value observed across the individual KIS and service sector industries remained essentially unchanged. In particular, agglomeration intensity decreased for the two most agglomerated subsectors (advertising and market research and computer programming, consultancy and related activities).

Agglomeration and urbanization appear to be strictly related in the case of KIBS activities. As shown in Figure 1, as the LLMA increases in size, so too does the specialization of the local economy in the KIBS sector. Within the set of the five LLMAs attaining the highest level of specialization in KIBS industries, there are the largest Italian metropolitan areas: Milan, Rome (respectively the first and second LLMA according to KIBS-specialization) and Turin.

**Figure 1.** Urban size and specialization in KIBS activities of Italian LLMAs: year 2011. (1)




(1) Urban size is measured by the log of LLMA population. Specialization is computed as the ratio of the KIBS employment share in the LLMA to the corresponding share measured at the national level.

## 4. The characteristics of KIBS sector firms: evidence from balance-sheet data

In order to describe the main characteristics and recent performance of KIBS sector firms operating in Italian urban and non-urban areas, we relied on balance-sheet information from the Cerved Group database, which covers almost the entire population of Italian limited-liability companies.

Yearly data for the period 2003-2013 were extracted for an unbalanced panel comprising about 263,000 service sector firms as a yearly average (Table 3). About 48,000 firms belong to the KIBS sector, while KIS activities account for about 85,000 firms in the panel. About two thirds of the firms are located in urban areas. However, in line with the evidence provided by the analysis of Census data, the share of urban firms is larger in the KIBS and KIS sectors.

About one half of the firms are established in Northern regions, while the Centre and the South account for about one quarter of the sample each. KIBS firms are relatively more concentrated in the North (about 58 per cent of the KIBS firms in the sample are located in this area).

A well-known difficulty associated with the Cerved company accounts archives is the lack of information on the number of employees for the majority of the firms included in the database. To overcome this drawback, we derive firm-level employment data from the National Social Insurance Institute (INPS) database, which contains information, on a monthly basis, on the average number of employees and average wages for each private firm operating in Italy. INPS data are provided separately for blue collars, white collars, directors and apprentices, which we pool together in order to obtain the figures for the overall number of firm employees.

The average values over the period 2003-2013 for some of the main firm-level indicators of size and performance are given in Table 4, while they are given separately for KIBS companies, the other KIS sector firms and the remaining tertiary activities.

KIBS sector firms employ on average a smaller number of workers compared to other KIS and remaining service sector enterprises, both in urban and non-urban areas. Firm size is generally found to be larger in urban compared with non-urban areas. The size gap of non-urban firms is particularly wide in the case of KIS activities, while it is less pronounced in the KIBS sector. The stock of tangible equipment per worker appears to be significantly lower in KIBS sector firms compared with other KIS and tertiary activities, while non-urban firms display slightly larger values compared with urban firms. On the contrary, companies located in urban areas appear to invest more in intangible assets, especially in the KIS sector.

Value added per employee is on average higher in the KIBS and other KIS sectors: there is also some preliminary evidence of the existence of an urban productivity premium that appears to be much wider in knowledge-intensive services compared to what is observed for the tertiary sector as a whole. A higher level of earnings before interest, taxes, depreciation and amortization (EBITDA) per employee is also recorded in the KIBS and KIS sectors, especially for companies located in urban areas. Differences across sectors and areas become less marked when firm performance is measured in terms of the net return on invested equity (ROE), although, also in this case, urban firms are found to attain higher profitability compared with remaining firms.

As regards the dynamics of firm-level labour productivity during the period considered in the analysis, in the years from 2009 to 2013 the general decline in value added per worker due to the crisis turned out to be somewhat less pronounced for KIS industries, in both urban and non-urban areas (Table 5). On the whole, during the crisis firms operating in urban areas experienced a deeper drop in value added per employee compared to non-urban companies.

## 5. The urban productivity premium in the KIBS sector

The descriptive statistics outlined in the previous section provide some preliminary evidence in favour of the existence of a labour productivity premium in the case of KIBS sector firms operating in urban areas. In order to get more robust insights into the existence and size of the urban productivity premium, we performed a regression analysis which, by controlling for a number of relevant firm and area characteristics, allows for a more precise assessment of the spatial productivity differentials and for a proper test of its statistical significance.

More specifically, a few variants of the following empirical model specification are considered:

$$Y_{it} = \alpha + \mu * Urban + \gamma * Urban\_KIS + \lambda * Urban\_KIBS + \beta' * X_{it} + u_{it} \qquad (1)$$

where:

- *Y* denotes firm labour productivity (log of value added per employee);
- *Urban* is a binary dummy equal to 1 if the firm is located in an urban LLMA;
- *Urban_KIS* is a binary dummy equal to 1 if the firm belongs to the KIS sector and is located in an urban LLMA;
- *Urban_KIBS* is a binary dummy equal to 1 if the firm belongs to the KIBS sector and is located in an urban LLMA;
- *X* is a set of control variables for year, area, sector and observed firm characteristics;
- *u* is a random term with the usual properties;

- the KIS and KIBS sector dummies are omitted, due to the multicollinearity with sector dummies.

According to the model specification given in expression (1), the $\mu$ coefficient measures the average relative productivity differential denoting urban versus non-urban firms in tertiary industries not included in the KIS sector. The $\gamma$ coefficient measures the extent of any additional productivity premium observed for urban KIS firms with respect to the one measured for urban non-KIS sector tertiary firms. Finally, the $\lambda$ coefficient captures any residual urban productivity differential between KIBS sector firms and the other KIS sector firms.

A positive estimate of the $\gamma$ coefficient implies that the urban productivity premium is larger for KIS firms (excluding those included in the KIBS subsector) compared with the average level observed for the remaining service sector activities. Analogously, a positive estimate of the $\lambda$ coefficient implies that the urban productivity premium is larger on average for KIBS firms compared with firms belonging to the remaining part of the KIS sector.

In the baseline model specification, we include as controls a full set of temporal dummy variables, sectoral dummies for the individual NACE two-digit industries and spatial dummies for the broad geographical partitions in which the Italian territory is subdivided by Istat (North West, North East, Centre, South, Islands)[7].

Moreover, considering the substantial size disparities between urban and non-urban firms evidenced by the preliminary descriptive analysis of the sample data, we also include a proxy of firm scale (log-number of employees) in the set of control variables in the model

Finally, considering that, according to the evidence gathered from the initial exploratory analysis, urban companies appear to invest more in both tangible and intangible assets, we include among the control variables the (log) amount of non-financial assets per employee, in order to control for varying capital intensity across firms.

[7] A model specification where the interactions between the sector and area dummies and between the former and year dummies are included was also estimated, yielding almost identical results.

The estimation results (shown in column 1 of Table 6) provide evidence of a positive and highly statistically significant urban productivity premium for non-KIS tertiary industries, with the coefficient of the Urban dummy implying a roughly 5.9 per cent labour productivity differential.

The estimated Urban_KIS coefficient is also positive and significant, providing evidence that firms operating in knowledge-intensive service industries attain a considerably higher urban labour productivity premium, averaging about 6.1 percentage points above the level estimated for the remaining part of the tertiary sector.

Finally, the coefficient estimate for the Urban_KIBS dummy is also found to be positive and significant, providing evidence that in this sector the urban labour productivity premium is about 1.2 percentage points higher than the value estimated for the average of remaining knowledge-intensive services.

Taken together, the three estimates imply that urban KIBS firms achieve on average labour productivity levels that are slightly more than 13 percentage points higher compared with non-urban KIBS companies of the same size and capital intensity and belonging to the same geographical partition.

According to the estimates of the corresponding dummy variables, all four remaining partitions display a significant average productivity gap with respect to the North West, chosen as the reference area. In line with expectations, the gap is considerably higher in the case of the less developed Mezzogiorno partitions (South and Islands).

At this stage, it ought to be acknowledged that the model specified according to expression (1) only allows us to assess average urban vs non-urban productivity differentials. Nonetheless, urban productivity premiums may display significant heterogeneity in a number of respects.

A first attribute that merits investigation relates to firm size: is the urban productivity constant for companies of any size, or is it increasing (decreasing) with firms' productive scale?

To gather some empirical evidence on this issue we then estimated an extended version of model (1) where the three urban dummies are interacted with a dummy

variable denoting firms whose size, measured by the number of employees, is greater than the pooled sample median.

The estimation results displayed in column (2) of Table 6 show how the interaction term between urban location and firm size is positive and statistically different from zero for non-KIS service sector firms, providing evidence that larger firms attain a slightly greater urban productivity advantage on average (about 1.4 percentage points) in this sector.

For firms belonging to the KIS sector but not included in KIBS, the urban productivity premium appears to be unrelated to firm size. The overall effect of firm size on the productivity of other KIS sector firms, given by the sum of the coefficients of the interaction terms between the firm size dummy and the Urban and Urban_KIS dummies is, in fact, found to be very close to zero (-0.004) and not statistically significant.

On the contrary, in the case of the KIBS sector, the urban productivity advantage estimated for larger firms is significantly higher. When we compute the overall effect of firm size on the productivity of KIBS sector firms (as the sum of the coefficients of the interaction terms between the firm size dummy and the three urban dummies in the model, Urban, Urban_KIS and Urban_KIBS), we now obtain a positive and significant coefficient of about 0.082.

Further regressions were subsequently carried out in order to uncover other possible sources of heterogeneity in the urban productivity differentials, namely in the temporal, spatial and sectoral dimensions.

As regards the first aspect, the preliminary analysis showed how during the prolonged recession that started at the end of 2008 the productivity of urban firms operating in KIBS activities was less severely affected than that of firms in the non-KIS service sector.

To measure the intensity of the decline of productivity during the crisis, we interacted the urban dummies in the model with a binary indicator variable for the period 2009-2013. The preliminary evidence of a less severe impact of the recession on urban firms in knowledge-intensive services is confirmed. While the urban productivity premium declined significantly during the crisis in the non-KIS service

sector (by about -1.9 points), it remained unchanged in the KIS sector and increased slightly for KIBS activities (see Table 7, column 1).

Considering the well-known and wide spatial disparities in economic performance historically observed in Italy between the Centre North and the Mezzogiorno, as a further extension we allowed the urban productivity premium to differ between those two areas by interacting the urban dummies in the model with a dummy variable identifying the two Mezzogiorno partitions (South and Islands).

The estimation results given in column 2 of Table 7 show how the percentage productivity premium gained in the Mezzogiorno by firms located in urban areas is significantly lower both in the case of traditional and knowledge-intensive services, the gap in urban productivity advantages in Southern regions being particularly large in KIBS industries.

Finally, considering that the analysis of the Census data highlighted the presence of substantial differences across the individual KIBS industries as regards the degree of urbanization and agglomeration, we estimated a model specification allowing for different values of the urban productivity differential for each of the NACE two-digit industries included in the KIBS sector.

The estimation results, portrayed in column 3 of Table 7, show that urban productivity advantages attain values significantly above the level estimated for the remaining KIS sector activities for three KIBS industries. In particular, advertising and market research appears to stand out as the sector where urban firms attain the highest additional productivity premium, followed by activities of head offices and management consultancy activities. These sectors represent two of the most urbanized and agglomerated industries within KIBS, in line with the existence of large urban productivity advantages in these specific industries. On the contrary, a significantly lower urban productivity premium is estimated for information service activities.

## 6. The determinants of KIBS firms' productivity in urban areas

In order to gain further insights into the urban productivity premium in the Italian KIBS sector documented above, we finally ran a regression analysis relating

the former to a set of potential determinants selected with reference to the literature briefly reviewed in Section 2. Our aim is to describe the relationships between the urban premium and its covariates and, consequently, we postpone to future research the proper identification of causal linkages.

The explanatory factors considered in the analysis were selected with reference to the literature reviewed in Section 2 and can be broadly classified in four groups: demand linkages, agglomeration economies, human capital and labour market thickness. While the set of covariates covers a rather wide spectrum, there are some aspects – namely the possible sorting of more productive firms in denser areas – that are not explicitly accounted for. We expect the latter to be reflected in any residual component of the urban productivity premium that is not accounted for by the explanatory variables considered in the analysis.

With respect to demand linkages, we considered both the local presence of firm headquarters, as set forth by Duranton and Puga (2005), and the strength of Hirschman forward linkages as considered in Meliciani and Savona (2015) where, to limit the extent of possible endogeneity issues, both demand-side proxies are computed with reference to the manufacturing sector only.

Considering that no separate statistics for the number of workers employed in corporate headquarters are available at the fine geographical scale required for our analysis, we proxy the local incidence of headquarter activities by the ratio of total firm employment to total plant employment at the LLMA level, based on Istat's 2011 Census data. Given that firm employment is statistically allocated to the area where the firm headquarter is located, a higher value of the ratio will denote a greater local presence of the headquarters of multi-plant firms with plants located in more than one LLMA.

Following Meliciani and Savona (2015) we proxy the intensity of intermediate demand by the local incidence of employment, as measured according to 2011 Census data, in industries that are more reliant on KIBS for their productive inputs. Based on the coefficients of the input-output table of the Italian economy compiled by Istat (the 2010 version of the table was considered), within manufacturing, the largest share of KIBS among intermediate inputs is observed in high-tech industries,

such as computer, electronic and optical products, pharmaceutical products and transport equipment other than motor vehicles.

To gauge the role of agglomeration economies, we refer to the standard proxies of MAR (Marshall-Arrow-Romer) and Jacobs externalities, namely local specialization in KIBS activities (the ratio of the employment share of the KIBS sector in a given LLMA to the corresponding share at the national level) and a measure of diversity of the local economic structure (the inverse of the Herfindahl-Hirshmann index of LLMA employment at the two-digit NACE rev. 2 industry classification). Both indicators were computed on the basis of the 2011 Census employment data.

In order to ascertain the role of better local human capital endowments in fostering the productivity of knowledge-intensive service sector firms, considering that the latter typically employ highly skilled workers, we focus on the individuals attaining at least a college degree and proxy local human capital endowment by the percentage share of college graduates among the resident population (source: Istat, 2011 Population Census).

The final group of explanatory factors includes two variables that may impact on the thickness of the local labour market. More specifically, we consider labour force participation, which affects labour supply for a given population density, while demographic factors are captured by the aged dependency ratio (the ratio of the number of LLMA residents aged 65 to the number of those aged from 15 to 64). Both indicators come from Istat's census database and refer to the year 2011.

Apart from the aged dependency ratio, which is clearly expected to be negatively associated with firms' productivity, the remaining two factors should exert a positive influence on KIBS productivity, mainly by improving the average quality of firm-worker matches.

Basic descriptive statistics for the individual explanatory factors are given in Table 8. In all cases urban areas display better endowments on average. The advantage is particularly marked with respect to human capital, where the difference between the mean level observed in urban and non-urban areas is equal to 1.3 times the standard deviation of the variable across Italian LLMAs. An equally wide gap is observed for the diversity and specialization in KIBS activity indicators (above 1.2

standard deviations in both cases). As expected, urban areas also appear to be denoted by considerably higher levels of downstream demand for KIBS services and by a larger incidence of corporate headquarters (differences between group means are respectively equal to 0.8 and 0.6 standard deviations). Labour force participation is also significantly higher, while the dependency ratio is lower, although the differential appears to be rather limited in this case (only about 0.1 standard deviations).

In order to assess to what extent the average productivity of urban KIBS firms across LLMAs can be related to better endowments with respect to the set of potential determinants outlined above, we first netted out labour productivity from the influence of individual firm characteristics (firm size and capital assets) and year, sector and macro-area fixed effects. More specifically, to maintain consistency with the urban premium estimates reported in Section 5, we first ran a regression similar to the one detailed in column 2 of Table 6, but excluding the three urban dummies, and subsequently singled out the regression residuals for the subsample including only KIBS sector firms. The latter were subsequently regressed on the Urban dummy and on the set of explanatory factors where, to allow for a check of the stability of estimation results, considering that some regressors display sizeable pairwise correlations (see Table 10), the explanatory variables belonging to the four groups were introduced in a step-by-step fashion.

In the first specification we included only the Urban dummy, whose coefficient measures overall urban productivity in the KIBS sector and is equal to about 13.2 percentage points (see column 1 of Table 9), in line with the estimates detailed in the previous section.

The two demand-side factors were subsequently included in the regression. The estimation results, given in column 2 of Table 9, show how both variables feature statistically significant coefficients with the expected positive sign, and how, conditional on these covariates, the estimated urban premium decreases to about 5 percentage points. The two agglomeration economies indicators were then added and the estimation results for this specification are given in column 3. For both the specialization and diversity indicators, the estimated regression coefficients show the expected positive sign and are statistically significant. The conditional urban

productivity premium falls further, to less than 1 percentage point, and is no longer significant.

In a subsequent step, the model specification was augmented by introducing the human capital proxy. In line with expectations, a larger share of college graduates in the population is found to be strongly positively associated with KIBS firms productivity (see column 4 of Table 9). Conditional on local human capital endowments the estimated urban productivity premium declines further, remaining not statistically different from zero.

In the final, and broader, model specification, two labour market thickness proxies were introduced. The estimation results (see column 5 of Table 9) show how both the aged dependency ratio and labour force participation enter with the expected sign (negative for the former) and a statistically significant coefficient. Conditional on the indicators of labour market thickness, the coefficient of the diversity indicator more than halves, while remaining statistically significant, possibly due to the correlation between the indicator and labour market participation.

On the whole, based on the above outlined estimation results, the difference in average human capital endowments appears to stand out as one of the main explanatory factors of the KIBS urban productivity premium in Italy. Moving from the average college graduate share observed in non-urban LLMAs to the average value recorded in urban areas is associated with a productivity increase of about 3 percentage points, according to the semi-elasticity estimates obtained under the final model specifications in Table 9. Similarly, the estimation results for the two forward demand linkages indicators are found to imply, *ceteris paribus*, an overall productivity increase of about 2.2 points in urban vs. non-urban areas. Taken together, the two proxies of agglomeration economies jointly explain slightly less than half of the urban productivity premium in the KIBS sector (about 6 percentage points), with specialization playing a major role compared to diversity.

A lower, but still sizeable, productivity differential (of about 1.4 points) can be related to the advantages observed in urban areas with respect to labour force participation, while demographic factors appear to play a minor role, mostly due to the fact that urban and non-urban LLMAs show only minor differences in this respect.

## 7. Concluding remarks

In this paper we investigated the role of urban areas in providing a favourable environment for the development of firms producing knowledge-intensive business services (KIBS) in Italy.

Based on the evidence gathered by Census data, KIBS sector activities have been shown to be more urbanized with respect to the entire service sector, notwithstanding the fact that the share of workers employed in cities declined slightly in the ten years from 2001 to 2011 (mainly reflecting the robust expansion in the least urbanized of the KIBS subsectors, such as for architectural and engineering activities).

KIBS activities were also shown to be among the most agglomerated tertiary industries, although there was considerable heterogeneity within the individual industries entering the aggregate sector. Unlike in manufacturing, however, urbanization and agglomeration in the case of KIBS activities tend to coexist, with the largest metropolitan areas also being the most specialized in the provision of this type of service.

To obtain more insights into the characteristics and performance of KIBS firms in Italy over the last decade, we subsequently exploited balance-sheet data for a large panel of companies.

We found evidence of a positive and significant urban productivity premium in the KIBS sector, which is more pronounced compared with the generality of non-KIS tertiary activities and also slightly larger compared with the average premium estimated for the remaining part of knowledge-intensive services.

In the KIBS sector, the value of the urban productivity premium was also shown to be significantly higher for larger firms, while it was essentially unrelated to size in other KIS industries. At the same time, the urban productivity premium was shown to be substantially larger for the most urbanized/agglomerated KIBS subsectors, according to the evidence of Census data, compared with subsectors where firms are more evenly spread across the local labour market areas. The intensity of urban advantages in KIBS activity was also found to be significantly lower in the less developed Mezzogiorno regions.

While our estimation period extends to both the pre- and post-2009 great recession, the estimated urban productivity premium in KIBS activities appears to have been only marginally influenced by cyclical macroeconomic dynamics, thus confirming its structural nature.

Finally, in order to investigate the association between average productivity advantages attained by KIBS firms in denser cities and some of the relevant structural urban features that have been identified as potential determinants in the literature, a regression analysis was performed.

A rather broad set of indicators, including both demand and supply side factors, was considered in the analysis. On the whole, the empirical findings show how, conditional on the structural features of urban areas, the observed urban productivity premium actually vanishes (i.e. it is entirely explained by the variables included in the econometric analysis).

Better human capital endowments and stronger agglomeration economies in urban areas appear to be the main explanatory factors. Increased opportunities to benefit from productive demand-side linkages were also found to represent an important factor with respect to urban productivity advantages in the KIBS sector. Both a larger presence of corporate headquarters and a greater diffusion of industries which – as is the case of high-tech manufacturing – rely more on the supply of knowledge-intensive services as intermediate inputs are found to play a significant role.

Among the remaining local productivity determinants, higher labour productivity in urban areas was found to be significantly associated with labour market thickness, as proxied by labour force participation and demographic conditions.

# APPENDIX: TABLES

**Table 1. Employment composition and dynamics in KIBS and other tertiary industries**

| SECTOR | Employment shares | | | | Average unit size (1) | | Employ-ment growth rate |
|---|---|---|---|---|---|---|---|
| | On total Service sector employment | | On total KIBS sector employment | | | | |
| | 2001 | 2011 | 2001 | 2011 | 2001 | 2011 | 2001-2011 |
| KIBS | 12.2 | 12.6 | 100.0 | 100.0 | 2.3 | 2.1 | 22.3 |
| *Computer programming, consultancy and related activities* | 2.5 | 2.2 | 20.2 | 17.2 | 4.9 | 4.8 | 4.4 |
| *Information service activities* | 1.4 | 1.1 | 11.3 | 8.9 | 3.7 | 3.5 | -4.3 |
| *Legal and accounting activities* | 4.2 | 4.5 | 34.7 | 35.4 | 1.8 | 1.7 | 24.8 |
| *Activities of head offices; management consultancy activities* | 1.1 | 1.2 | 8.9 | 9.8 | 2.5 | 2.6 | 34.7 |
| *Architectural and engineering activities; technical testing and analysis* | 2.0 | 2.9 | 16.4 | 22.8 | 1.6 | 1.4 | 69.4 |
| *Scientific research and development* | 0.3 | 0.2 | 2.1 | 1.8 | 2.6 | 2.7 | 3.3 |
| *Advertising and market research* | 0.8 | 0.5 | 6.4 | 4.2 | 3.0 | 2.7 | -19.2 |
| Other KIS | 20.0 | 19.4 | – | – | 3.4 | 3.3 | 14.1 |
| Other Services | 67.8 | 68.0 | – | – | 2.8 | 3.1 | 18.2 |

Source: Istat.

(1) Number of employees per local productive unit.

**Table 2. Agglomeration and urbanization indexes in KIBS and other Service sector industries**

| SECTOR | Urbanization (1) | | Agglomeration (2) | | | |
|---|---|---|---|---|---|---|
| | 2001 | 2011 | 2001 | | 2011 | |
| KIBS | 73.7 | 71.0 | 0.0082 | | 0.0052 | |
| *Computer programming, consultancy and related activities* | 84.4 | 84.4 | 0.0356 | | 0.0317 | |
| *Information service activities* | 67.3 | 67.0 | 0.0034 | | 0.0038 | |
| *Legal and accounting activities* | 68.9 | 68.0 | 0.0014 | | 0.0009 | |
| *Activities of head offices; management consultancy activities* | 79.7 | 80.0 | 0.0295 | | 0.0348 | |
| *Architectural and engineering activities; technical testing and analysis* | 67.6 | 61.0 | 0.0008 | | -0.0003 | |
| *Scientific research and development* | 75.8 | 75.3 | 0.0014 | | -0.0024 | |
| *Advertising and market research* | 84.6 | 81.9 | 0.0654 | | 0.0566 | |
| Other KIS | 70.8 | 71.2 | 0.0110 | (3) | 0.0085 | (3) |
| Other Services | 61.8 | 61.1 | 0.0028 | (3) | 0.0014 | (3) |

Source: Istat.

(1) Share of sector employment pertaining to establishments located in urban areas. – (2) Ellison-Glaeser index. – (3) Median value of the index among the individual two-digit industries included in the sector.

**Table 3. Sample composition (number of firms)**

| YEAR/AREA | KIBS | of which: Urban | KIS | of which: Urban | Services | of which: Urban |
|---|---|---|---|---|---|---|
| 2003 | 36,814 | 28,773 | 64,237 | 48,721 | 200,194 | 141,165 |
| 2004 | 39,990 | 31,24 | 70,057 | 53,223 | 220,458 | 155,262 |
| 2005 | 42,573 | 33,098 | 74,470 | 56,366 | 233,180 | 163,316 |
| 2006 | 44,491 | 34,539 | 77,805 | 58,721 | 243,241 | 169,587 |
| 2007 | 45,387 | 35,000 | 79,402 | 59,458 | 248,653 | 171,619 |
| 2008 | 49,553 | 38,118 | 86,969 | 64,811 | 271,678 | 186,912 |
| 2009 | 53,063 | 40,666 | 93,256 | 69,397 | 290,005 | 198,680 |
| 2010 | 55,132 | 41,898 | 96,767 | 71,478 | 298,098 | 203,165 |
| 2011 | 55,681 | 42,331 | 98,138 | 72,467 | 299,739 | 203,838 |
| 2012 | 55,194 | 41,814 | 97,569 | 71,620 | 296,880 | 201,146 |
| 2013 | 53,731 | 40,808 | 94,627 | 69,666 | 286,459 | 194,355 |
| Yearly average | 48,328 | 37,117 | 84,845 | 63,266 | 262,599 | 180,822 |
| of which: | | | | | | |
| North | 28,040 | 22,597 | 45,669 | 36,161 | 131,770 | 98,518 |
| Centre | 11,552 | 8,701 | 21,222 | 15,878 | 66,605 | 45,637 |
| South | 8,736 | 5,819 | 17,954 | 11,227 | 64,224 | 36,668 |

Source: Cerved.

**Table 4. Sample averages of firm indicators**

| VARIABLE | KIBS | | Other KIS | | Other Services | |
|---|---|---|---|---|---|---|
| | Urban | Non-urban | Urban | Non-urban | Urban | Non-urban |
| Number of employees | 11.0 | 7.7 | 29.0 | 15.3 | 14.6 | 10.2 |
| Tangible assets (per employee) | 42.8 | 46.2 | 109.3 | 83.9 | 76.4 | 87.2 |
| Intangible assets (per employee) | 15.7 | 10.8 | 35.9 | 14.6 | 15.0 | 10.8 |
| Value added (per employee) | 59.9 | 46.8 | 62.7 | 45.0 | 50.8 | 46.2 |
| EBITDA (per employee) (1) | 19.7 | 15.4 | 24.5 | 17.1 | 16.7 | 15.7 |
| ROE (2) | 7.6 | 7.1 | 6.9 | 6.7 | 7.5 | 6.7 |

Source: Cerved and INPS.

(1) Earnings before interest, taxes, depreciation and amortization. – (2) Sample medians are considered to yield evidence robust to the presence of outliers in the distribution of the indicator.

**Table 5. Labour productivity dynamics** (1)

| PERIOD | KIBS | | Other KIS | | Other Services | |
|---|---|---|---|---|---|---|
| | Urban | Non-urban | Urban | Non-urban | Urban | Non-urban |
| 2003-2005 | 55.8 | 42.3 | 60.9 | 43.3 | 50.4 | 45.4 |
| 2006-2008 | 62.8 | 48.9 | 67.0 | 47.5 | 53.2 | 47.5 |
| 2009-2013 | 60.2 | 47.5 | 61.4 | 44.4 | 49.8 | 45.9 |

Source: Cerved and INPS.

(1) Average level of firm value added per employee.

**Table 6. Regression results (dependent variable: log-value added per employee)** (1)

| Explanatory variables | (1) | (2) |
|---|---|---|
| Urban | 0.059*** | 0.052*** |
| | [0.002] | [0.003] |
| Urban * Large firm | | 0.014*** |
| | | [0.004] |
| Urban_KIS | 0.061*** | 0.070*** |
| | [0.007] | [0.008] |
| Urban_KIS * Large firm | | -0.018** |
| | | [0.007] |
| Urban_KIBS | 0.017** | -0.021** |
| | [0.008] | [0.009] |
| Urban_KIBS * Large firm | | 0.086*** |
| | | [0.008] |
| Firm size (log-Number of employees) | 0.012*** | 0.011*** |
| | [0.001] | [0.001] |
| Large firm (2) | | -0.013*** |
| | | [0.004] |
| Log- Capital assets per employee | 0.140*** | 0.141*** |
| | [0.001] | [0.001] |
| Area – North East | -0.063*** | -0.063*** |
| | [0.003] | [0.003] |
| Area – Centre | -0.081*** | -0.080*** |
| | [0.003] | [0.003] |
| Area – South | -0.217*** | -0.217*** |
| | [0.003] | [0.003] |
| Area – Islands | -0.254*** | -0.254*** |
| | [0.004] | [0.004] |
| Year dummies | | |
| Sector dummies (3) | | |
| Observations | 1,827,659 | 1,827,659 |
| R-squared | 0.256 | 0.256 |

Source: Cerved and INPS.

(1) Robust standard errors, adjusted for clustering at the individual firm level, are given in brackets. *** p<0.01, ** p<0.05, * p<0.1. – (2) A binary dummy variable denoting firms with a number of employees larger than the pooled sample median. – (3) Separate dummies for the individual two-digit NACE rev. 2 divisions.

**Table 7. Additional regression results. Dependent variable: log-value added per employee** (1)

| Explanatory variables | (1) | (2) | (3) |
|---|---|---|---|
| Urban | 0.068*** | 0.063*** | 0.059*** |
| | [0.003] | [0.003] | [0.002] |
| Urban * Dummy crisis | -0.019*** | | |
| | [0.003] | | |
| Urban * Dummy Mezzogiorno | | -0.010** | |
| | | [0.005] | |
| Urban_KIS | 0.050*** | 0.068*** | 0.061*** |
| | [0.007] | [0.007] | [0.007] |
| Urban_KIS * Dummy crisis | 0.021*** | | |
| | [0.005] | | |
| Urban_KIS * Dummy Mezzogiorno | | -0.027*** | |
| | | [0.009] | |
| Urban_KIBS | 0.004 | 0.026*** | |
| | [0.009] | [0.009] | |
| Urban_KIBS * Dummy crisis | 0.026*** | | |
| | [0.005] | | |
| Urban_KIBS * Dummy Mezzogiorno | | -0.081*** | |
| | | [0.011] | |
| Urban_KIBS: Subsectors | | | |
| *Computer prog., consultancy and related activities* | | | 0.007 |
| | | | [0.013] |
| *Information service activities* | | | -0.031*** |
| | | | [0.011] |
| *Legal and accounting activities* | | | -0.009 |
| | | | [0.018] |
| *Activities of head offices; manag. consult. activities* | | | 0.068*** |
| | | | [0.015] |
| *Architectural and engineering activities; technical testing and analysis* | | | 0.031** |
| | | | [0.013] |
| *Scientific research and development* | | | 0.003 |
| | | | [0.043] |
| *Advertising and market research* | | | 0.120*** |
| | | | [0.022] |
| Firm size (log-Number of employees) | 0.012*** | 0.012*** | 0.012*** |
| | [0.001] | [0.001] | [0.001] |
| Log- Capital assets per employee | 0.141*** | 0.141*** | 0.141*** |
| | [0.001] | [0.001] | [0.001] |
| Area dummies | Yes | Yes | Yes |
| Year dummies | Yes | Yes | Yes |
| Sector dummies | Yes | Yes | Yes |
| Observations | 1,827,659 | 1,827,659 | 1,827,659 |
| R-squared | 0.256 | 0.256 | 0.256 |

Source: Cerved and INPS.

(1) Robust standard errors, adjusted for clustering at the individual firm level, are given in brackets. *** p<0.01, ** p<0.05, * p<0.1. – (2) Separate dummies for the individual two-digit NACE rev. 2 divisions.

**Table 8. Descriptive statistics for the KIBS productivity explanatory variables**

| VARIABLE | Obs. | Mean (1) | Std. Dev. (1) | Min | Max |
|---|---|---|---|---|---|
| | | | *All LLMAs* | | |
| Downstream linkages | 611 | 2.09 | 0.90 | 0.00 | 5.03 |
| Headquarters diffusion | 611 | 98.80 | 18.01 | 24.75 | 220.63 |
| Specialization in KIBS activities | 611 | 0.96 | 0.32 | 0.22 | 1.62 |
| Diversity | 611 | 20.53 | 5.05 | 2.98 | 28.85 |
| College graduate population share | 611 | 11.17 | 3.14 | 3.23 | 18.61 |
| Aged dependency ratio | 611 | 32.28 | 5.67 | 18.36 | 60.28 |
| Labour force participation | 611 | 50.85 | 4.61 | 34.76 | 63.00 |
| | | | *Urban LLMAs* | | |
| Downstream linkages | 73 | 2.40 | 0.71 | 0.95 | 4.15 |
| Headquarters diffusion | 73 | 103.67 | 19.25 | 38.29 | 166.36 |
| Specialization in KIBS activities | 73 | 1.16 | 0.29 | 0.70 | 1.62 |
| Diversity | 73 | 23.38 | 3.62 | 13.45 | 28.85 |
| College graduate population share | 73 | 13.05 | 2.71 | 7.38 | 18.61 |
| Aged dependency ratio | 73 | 32.06 | 5.48 | 22.03 | 47.99 |
| Labour force participation | 73 | 51.72 | 4.14 | 43.82 | 58.74 |
| | | | *Non-urban LLMAs* | | |
| Downstream linkages | 538 | 1.72 | 0.95 | 0.00 | 5.03 |
| Headquarters diffusion | 538 | 93.03 | 14.62 | 24.75 | 220.63 |
| Specialization in KIBS activities | 538 | 0.74 | 0.19 | 0.22 | 1.33 |
| Diversity | 538 | 17.16 | 4.40 | 2.98 | 25.06 |
| College graduate population share | 538 | 8.94 | 1.96 | 3.23 | 17.85 |
| Aged dependency ratio | 538 | 32.54 | 5.91 | 18.36 | 60.28 |
| Labour force participation | 538 | 49.83 | 4.95 | 34.76 | 63.00 |

Source: Cerved, INPS and Istat.

(1) The statistics are weighted by LLMA population in 2011.

**Table 9. Regression results for the determinants of the productivity of KIBS sector firms** (1)

| Explanatory variables | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Urban | 0.1320*** | 0.0803*** | 0.0071 | -0.0017 | 0.0007 |
| | [0.0049] | [0.0055] | [0.0065] | [0.0067] | [0.0069] |
| Downstream linkages | | 0.0271*** | 0.0160*** | 0.0173*** | 0.0245*** |
| | | [0.0031] | [0.0031] | [0.0032] | [0.0032] |
| Headquarters diffusion | | 0.0022*** | 0.0004** | 0.0004** | 0.0005*** |
| | | [0.0001] | [0.0002] | [0.0002] | [0.0002] |
| Specialization in KIBS activities. | | | 0.1352*** | 0.0912*** | 0.1055*** |
| | | | [0.0100] | [0.0131] | [0.0146] |
| Diversity | | | 0.0074*** | 0.0072*** | 0.0026*** |
| | | | [0.0007] | [0.0007] | [0.0009] |
| College graduate population share | | | | 0.0069*** | 0.0075*** |
| | | | | [0.0013] | [0.0015] |
| Aged dependency ratio | | | | | -0.0038*** |
| | | | | | [0.0005] |
| Labour force participation | | | | | 0.0074*** |
| | | | | | [0.0008] |
| Constant | -0.0998*** | -0.3508*** | -0.4077*** | -0.4376*** | -0.6467*** |
| | [0.0041] | [0.0141] | [0.0154] | [0.0164] | [0.0341] |
| Observations | 289,553 | 289,553 | 289,553 | 289,553 | 289,553 |
| R-squared | 0.009 | 0.014 | 0.019 | 0.020 | 0.022 |

Source: Cerved, INPS and Istat.

(1) The dependent variable is given by the residuals of the regression of the log-value added per employee on firm size (log-number of employees), log-capital assets/number of employees and year, area and sector dummies. The regression is conducted on the whole sample in order to yield elasticity estimates in line with those detailed in Table 6; the data pertaining to KIBS firms are subsequently singled out. Robust standard errors, adjusted for clustering at the individual firm level, are given in brackets. *** p<0.01, ** p<0.05, * p<0.1.

**Table 10. Multicollinearity analysis for the productivity determinants regression** (1)

| VARIABLE | VIF | 1/VIF | Correlation coefficients | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Downstream link. | Head quart. diff. | Spec. in KIBS activities | Diversity | Coll. grad. pop. share | Aged dep. ratio | Lab. force participation |
| Downstream linkages | 1.25 | 0.80 | 1.00 | | | | | | |
| Headquarters diffusion | 2.06 | 0.49 | 0.21 | 1.00 | | | | | |
| Specialization in KIBS activities | 5.26 | 0.19 | 0.33 | 0.58 | 1.00 | | | | |
| Diversity | 3.34 | 0.30 | 0.39 | 0.52 | 0.69 | 1.00 | | | |
| College graduate population share | 4.04 | 0.25 | 0.29 | 0.52 | 0.85 | 0.65 | 1.00 | | |
| Aged dependency ratio | 1.33 | 0.75 | 0.09 | 0.32 | 0.09 | 0.17 | 0.23 | 1.00 | |
| Labour force participation | 1.77 | 0.57 | 0.13 | 0.41 | 0.23 | 0.56 | 0.33 | 0.25 | 1.00 |

Source: Cerved, INPS and Istat.

REFERENCES


Abel J., Dey, I. and Gabe, T.M. (2012), 'Productivity and the Density of Human Capital', *Journal of Regional Science*, Vol. 52, No. 4, pp. 562-86.

Accetturo, A., Di Giacinto, V., Micucci, G. and Pagnini M., (2013), 'Geography, productivity and trade: does selection explain why some locations are more productive than others?', *Temi di Discussione* (Bank of Italy Working Papers), 910.

Acs, Z.J. and Armington, C. (2004), 'The impact of geographic differences in human capital on service firm formation rates', *Journal of Urban Economics*, 56, 244-278.

Aslesen, H. and Isaksen, A. (2010), 'Knowledge-intensive business services as knowledge mediators in different regional contexts: the case of Norway', in Doloreux, D., Freel, M. and Shearmur, R. (Ed.), *Knowledge intensive business services: geography and innovation*, Ashgate, Farhham, pp. 99-122.

Bettencourt, L., Ostrom, A., Brown, S. and Roundtree, R., (2002), 'Client co-production in knowledge-intensive business services', *California Management Review*, Vol. 44, No. 4, pp. 100-128.

Combes, P.-P. (2000), 'Economic Structure and Local Growth: France, 1984-1993', *Journal of Urban Economics*, 47.

Combes, P., Duranton G., Gobillon, L., Puga, D. and Roux, S., (2012), 'The productivity advantages of large cities: Distinguishing agglomeration from firm selection', *Econometrica*, 80, pp. 2543-2594.

de Bok, M., van Oort, F. (2011), 'Agglomeration economies, accessibility and the spatial choice behavior of relocating firms', *Journal of Transportation and Land Use*, 4: 5–24.

den Hertog, P. (2002), 'Co-producers of innovation: on the role of knowledge-intensive business services in innovation', in Gadrey, J. and Gallouj, F. (Ed.), *Productivity innovation and knowledge in services: New Economic and Socio-economic Approaches*, Edward Elgar, Cheltenham and Massachusetts, pp. 233-255.

Desmet, K. and Fafchamps, M. (2005), 'Changes in the spatial concentration of employment across US counties: a sectoral analysis 1972–2000', *Journal of Economic Geography*, 261–284.

Di Giacinto, V., Gomellini, M., Micucci, G. and Pagnini, M. (2014), 'Mapping local productivity advantages in Italy: industrial districts, cities or both?', *Journal of Economic Geography*, Vol. 14 (2), pp. 365-394.

Di Giacinto, V. and Micucci, G., (2009), 'The producer service sector in Italy: long-term growth and its local determinants', *Spatial Economic Analysis*, Vol. 4, No. 4, December.

Duranton, G. and Puga, D., (2004), 'Microfoundations of urban agglomeration economies', in Henderson, V. and Thisse, J.F., (eds.) *Handbook of Regional and Urban Economics*, Amsterdam, North Holland, 4, pp. 2063-2117.

Duranton, G. and Puga, D., (2005), 'From Sectoral To Functional Urban Specialisation', *Journal of Urban Economics*, Vol. 57. No. 2, 343-370.

Ellison G., Glaeser, E.L., (1997), 'Geographic Concentration in U.S. Manufacturing Industries: a Dartboard Approach', *Journal of Political Economy*, Vol. 105, No. 3, pp. 889-928.

European Commission (2007), '*Towards a European strategy in support of innovation in services: Challenges and key issues for future actions'*, Commission Staff Working Document, SEC (2007) 1059. Brussels: Commission of the European Communities.

European Commission (2012), *Knowledge-intensive (business) services in Europe*, Directorate-General for Research and Innovation.

Henderson, J.V. and Ono, Y., (2008), 'Where do manufacturing firms locate their headquarters?', *Journal of Urban Economics*, 63, 431–450.

Jacobs, J. (1969), *The economy of cities*, New York, Vintage.

Jacobs, W., Koster, H.R.A. and van Oort, F., (2013), 'Co-agglomeration of knowledge-intensive business services and multinational enterprises', *Journal of Economic Geography*, Vol. 8, pp. 1-33.

Lamorgese, A. and Petrella, A. (2016), 'An anatomy of Italian cities: evidence from firm-level data', Bank of Italy, Occasional Papers, No. 362.

Meliciani, V. and Savona, M. (2015), 'The determinants of regional specialisation in business services: agglomeration economies, vertical linkages and innovation', *Journal of Economic Geography*, 15 (2), pp. 387-416.

Melitz, M. (2003), 'The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity', *Econometrica*, 71, pp. 1695-1725.

Melitz, M. and Ottaviano, G., (2008), 'Market size, trade, and productivity', *Review of Economic Studies*, 75, pp. 295–316.

Melo, P., Graham, D. and Noland, R., (2009), 'A meta-analysis of estimates of urban agglomeration economies', *Regional Science and Urban Economics*, 39, pp. 332-342.

Micucci, G. (2003), 'L'utilizzo e l'outsourcing dei servizi alle imprese nei distretti industriali', *Rivista di Politica Economica*, XCIII, 79-113.

OECD (2005), *Growth in Services. Fostering Employment, Productivity and Innovation*, Paris.

Polanyi, M. (1967), *The tacit dimension*, Routledge & Kegan Paul, London.

Rosenthal, S. S. and Strange, W., (2004), 'Evidence on the nature and sources of agglomeration economies', in Henderson, V. and Thisse, J.F., (eds.), *Handbook*

*of Regional and Urban Economics*, Amsterdam, North Holland, 4, pp. 2119-2171.

Schnabl, E. and Zenker A. (2013), 'Statistical Classification of Knowledge-Intensive Business Services (KIBS) with NACE Rev. 2', Technical Note, Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe.

Shearmur, R. and Doloreux, D. (2008), 'Urban hierarchy or local buzz? High-order producer services and (or) knowledge-intensive business service location in Canada, 1991–2001', *The Professional Geographer*, 60: 333–355.

Shearmur, R. and Doloreux, D. (2009), 'Place, space and distance: towards a geography of knowledge-intensive business service innovation', *Industry and Innovation*, 16: 79–102.

Shi X., Wu, Y. and Zhao, D., (2013), 'Knowledge Intensive Business Services and their impact on Innovation in China', University of Western Australia, Discussion Paper No. 19.

Strambach, S. (2001), 'Innovation Process and the Role of Knowledge-Intensive Business Services', in Koschatzky, K., Kulicke, M. and Zenker, A. (Ed.), *Innovation Networks - Concepts and Challenges in the European Perspective*, Physica-Verlag, Heidelberg and New York, pp. 53-68.

van Dijk, J. and Pellenbarg, P.H., (2000), 'Firm relocation decisions in the Netherlands; an ordered logit approach', *Papers in Regional Science*, 79: 191–219.

Wood, P. (2009), 'Service competitiveness and urban innovation policies in the UK: the implications of the London Paradox', *Regional Studies*, 43: 1047–1059.

Zieba M. (2013), 'Knowledge-Intensive Business Services (KIBS) and their Role in the Knowledge-Based Economy', Working Paper Series, Gdansk University of Technology.