The new business statistics framework at the territorial level

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Abstract

Recent empirical analyses of the contemporary territorial reconfiguration of productive activities have highlighted the need for official statistics to provide detailed economic information at the territorial level. The implementation of the new "Territorial Structural Business Statistics Register" (T-SBS Register) provides estimates of key economic account results at the establishment level, enabling highly granular territorial analysis. By integrating multiple data sources, including a direct survey of local units, the new T-SBS Register is fully consistent with Eurostat's Structural Business Statistics framework for enterprises. This paper presents a new methodology for estimating value added at the territorial level and offers insights into its potential for empirical economic analysis.

Keywords: Territorial Structural Business Statistics Register, data integration, value added at the territorial level, value added at the establishment level.

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1. Introduction

The growing strand of literature focused on analysing local economic development paths has so far been constrained by the availability of sub-regional economic data. In fact, employment has been the key metric of economic performance, with other measures unavailable at the micro level. Hence, territorial economic data used in pillar territorial analyses of the Italian production system, its development and transformation have so far been based on employment, with information sourced from Business Registers of Local Units, the only available official statistics source (see, among others, Iuzzolino 2004; Istat 2005; Istat 2015a and 2015b). This has forced researchers devoted to analysing territorial efficiency and growth to build several territorial databases using statistical techniques to estimate local wealth indicators based on available data and research objectives (Faramondi 2008; Bollino and Espa 2016; Bigerna et al. 2026).

In this empirical research context, the Italian National Institute of Statistics (Istat) has improved the supply of statistical information at the territorial level by intensively using administrative data (Nordbotten 2010) within the Eurostat regional Structural Business Statistics (SBS) framework. Since 2018, Istat has published a new statistical Register of economic units at the territorial level each year, known as the "Territorial Structural Business Statistics Register" (hereafter, T-SBS Register). Its provision represents a significant innovation in the business data arena for official statistics, as it increases territorial granularity compared with standard statistical domains (Menghinello et al. 2020). Official regional statistics have traditionally relied on aggregate SBS data as the primary source for territorial economic analysis. These data are based on firm-level sample surveys focused on the system of economic accounts for enterprises. As regions are a strata variable in the sample, data dissemination has so far been published at the regional level; in the case of the sub-regional domain of estimation, estimates would have been affected by sampling error in the unplanned territorial domain. Furthermore, the units of analysis are firms (legal units), without considering multi-plant firms. For these reasons, the T-SBS Register significantly improves the statistical supply of territorial information. Here, statistical units are not the enterprises but their local units, that is, their establishments and individual sites, whose information collection is mandatory within the European

framework for Business Registers, in addition to enterprises and enterprise groups. In particular, statistical units of the T-SBS Register are derived from the official Business Register (BR) of Local Units (BR-LU); hence, the new Register collects, for each enterprise, economic information on its local units that contribute to the production of goods and services. For the first time, in June 2018, official statistics provided information on the main variables of the economic account for each local unit, with 2015 as the reference year.

The present work focuses on the methodological and theoretical aspects of integrating multiple data sources at the core of the new statistical Register and presents preliminary results based on new data. These results describe a new economic geography, opening the way to new scenarios for empirical analysis at the territorial level. Section 2 sets out the European framework for the official Structural Business Statistics and related data sources; Section 3 presents the genesis of the new statistical Register and its methodological aspects. Results from the new data are presented in Section 4 at the aggregate regional, municipal, and Labour Market Area (LMA) levels. Section 5 presents the quality assessment, while conclusions are drawn in the final Section.

2. The SBS system of statistical Registers

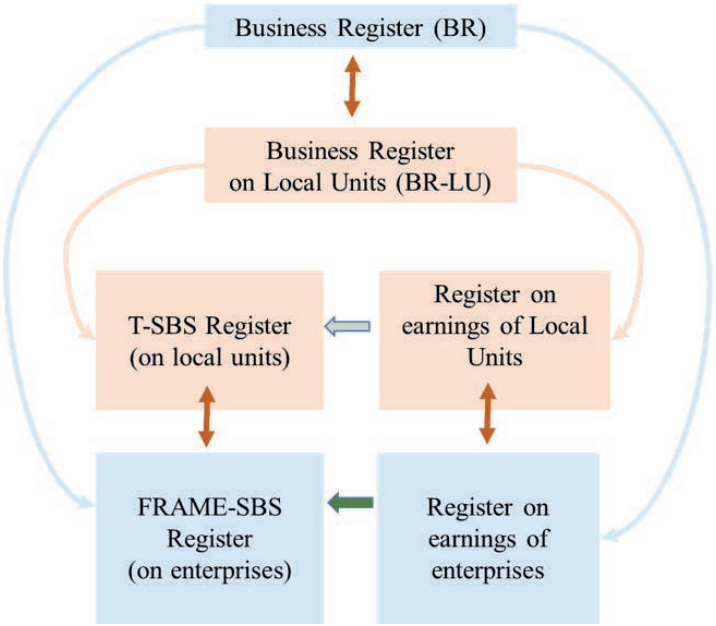
In official statistics, the Integrated System of Registers builds on the thematic development of statistical business BRs, which serve as "base statistical Registers" for economic units. Further integration with administrative and fiscal sources, as well as statistical direct surveys (both sample and total), improves topic coverage and broadens the Registers' scope within the SBS framework. Hence, integrating "basic Registers" BR and BR-LU with economic accounts information gives rise, respectively, to the SBS Register on enterprises (FRAME-SBS) and the T-SBS Register on local units. Such "thematic" registers are part of a highly integrated system, in which each Register is connected to the other components of the system, ensuring the consistency of accounting relations and the firm's productive organisation (Figure 2.1). In this framework, each enterprise-level economic variable is consistent with the sum of its local units' economic variables. As shown in Figure 2.1, the system of basic and thematic Registers of enterprises and local units can be represented in a circular form, with the outer ring representing BR and the inner ring representing the Registers of local units. In the external ring, the BR includes structural information about enterprises (specifically: sector of economic activity, number of employees, location, legal form, and group membership). It is the basis for building the extended Register on earnings, working hours, and labour costs for persons and enterprises, and, subsequently, the SBS Register on enterprises, which provides information and indicators on labour costs and the positive and negative components of the income statement, respectively.

In detail, the Register on earnings, working hours, and labour cost builds upon the integration of administrative and labour cost survey data with firm-level employment positions2. Such data integration represents the extension to the variables on labour input and labour cost for enterprises with at least one employee. The production of this Register in Istat began with the 9th Business Census in 2011, which served as the reference year. It was the result of an overall optimisation of data sources, made possible by the availability of new administrative data sources, as well as by existing sources that were usable with better timeliness. Overall, the new economic information structure

2 For details on the production process and metadata, see https://www.istat.it/scheda-qualita/registro-annuale-su-retribuzioni-ore-e-costo-del-lavoro-per-individui-e-imprese-racli/.

is composed of three levels: firms, individual workers, and their working-activity relations, and provides insights into objective aspects of working conditions (Gigante et al. 2019).

Figure 2.1 - Overview of the Integrated System of Registers on economic units



Source: Authors' processing

As far as the SBS Register on enterprises is concerned, starting from 2012 as reference year, Istat has produced the microdata containing the main economic variables, such as turnover, purchase cost of goods and services, personnel costs, value added and other more detailed variables (Luzi and Monducci 2016; Arnaldi et al. 2020). Such information is derived from an estimation process applied to data from several administrative sources, such as Chambers of Commerce, the Revenue Agency, and the National Social Security Institute. Information on companies with fewer than 100 employees is derived from a statistical treatment of administrative sources, taking into account the results of the sample survey of Small and Medium-sized

Enterprises (SMEs), which is used to construct models to impute certain variables in the SBS Register. The information relating to companies with 100 or more employees derives instead from the (census) survey on the economic accounts of large enterprises.

Finally, the internal ring focuses on local units, and its core is the base Business Register on Local Units, which provides information on the main structural characteristics of local units, such as economic activity, number of employees, and the localisation of each establishment. The territorial Register on earnings, working hours, and labour cost builds upon the BR on Local Units and, therefore, the T-SBS Register as well. These three Registers are consistent with the relevant Registers at the firm level, and all three are related to one another with respect to the economic information conveyed in the T-SBS Register. Data sources used in the three Registers are similar to those used at the firm level, with the addition that, for the definition of the BR-LU and T-SBS Register, information is also obtained from a direct survey: the coverage survey on local units (Section 3).

To ensure full consistency of the information provided in the thematic Register T-SBS Register, it is important to define its unit of analysis. In particular, in the European framework, the firm is broken down into different parts, from the local unit to the kind of activity unit (KAU)3 and its local KAU (LKAU). Currently, the statistical units of the Business Register for local units represent the best approximation of the LKau, where each elementary unit is the territorially localised production unit, and economic activity is assigned based on the prevailing economic activity criterion (i.e., the establishment). Such a definition is a proxy for LKau, since they are local units to which only one economic activity is assigned, the prevailing one. Once the basic unit closest to LKau is identified and the one represented by the BR-LU Register is taken as the territorial structure, the method for territorialising value added is defined.

3 Eurostat defines KAU as a part of an enterprise. The KAU groups together all the offices, production facilities, etc., of an enterprise that contribute to the performance of a specific economic activity defined at the class level (four digits) of the Statistical Classification of Economic Activities in the European Community (NACE Rev. 2).

3. Estimating value added at the territorial level

3.1 The methodological strategy

The estimate of value added at the territorial level builds upon the finest unit of analysis, which gives more details in the local context, that is, the local unit. As explained in the previous paragraph, the BR on Local Units contains all the local units that contribute to the production of goods and services realised by the firm itself. It provides information on their economic activity and number of employees, as well as their geographical location (for some establishments, it even includes the address, allowing geo-referencing). Hence, the statistical universe of the T-SBS Register is derived from BR on Local Units. The statistical population aligns with the scope of SBS regulation and covers NACE Rev.2 Sections B to N and Group S95 (that is, NACE Rev.1.1 Sections C to K).

The T-SBS Register is the territorial implementation of the SBS Register, which provides economic account information at the enterprise level. The innovation in the production process of territorial economic data is a methodological approach that accounts for available data sources at the local-unit level and enterprise-level information from the SBS Register. In fact, the only data source on economic information available at the territorial level is represented by the Register on earnings, working hours and labour cost on local units, which contains the information derived from the National Social Security Institute (INPS) and provides the value of the salaries of employees of the local units localised in the national territory. Therefore, wages at the local unit level are a key variable in estimating value added. Operationally, it is not possible to calculate value added as the difference between production value and its costs due to a lack of data. Therefore, the selected methodology is the "Income Approach" (Eurostat 2013). According to this method, the value added can be determined as the sum of some components per single Local Unit (LU) in the following way:

$$\widehat{VA}_{ij} = L_{ij} + \hat{K}_{ij} + \hat{R}_{ij} \quad (1)$$

where $\widehat{VA}_{ij}$ represents the value added of the j-th local unit of enterprise i, L_{ij} corresponds to the personnel costs, $\hat{K}_{ij}$ is depreciation, and $\hat{R}_{ij}$ is earnings

before income and tax (EBIT), calculated in the same local unit of the same enterprise. Hence, value added is the sum of components (labour, capital, and wages) rather than the difference between production value and its costs. In fact, in calculating GDP under the Eurostat Framework of National Accounts, the income-side approach shows how value is distributed among participants in the production process.

In addition, since 2017, the reference date and depreciation value have been sourced directly from the direct coverage survey of local units (see Section 3.2). A subset of large enterprises reports the amount of depreciation for each local unit of large multi-plant enterprises to the T-SBS Register, while the remaining subset is estimated (see Section 3.3). The income approach allows, therefore, a better exploitation of statistical sources at the local unit level, thus reducing the estimation of only one variable: EBIT ($\tilde{R}_{ij}$) and depreciation and amortisation ($\tilde{K}_{ij}$) that are not provided from a direct survey.

3.2 The direct survey on multi-plant enterprises

Previous paragraphs have shown that estimates of economic variables primarily concern multi-plant enterprises, i.e., enterprises with more than one local unit, which may be located outside the planned territorial domains of the SBS framework (regions). Moreover, while administrative data integration provides information on employees and wages for local units, data on their fixed investments are not available, even though they are crucial for the correct calculation of value added. Therefore, the central role of depreciation in estimating territorial value added for local units of multi-plant firms is evident. In the Italian productive landscape, local units of multi-plant enterprises represent an important component of the business system: in 2015 (the first reference year of the T-SBS Register), there were more than 510,000 such units, representing 11.2% of the total number of local units and 35.3% of total employees, but accounting for about half of the value added (48.8%) and depreciation (55%).

The T-SBS Register sources depreciation data for establishments from a direct survey and a yearly coverage survey of firms instrumental to the production of BR-LU. Since the production of the T-SBS Register, firms are asked for information not only on the structural aspects of their

establishments – such as persons employed, address, and state of activity, as well as the type of local unit - but also on depreciation, which therefore does not have to be estimated. This improvement in the direct sourcing of depreciation is relevant given the sample size and the structural composition of Italian enterprises.

The survey sample is mixed in nature, as it is based on a census of very large enterprises, both single- and multi-plant (with more than 100 persons employed), while smaller enterprises are rotated every two to three years. Overall, the sample survey accounts for about 10,000 enterprises, which cover almost one-third of local units of multi-plant firms each year. For this reason, it is not possible to provide information on depreciations for all multi-plant firms every year, as they are excluded from the direct survey. For such firms, an estimation approach is necessary (see Section 3.3).

Editing and imputation of information on collected depreciation use administrative data at the firm level to check the total value. However, the most important advantage of the direct survey is that firms are asked to estimate depreciation on fixed investments even when they lack accounting information. This case can be quite frequent for smaller enterprises, as it is not mandatory information. For this reason, the data editing steps are guided by the principle of retaining the most accurate survey data, while incomplete information (depreciations provided for some local units only, without explanation) is not taken into consideration and is therefore estimated in the following phase. Therefore, missing values and measurement errors are first checked in detail. Secondly, consistency checks are performed between the administrative value of depreciation at the firm level and the sum of surveyed establishment values. Thirdly, quality evaluations are devoted to cases of concentrated depreciation (i.e., enterprises with depreciation in only one establishment). Finally, the analysis of correlations between depreciation and persons employed by the domain across both enterprises and establishments concludes the process. Overall, since the introduction of the economic section in the questionnaire, the use of survey data has increased the number of firms whose depreciation was collected directly, rising from 13% in the first survey (reference year 2017) to 16% in the following year.

3.3 The estimation approach

As previously mentioned, the only addendum to equation (1) provided by a statistical source is a proxy for the cost of personnel, in this case, the amount of wages. The Register on earnings, working hours, and labour costs of local units is therefore the source of input L_{ij}. With respect to the remaining variables, their estimation at the local unit level takes place in a sequential manner by collecting information on depreciation first ($\hat{K}_{ij}$), and then by exploiting the former variable to estimate EBIT ($\hat{R}_{ij}$).

3.3.1 Estimation of depreciation and the hypothesis on multi-plant enterprises

Depreciations per local unit are collected annually through a direct survey (see Section 3.2 above). However, depreciation estimates are made for the sub-population of large enterprises that do not provide such information. To move forward with the value-added estimation procedure, it is necessary to identify the group of companies that best represents the performance of the local units and, on this basis, determine the best model for estimating depreciation at the territorial level. In this regard, all economic information on single-plant enterprises is derived from the SBS Register. Such firms are, by definition, composed of a single establishment that coincides with the legal unit and carries out only one predominant activity. In addition, large enterprises that carry out only one prevalent activity ("single-function" large enterprises) are included in this group[4]. The basic hypothesis concerns the local units of multi-plant enterprises, the only ones that need to be estimated at the plant level in economic accounts. They are supposed to have an "economic behaviour" completely similar to that of "single-function" large enterprises and single-plant enterprises that operate in the same sector. For this reason, great emphasis has been placed on the variable relative to the NACE classification, which has been kept as detailed as possible across the estimation domains to better identify the underlying model.

In initial attempts to estimate, Faramondi et al. (2018) describe the methods. The fundamental choice was the logic of identifying the domains of estimation in which to estimate depreciation: we started from a very detailed situation considering the 5-digit NACE, 10 classes of employees (0, 1, 2-3,

4 The "multi-functional" large enterprises are not included, as they could have made spurious the existing relations between the variables that would then be used in the model.

4-5, 6-9, 10-19, 20-49, 50-99, 100-249, 250+) and the Italian geographical areas (North, Centre, South and Islands), and then verify whether there were a sufficient number of units within the cell thus identified. In the event that this did not happen, the domains were collapsed, initially eliminating the geographical distribution, which was not considered particularly significant for the estimation of depreciation in local units, and then aggregating the classes of employees, only as a last resort, which was considered a less detailed level of the NACE classification. Since depreciation is a variable that is not always present and linked to other variables in the profit and loss account, modelling the interrelations between it and the other variables available at the territorial level may be difficult and even uncertain. Among the various studies carried out during the preparation of the activities for estimating depreciation, it was decided to use the average value of depreciation per employee calculated in a very fine domain (starting from the 5-digit NACE) for single-plant and unified enterprises; the availability of information on wages from the source RACLI also suggested to consider separately two sub-sets, that of enterprises with employees and that of enterprises without employees. The solution used was therefore certainly very simple, even if its use has guaranteed a set of "prudent" estimates, not having more certain reference points with regard to a very great territorial detail: it is desirable, however, that we can, in the near future, deepen other methods (regressive models, neural networks, etc.) in order to ensure the best possible result.

Depreciations are calculated using an average indicator for each domain (^{d}) derived from single-plant enterprises. Such an indicator is:

$$\bar{K}_{ij}{}^{d} = K_i / Emp_{ij}$$

Domains are combinations of the four-digit NACE codes (classes of economic activity), size (classified by employees), and macro-geographical area[5].

3.3.2 Estimation of Earnings Before Interest, Taxes, Depreciation, and Amortisation (EBITDA)

To estimate the last addend of the income approach equation (1), namely EBIT, we need to introduce an additional hypothesis. We assume that the

5 Scarcely populated domains are collapsed into higher hierarchical level domains. In case of zero employees in the local unit object of estimate, the average domain indicator d is multiplied conventionally by 0.5.

incidence of EBITDA in the local unit equals that of the sum of wages and depreciation in the unit itself.

Therefore, remembering that for each local unit "j" of the enterprise "i" we have

$$\widehat{VA}_{ij} = L_{ij} + \hat{K}_{ij} + \hat{R}_{ij} \qquad (1)$$

Where $\widehat{VA}_{ij}$=value added, L_{ij}=salaries, $\hat{K}_{ij}$= the value of depreciation and amortisation, and $\hat{R}_{ij}$=EBITDA. As $\hat{K}_{ij}$ is calculated in the previous phases, by using the Register on earnings, working hours and labour cost of local units, it follows that

$$\widehat{VA}_{ij} - \hat{R}_{ij} = L_{ij} + \hat{K}_{ij} = \hat{X}_{ij} \qquad (2)$$

Calculating on the SBS Frame at the enterprise level, the same amount $X_i = L_i + K_i$, we can determine the EBITDA per local unit as follows

$$\hat{R}_{ij} = \frac{\hat{X}_{ij}}{X_i} R_i \qquad (3)$$

Finally, by replacing in (1) the value of $\hat{R}_{ij}$ we obtain an estimate of the value added of the local unit *j* of the firm *i* by summation of the addends.

3.3.3 Estimation of other variables

To estimate the other variables of the profit and loss account for local units, the methodology of the SBS Register is followed. Therefore, estimates are carried out in three phases:

1. Estimation of the positive components of the value of production and changes in stocks (VP) and the cost components (C) per local unit, starting from the estimated value added, using the formula already used in the SBS Register, namely Value added = VP - C;
2. Estimate of the components of VP (revenues from sales and services, increases in fixed assets, other revenues, changes in contract work in progress and changes in inventories) and of C (purchases of goods and services, use of third-party assets and other operating costs).
3. Quadrature of variables at the enterprise and local-unit levels.

To estimate VP and C, we selected Predictive Mean Matching (PMM) (Rubin 1986; Little 1988). A statistical model defines a distance function under which

the donor provides the value closest to the recipient's "predicted average". The variables used to calculate this distance were value added and salaries for local units of enterprises with employees, while value added was the only variable for those without employees. The imputation domain was set at a 5-digit NACE code; however, if the number of donors was fewer than 100 or the ratio of recipients to donors was less than 50%, the domains were aggregated.

All donors were identified using the same method as for estimating value added: only single-plant and unified companies were included; obviously, all receivers were identified by all the local units of the multi-plant firms. The application of the method has therefore allowed us to impute the values of VP and C in a way that is completely consistent with the previously estimated value added per local unit. However, the method does not guarantee that the sum per enterprise of the two variables estimated at the local unit level matches the overall enterprise data; therefore, a first redistribution of the values attributed to VP and C is necessary to make their sum equal (except for approximations) to the total enterprise, while at the same time ensuring that VP-C still provides the value added.

The Nearest Neighbour Donor (NND) method (Kalton and Kasprzyk 1982; Chen and Shao 2000; Luzi et al. 2007) was used to impute the component variables of VP and C. In this method, which is a generalisation of the previous method, missing or inconsistent values detected in a receiving unit are imputed using values from a donor considered the "closest" based on a distance measure derived from a vector of observed, auxiliary, or matching variables. The distance function used is Euclidean, and, as matching variables, VPs, Cs, and Register on earnings, working hours, and labour cost for local units have been used; for enterprises with employees, only VPs and Cs are used; for those without employees, only Register.

What is actually imputed in this case is not the value of the variable itself, as it was previously done, but a series of ratios of the variables to be imputed with respect to VP or C: the imputation of these ratios derived from the donor, applied then to the total VP or C estimated per local unit, provides the value of the attributed variable. For some sectors (supermarkets and airlines) and for one firm in particular (Post Office), the imputation method described above was not used because of the difficulty of finding single-plant, unified companies that could serve as donors, given the specificity of these companies.

In these cases, the firm's economic value was therefore distributed among the local units based on their weight in the total, measured by employees and/or value added.

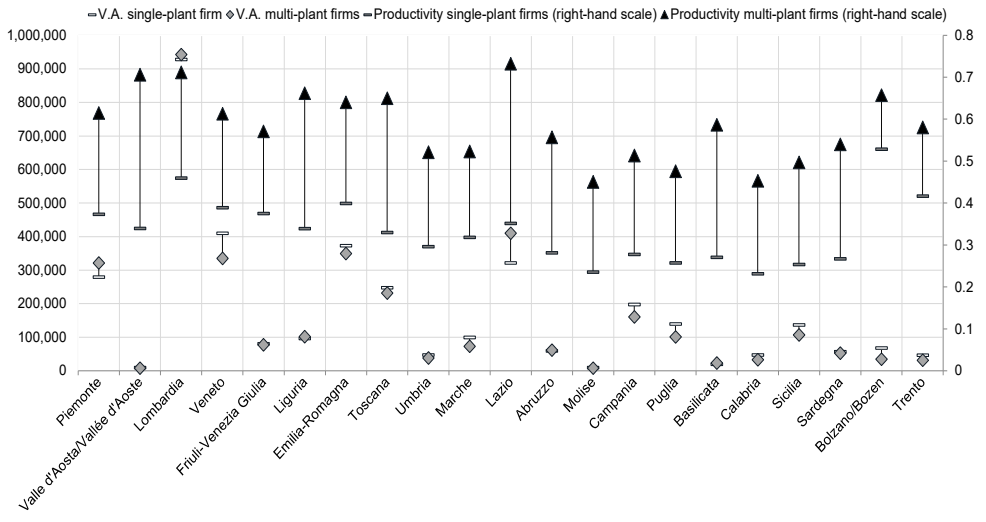
The use of the NND method, as constructed, guarantees congruence between the VP and the sum of its components, and between the C and the sum of its components. As before, however, the method does not guarantee that the sum per local unit of the various components, taken separately, equals the enterprise-level data for the same variable. For this reason, it was necessary to move on to a quadrature phase, which was also quite complex, as it had to reconcile the values of all variables estimated per local unit with those at the firm level, ensuring their internal and overall consistency with the data provided by the SBS Frame.

4. Quality assessment on value-added estimates of multi-plant firms

The Sections above have shown that estimating economic variables primarily concerns multi-plant enterprises. This Section focuses on the analysis of F-SBS estimates, without entering into comparisons with other sources, with particular attention to selected variables and indicators used to assess the quality of the estimated output.

Local units of multi-plant enterprises represent an important component of the business system. As for single-plant firms, they are mainly localised in the Northern and Central regions, while their employees are concentrated in a few regions: Lombardia, Piemonte, Veneto, Lazio, and Emilia-Romagna, meaning that their average size is higher in these regions (Figure 4.1). Despite the uneven distribution of multi-plant firms' local units and employees, their aggregate value added at the regional level equals that produced by single-plant firms, thereby generating differentials in nominal labour productivity, measured as value added per employee. Three stages feature this part of the work.

Figure 4.1 - Value added and productivity of local units of single and multi-plant enterprises, total economy. Year 2015 (Values in thousands of euros)



Source: Authors' processing of the T-SBS Register data

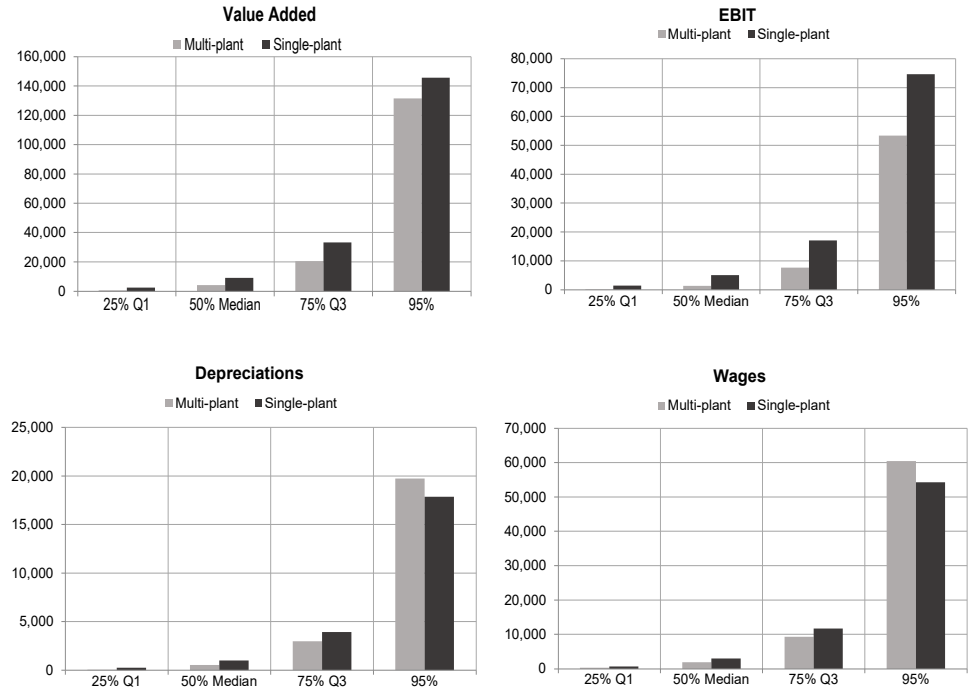
In the first stage of the analysis of the estimate of value added at the national level, we concentrated on the study of the variability of the distributions of the economic variables at the level of local units in each domain, that is, combinations of regions and divisions of economic activities according to the NACE 2007 classification. Economic results for local units of multi-plant and single-plant enterprises were investigated separately as distinct subsets of the local unit population. Overall, the investigated domains are 1,508, and the variables are value added, amortisation, earnings before income and tax (EBITDA), turnover, and their relative terms (per employee). In order to compare variability among statistical distributions of such variables, we selected the coefficient of variation as a metric, since it allows the comparison of the dispersion of data with different ranges of variation:

$$CV = \left(\frac{\sigma}{|\mu|}\right) * 100 \quad \mu \neq 0$$

Where σ is the standard deviation and |μ| is the absolute value of the mean of each distribution. Marking IQR = (Q3-Q1), the interquartile difference, the lower adjacent value is the smaller value among the observations that is greater than or equal to Q1-1,5*IQR. The upper adjacent value is the largest value among the observations that is less than or equal to Q3+1.5*IQR. Therefore, the CV contained between Q1-1,5*IQR and Q3+1,5*IQR is considered acceptable. As far as multi-plant firms are concerned, 97.5% of the coefficients of variation are acceptable, as they fall within the range defined by the adjacent lower and upper extremes of their respective distributions. The number of unacceptable CVs of multi-plant firms is consistent with that of single-plant firms.

In the second stage, a municipality-level analysis of local units of multi-plant companies focuses on 7,822 municipalities with local units (97.3% of the total) in 2015. The comparison of variables between local units of single- and multi-plant firms shows wide differences in their distributions. Graphically (Figure 4.2), the value of IQR of the municipal aggregates of local units of multi-plant firms is systematically lower than that of the localised ones. The comparison between the distributions of value added, EBITDA, amortisations, and wages of the two subsets of local units shows similarities between amortisations and salaries and wages, with the 95th percentile of the localised multiples significantly higher than the localised ones (third and fourth quadrants).

Figure 4.2 - Distribution of value, EBIT, depreciation, wages and salaries of local units of single- and multi-plant enterprises at the municipal level. Year 2015
(Values in thousands of euros)



Source: Authors' processing of the T-SBS Register data

Lastly, in the third stage, specific attention is given to evaluating the contribution of local units of multi-plant firms to the formation of aggregate value added at the municipal level. By relating the total value added generated by total local units as a function of the amortisations generated only by local units of multi-plant firms at the municipal level, a high correlation is shown, as expressed by the Pearson coefficient equal to 0.97683.

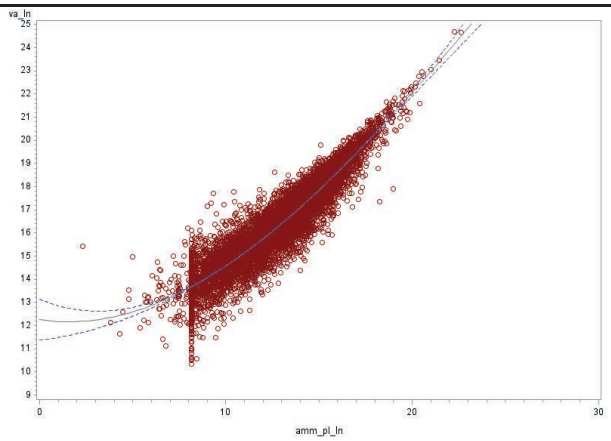
The relation examined is:

$$[\text{Value Added (multi-plant + single-plant)}, \text{Municipality}] = f[(\text{Amortisations multi-plant, Municipality})]$$

The presence of high heteroscedasticity requires a logarithmic transformation of the variables, which allows the non-linearity of the phenomenon to be represented in Figure 4.3 by a third-degree polynomial

relation. The non-proportional contribution of the amortisation of localised multiples indicates that aggregated returns to scale are not constant.

Figure 4.3 - Plot of depreciation of local units of multi-plant enterprises (x) and total value added (y). Year 2015



Source: Authors' processing of the T-SBS Register data

5. Results from the new data: a breakthrough in regional studies

The availability of the first extended Register of economic variables at the territorial level increases the accuracy of official territorial economic information.

The accessibility of accurate data at the establishment level enables in-depth investigations using a variety of sub-regional geographies as units of analysis, either functional or census-based. In fact, the dissemination of results is organised by structural dimensions and subnational geographies. These geographies make use of both administrative areas of the Italian territory (i.e., regions, Autonomous Provinces, metropolitan areas, municipalities, and their subset of capital municipalities of provinces) as well as official functional geographic units of analysis, such as Labour Market Areas (LMAs) and their official classifications (Istat 2015c; Faramondi et al. 2022). However, the availability of microdata enables the finest aggregation, which is instrumental to research interests in regional studies.

This Section presents such an increase at the regional level (Section 5.1), which is the administrative division compliant to SBS Regulation, at the municipality level (Section 5.2), that is, the fines administrative division, and at the intermediate territorial level (Section 5.3) in terms of functional partitions of geographies.

5.1 Measuring the regional value added of Southern Italy

Its comparison with the information disseminated by Istat at the regional level to comply with EU Regulation N. 295/2008 within the SBS framework "T-SBS data" reveals an average discrepancy of 0.1% in value added, as well as a territorial aggregation of uncovered value added in the Southern regions of Sardegna and Calabria (Table 5.1).

In terms of geographical distribution, indeed, the new data highlight an increase in value added in the South by 1.5%, in the Centre by 1.1%, and in the North-East by 0.2%, and a decrease in the North-West (-1.5%). At the regional level, the estimate of value added for 2015 shows significant differences across more than half of the Italian regions. In particular, among the northern regions, Lombardia, which contributes more than 26% to national value added, records a 2.3% decrease in value added (-4,493,997 thousand euros), while Friuli-Venezia

Giulia shows a 591,413 thousand euros increase (+3.9%). Across the regions of Central and Southern Italy, with the exception of Basilicata, which recorded a 0.9% decrease, there was a general increase in value added. The new estimate shows, in fact, a significant increase in absolute terms for Lazio and Tuscany (respectively +1,018,424 thousand euros and +1,006,987 thousand euros), and an increase of 7.8% for Sardegna, amounting to 791,791 thousand euros.

Lombardia remains the region that holds the first place in the ranking, achieving over 187 billion euros of value added, followed by Veneto (74.5 billion), Lazio (73.1 billion) and Emilia Romagna (72.1 billion), while the last places are held by Valle d'Aosta/*Vallée d'Aoste* (1.7 billion), Molise (1.7 billion) and Basilicata (4.2 billion).

Table 5.1 - Comparison of value added by Italian regions. Year 2015 (thousands of euros and percentages)

REGION	T-SBS	SBS	Difference %	
	Value added (VA1)	Value added (VA2)	Value added	*Value added per employee*
Piemonte	59,985,432	59,453,050	0.9	-0.4
Valle d'Aosta/*Vallée d'Aoste*	1,698,926	1,772,874	-4.2	0.7
Lombardia	187,004,426	191,498,423	-2.3	-0.7
Bolzano/*Bozen*	10,166,212	10,474,455	-2.9	-0.4
Trento	7,712,177	7,821,357	-1.4	-3.6
Veneto	74,479,647	74,570,865	-0.1	0.2
Friuli-Venezia Giulia	15,724,130	15,132,717	3.9	1.4
Liguria	19,690,665	19,459,277	1.2	0.0
Emilia-Romagna	72,150,588	71,732,719	0.6	0.1
Toscana	47,883,708	46,876,721	2.1	0.5
Umbria	8,457,732	8,376,893	1,0	-0.5
Marche	17,165,792	17,113,342	0.3	0.1
Lazio	73,129,182	72,110,758	1.4	2.1
Abruzzo	12,011,393	11,914,397	0.8	-0.4
Molise	1,729,221	1,699,016	1.8	3.2
Campania	35,696,255	35,634,715	0.2	0.5
Puglia	23,932,108	23,517,620	1.8	0.3
Basilicata	4,199,596	4,236,826	-0.9	-2.0
Calabria	7,937,560	7,751,935	2.4	-0.2
Sicilia	24,262,515	24,022,324	1,0	0.1
Sardegna	10,896,845	10,105,054	7.8	7.4
Geographical areas				
North-West	268,379,449	272,183,624	-1.5	-0.6
North-East	180,232,753	179,732,113	0.2	0.0
Centre	146,636,414	144,477,714	1.1	1.2
South	120,665,493	118,881,887	1.5	0.8
ITALY	**715,914,109**	**715,275,338**	**0.1**	**0.1**

Source: Authors' processing of the Istat T-SBS Register data

The new information base also shows that Northern regions, with about 2.3 million local units, account for more than 60% of national value added. In the regions of the Centre reside 21.5% of the local units, which contribute 20.5% to national value added, while the South accounts for 16.9% (27.8% of local units). In 2015, data on labour productivity across territorial divisions confirm higher values in the North Western regions (73.6 thousand euros per employee), followed by the North Eastern regions (67.7 thousand euros per employee), the Centre (65.2 thousand euros per employee), and the South (50.8 thousand euros per employee).

5.2 The first official estimate of value added at the municipal level

The T-SBS Register has also filled a significant information gap at the municipal level. The municipal ranking by value added shows only capital cities in the top twenty positions, which together represent 40% of national value added, produced by 36.3% of the local units of the national territory. Specifically, Milano ranks first, with a value added of more than 52 billion euros, accounting for 7.3% of national value added. Roma ranks second with 51,8 billion, equal to 7.2% of the total, due to the considerable weight of the value added generated by construction and utilities. Torino, Genova and Napoli follow, generating wealth equal to 2.1%, 1.5% and 1.3% of the Italian value added, respectively.

Overall, the first five municipalities in the ranking, which account for 14.1% of local units, contribute 19.5% to national wealth. The last positions, by contrast, are mainly held by municipalities in the Southern regions, particularly Sardegna (with seven capitals in the last seven positions). The Centre ranks at the bottom of the list, with the capitals of Fermo and Rieti.

The analysis by macro-sector highlights the primacy of the Municipality of Roma in industry, where the value added, generated by 3.0% of the national economic units, exceeds 10 billion euros, while Milano stands at just under 9 billion euros (Table 5.2), In detail, the comparison between the two capitals shows the prevalence of manufacturing only for the Municipality of Milano (+24% of value added compared to Roma) against a lower contribution in the sectors of energy and water supply (-70.5%) and construction (-8.7%). In terms of services, the top five positions confirm the ranking already observed on the total economy; it is worth noting the rise, among the municipalities of

the South, of Palermo, in tenth place with 3,9 billion euros of value added, and Bari, in twelfth place with 2,9 billion euros.

Table 5.2 - Top 20 capital municipalities in the ranking of value added in industry and services. Year 2015 (thousands of euros and percentage values)

Industry					Services				
		Value added		%			Value added		%
Ranking	Municipality	Absolute values (in thousands of euros)	% In Italian value added	Local units in Italy	Ranking	Municipality	Absolute values (in thousands of euros)	% In Italian value added	Local units in Italy
1	Roma	10,780,374	3.58	3.03	1	Milano	43,533,403	10.49	4.62
2	Milano	8,973,454	2.98	2.13	2	Roma	41,020,448	9.88	6.33
3	Torino	3,741,023	1.24	1.27	3	Torino	11,469,419	2.76	1.97
4	Genova	2,900,855	0.96	0.78	4	Genova	7,598,369	1.83	1.14
5	Napoli	2,038,774	0.68	0.78	5	Napoli	7,346,710	1.77	1.72
6	Parma	1,995,463	0.66	0.33	6	Firenze	5,919,073	1.43	1.06
7	Firenze	1,859,090	0.62	0.63	7	Bologna	5,771,064	1.39	1.03
8	Bologna	1,839,893	0.61	0.46	8	Venezia	4,267,460	1.03	0.59
9	Modena	1,757,548	0.8	0.33	9	Verona	3,925,419	0.95	0.59
10	Brescia	1,475,197	0.49	0.29	10	Palermo	3,885,426	0.94	0.93
11	Venezia	1,384,874	0.46	0.34	11	Padova	3,580,466	0.86	0.63
12	Reggio nell'Emilia	1,286,896	0.43	0.42	12	Bari	2,875,989	0.69	0.64
13	Prato	1,098,139	0.37	0.78	13	Brescia	2,779,153	0.67	0.56
14	Bolzano/ *Bozen*	1,092,651	0.36	0.22	14	Modena	2,261,385	0.54	0.42
15	Ravenna	1,033,683	0.34	0.24	15	Parma	2,142,369	0.52	0.43
16	Verona	995,549	0.33	0.34	16	Bergamo	2,094,611	0.50	0.40
17	Palermo	980,377	0.33	0.42	17	Reggio nell'Emilia	2,065,402	0.50	0.34
18	Padova	896,045	0.30	0.27	18	Catania	2,024,885	0.49	0.54
19	Bari	865,396	0.29	0.29	19	Bolzano/ *Bozen*	1,857,650	0.45	0.26
20	Forlì	852,646	0.28	0.23	20	Cagliari	1,799,192	0.43	0.43
	ITALY	**300,812,447**	**100.00**	**100.00**		**ITALY**	**415,101,662**	**100.00**	**100.00**

Source: Authors' processing of the Istat T-SBS Register data

In terms of labour productivity, shifts feature at the top of the ranking. With the exception of the first position, where the Municipality of Milano is confirmed, with productivity that exceeds the Italian average by one and a half times, the Municipality of Bolzano/*Bozen*, in second position, presents an equally considerable result (index number 151.3, with value added per employee of 68,9 thousand euros); followed by the Municipality of Siena (index number 132.0) and the Municipality of Brindisi, the only municipality in the South of Italy to rank first with a productivity value of 58,2 thousand (index number 127.7), before Roma, which stood at 57,1 thousand euros. At the bottom of the ranking

are the municipalities of the South and the Islands, as well as some capitals of the Centre (Fermo, Rieti, Viterbo, Grosseto, Prato, Macerata, Pistoia).

In terms of macroeconomic sectors, the performance of industry in the Municipality of Bolzano/*Bozen* stands out, with nominal labour productivity of 122,9 thousand euros, more than double the Italian average, followed by the Municipality of Pavia, which ranks second. It should also be noted that Brindisi's positive result is driven by the industrial sector, in particular the energy supply sector; it is the same sector that places the Municipality of Avellino in fifth position, between Milano and Roma. In the services sector, after Milano, which stands out with 67,2 thousand euros of value added per employee, the Municipality of Siena is positioned, characterised by productivity (55,8 thousand euros) mainly related to business services. The first capital of the South appears only at the 28th position: it is Naples, with an indicator value of 39,3 thousand euros, slightly lower than the national average (index number 99.3).

Looking at the totality of the municipalities, beyond the imbalance in the distribution of labour productivity values in favour of the northern area of the country, it is possible to identify some areas of particular interest (Table 5.3). In the Centre, the Municipality of Pomezia, characterised by a strong concentration of production activities linked to large multinational groups, stands out for a significant economic result in terms of both value added (1,8 billion) and productivity (58,2 thousand); equally significant is the figure for the Municipality of Fiumicino, which, especially by virtue of the presence of the airport, recorded 1,7 billion of value added with a productivity of almost 48 thousand euros. In the southern area, the municipalities of Melfi and Foggia have a pole of industrial units. In particular, as far as the manufacturing industry sector only, the performance of the Municipality of Melfi emerges, which stands out not only among those of the South: in the ranking of non-capital municipalities, it ranks second, with a value added of 863 million and a productivity of 92,4 thousand euros, behind the Municipality of Maranello, which is close to one billion in terms of value added (962 million) and has a nominal productivity value of more than three and a half times that of Italy (213,5 thousand). The South is also represented, in the first twenty positions, by the municipalities of Atessa (671 million of value added), Modugno (543 million) and Pomigliano d'Arco (515 million), where a large part of the value added is generated by the plants of large companies operating in the sectors of the manufacture of motor vehicles and other means of transport.

Pomigliano, in particular, differs in that its average labour productivity is lower than the national figure (an index number of 82.8). In Lazio, for the municipalities of Pomezia and Aprilia, the largest contribution to value added comes from the pharmaceutical sector. Tuscany is represented by the municipalities of Sesto Fiorentino and Scandicci, both supported by the economic results of the leather goods manufacturing sector. Of particular importance, finally, is the figure for the Municipality of Vado Ligure, which is characterised by a greater impact on the chemical sector's value added and, in terms of productivity, reaches a value 5 times higher than the national one (316,2 thousand).

Table 5.3 - Top 20 non-capital municipalities by value added in the manufacturing industry. Year 2015 (thousands of euros and percentage values)

Position in the overall ranking	Position in the ranking of non-capital municipalities	Municipality	Value added (in thousands of euros)	Value added per employee	
				Absolute values (in thousands of euros)	Index Italy number =100
11	1	Maranello	962,000	213,547	360.6
12	2	Melfi	863,225	92,402	156.0
14	3	Pomezia	822,561	94,892	160.2
16	4	Fiorano Modenese	779,615	84,669	143.0
17	5	Sesto San Giovanni	685,685	126,660	213.9
18	6	Sesto Fiorentino	673,880	100,270	169.3
19	7	Atessa	670,539	62,494	105.5
21	8	Aprilia	638,615	91,782	155.0
25	9	Agrate Brianza	598,921	81,189	137.1
26	10	Scandicci	564,900	62,088	104.8
27	11	Alba	554,937	103,769	175.2
29	12	Modugno	542,827	62,837	106.1
32	13	Pomigliano d'Arco	514,725	49,018	82.8
34	14	Schio	497,857	69,468	117.3
36	15	Imola	489,571	74,029	125.0
37	16	Cesena	485,966	60,355	101.9
39	17	Arzignano	471,082	65,808	111.1
41	18	Rivalta di Torino	443,914	115,879	195.7
43	19	Vado Ligure	440,581	316,205	534.0
44	20	Fabriano	439,914	70,710	119.4
		ITALY	**213,458,400**	**59,218**	**100.0**

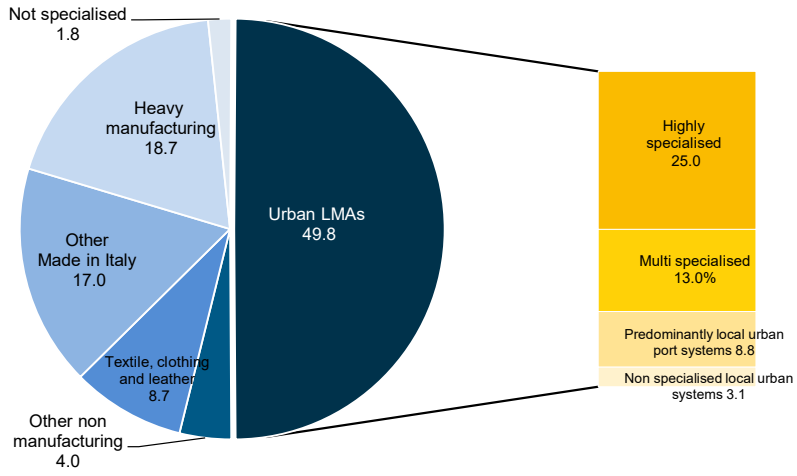
Source: Authors' processing of the Istat T-SBS Register data

5.3 Labour market areas (LMAs) analysis

Traditionally, regional sciences have made extensive use of LMAs as a unit of analysis, although, as noted above, employment has traditionally been the sole economic performance metric (Sforzi 2009; Lombardi and Sforzi 2016).

As for value added, the T-SBS Register provides interesting figures on the deep transformation underway in the Italian production system. In 2015, urban LMAs generated almost half (49,8%) of national value added in industry and non-financial services (Figure 5.1). In this category, the share of local units and employment is about 46%. Urban local systems with high specialisation play a crucial role in the national economy, realising 25% of overall value added (and 43% of service value added), followed by pluri-specialised ones (13%). At the same time, there is a strong polarisation around the LMAs of Milano and Roma. In line with the OECD (2020), the correlation between urbanisation and economic growth is evident in Italian metropolitan areas, where the economic role of commuting zones is crucial. Figure 5.1 shows that Made in Italy LMAs account for over a fourth of the national economy (textile, clothing, and leather at 8,7% and other Made in Italy specialisations at 17%), while heavy manufacturing accounts for less than a fifth (18,7%). In the former group, a significant share is covered by industrial districts, especially in the machinery, textile and clothing sectors. Finally, Made in Italy LMAs account for one-third of industrial value added and one-fifth of services, thus highlighting the territorial pattern of integration between manufacturing and services. Among Heavy Manufacturing LMAs, those specialised in the petrochemical and pharmaceutical industries realise 6,6% of overall value added.

Figure 5.1 - Value added by type of Labour Market Area. Year 2015 (percentage values)



Source: Authors' processing of the Istat T-SBS Register data

The availability of the T-SBS Register has revealed the growing developmental role of specific service sets by clarifying the relationship between service localisation patterns and the economic performance of LMAs. In particular, it highlights the role of a class of advanced services known as knowledge-intensive business services (KIBS) in empowering local manufacturing systems (Vendrell-Herrero and Wilson 2017; Lafuente et al. 2017). In 2015, KIBS employment accounted for 18,6% of overall national employment (Table 5.4). Overall, high-specialisation and pluri-specialised local urban systems have KIBS location quotients (LQ) greater than 1, indicating that employment in these LMAs exceeds the national average. This is evidence of local systems specialised in KIBS. An interesting result concerns another set of LMAs specialised in KIBS: the transport industry LMAs. However, all the Made in Italy LMAs, with the exception of those specialised in Jewels, glasses and musical instruments, have KIBS employment below the national average. This may hamper traditional manufacturing's ability to enter servitisation trajectories.

In terms of KIBS value-added generation, KIBS value-added is concentrated in urban specialised areas, which generate two-thirds of total KIBS value-added, though specific manufacturing systems also contribute. Among the above-mentioned specialisations (e.g., transport industries), the textile and clothing industries and the agro-food industries also exhibit embedded KIBS, generating a high level of value added. The proportion of KIBS value added to service activity value added offers some insight into the structural transformation of these LMAs. Figures show that the higher share is in local urban systems with high specialisation and in manufacturing LMAs specialised in transport industries, where KIBS also have the highest weight on total service value added. Moreover, Made in Italy LMAs, where KIBS employment accounts for a percentage of the total economy (14, 5%) lower than the national average (18, 6%), in fact generate increasing shares of service value added. This provides insight into how servitisation processes affect the Italian transformation process. Here, about 30% of service value added is generated by KIBS. This investigation allows the identification of the impact of different types of services on the structural redefinition of value creation. Moreover, even if urban areas seem to be a more favourable environment for KIBS location, specialisation is important for KIBS value creation. Finally, in line with recent servitisation literature (Vendrell-Herrero and Wilson, 2017), although urban areas are usually deemed the privileged location for KIBS, recent evidence

shows that the increasing demand for knowledge-intensive services is driven by firms in spatially clustered industries in non-urban areas. In this regard, Lombardi et al. (2022) demonstrate that KIBS have a positive effect on manufacturing performance in both urban and non- urban areas, with the magnitude varying depending on contextual factors, and highlight the role of education level in determining this positive effect. By and large, such figures give a precise idea of the extensive reconfiguration of production organisation and business fields' borders experienced by industrialised countries, where the current wave of digital technologies, often referred to as Industry 4.0 or "the Fourth Industrial Revolution" (Schwab 2016), has indeed opened renewed opportunities as well as threats for manufacturing areas and SMEs.

Table 5.4 - Employment in KIBS by LMA type. Year 2015 (percentage values) (a) (b)

Type of LMA	LQ of KIBS	KIBS Employees on total employment (% values)	KIBS value added distribution (%values)	KIBS value added on Services value added (%values)
Urban LMAs	-	22.7	66.1	40.6
Local urban systems with high specialisation	1.5	28.6	41.2	47.5
Multi-specialised local urban systems	1.1	19.5	13.7	35.7
Predominantly local urban port systems	1.0	17.7	8.5	30.3
Non-specialised local urban systems	0.9	17.2	2.7	27.6
Other non- manufacturing systems	-	11.8	2.1	17.3
Tourist local systems	0.6	11.8	1.6	17.2
Agricultural vocation	0.6	11.7	0.5	17.7
Manufacturing - Made in Italy systems	-	14.5	16.2	29.2
Textile and clothing industries	0.8	14.8	3.7	30.1
Hides and leather industries	0.7	12.8	1.6	26.1
Machine manufacturing industries	0.8	14.7	4.0	31.6
Wood and furniture industries	0.8	15.3	3.1	30.4
Agro-food industries	0.8	14.3	2.8	26.0
Jewels, glasses and musical instruments	0.8	15.2	1.0	29.4
Heavy manufacturing systems	-	17.2	14.8	35.3
Local systems of transport industries	1.1	21.0	6.3	44.1
Metals production and processing	0.8	15.0	3.2	31.3
Construction materials industries	0.7	12.7	0.7	23.6
Petrochemical and pharmaceutical industries	0.9	16.9	4.6	31.8
Non-specialised local systems	0.6	11.4	0.9	18.4
ITALY	**1.0**	**18.6**	**100.0**	**36.1**

Source: Authors' processing of the Istat T-SBS Register data

(a) Service sectors include the following NACE Rev. 2 sections: "H", "I", "J", "L", "M", "N", "P", "Q", "R", "S",

(b) NACE codes for KIBS follow the territorial servitisation literature, which applies the Wong and He (2005) classification to identify economic activities that could be classified as services and are relevant to manufacturing companies. They establish the North American Industry Classification System (NAICS) codes relevant to servitisation theory. These codes are linked to the following economic activities: (1) IT and related services; (2) engineering and technical services; and (3) business and management consulting. See Lombardi et al. (2022) for the complete list, transcoded into NACE Rev.2 codes.

6. Concluding remarks

This paper has shown that, before the implementation of the T-SBS Register, estimates of value added at the local unit level were produced using a top-down method, in which the enterprise's value added was distributed pro quota to estimate the value added of each local unit. For enterprises responding to the survey on the economic accounts of large enterprises, the distribution was based on the functional regional unit distribution of labour costs; for those not responding, it was based on the distribution per local unit of the number of employees, taken from the BR-LU. By contrast, the methodology proposed here introduces innovations that greatly improve compliance with the requirements of the European Regulation, enhance the consistency of micro- and macro-level information on business structures, enrich the territorial detail of information available on businesses and local units, and increase analytical and interpretative potential. The exercise conducted to calculate and analyse value added and productivity at the municipal level - beyond the results obtained, which are of great interest and provide interesting research prospects - is an in vivo example of the potential offered by the new method of "punctual" (i.e., micro) estimation of value added at the finest territorial level.

Implications for research and practice are wide-ranging. The T-SBS register has already contributed to monitoring the effects of the COVID-19 pandemic, as territorial-level economic indicators now provide the most accurate data for analysing these effects (Istat 2020). Most importantly, the tool for interpreting reaction trajectories at the subnational level (Istat, 2021) and the emerging role of cities in the post-COVID era are notable (Armenise and Viesti 2021). Hence, business statistics at the territorial level can be of great use in policy-making, where workplace geography has attracted renewed attention (Faramondi et al. 2022; Franconi et al. 2017).

Finally, some directions for future research are needed. The T-SBS Register was deliberately conceived to improve the provision of data on business indicators by official statistics, with greater territorial granularity, thereby marking a difference from previous territorial microdata. It is a powerful tool for studying economic change through territorial-level analysis. In fact, this provision has improved academic research on the Italian landscape, identifying trajectories and sectors that are intertwined with local economies at different levels. Future research should strengthen collaboration with the

national government and local institutions to develop business indicators to inform the design of targeted industrial policies that, more generally, address issues of local development.

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