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SMALL AND MEDIUM-SIZED CITIES: ENDOGENOUS OR EXOGENOUS DEVELOPMENT TRAJECTORIES?

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ABSTRACT

The issue of small and medium-sized cities (SMCs) is a topic which, with a few exceptions, has until now not received the attention it deserves, both in the academic and public policy debates. The recent draft opinion of the Commission for Territorial Cohesion "Towards an Integrated Urban Agenda for the EU" may represent a turning point in this view. Hosting nearly forty percent of the EU total population, SMCs are supposed to contribute to a more balanced territorial distribution of economic activities as well as to improve regional innovation potential. This topic is crucial for Italy, where the urban and productive fabric related to SMCs is remarkable and widespread across the entire national territory. This paper aims at assessing what opportunities and risks follow for SMCs from the entry into the knowledge economy. After having introduced this issue in the first Section, Section 2 reassesses the interplay between agglomeration economies and diseconomies in the knowledge economy by taking a hermeneutical viewpoint on the knowledge itself. A set of hypotheses on the role SMCs can play in this new condition is put forward in Section 3. An empirical analysis follows on the Italian case to test the consistency of the above hypotheses. Finally, Section 5 will draw conclusions and suggestions for policies.

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1. Introduction

Until transport/transmission costs exist, there is room for agglomeration economies and, therefore, for urban agglomerations to last. This does not entail however that all agglomerations are equal in size or that a certain urban configuration, once formed, is not subject to exogenous or endogenous stresses. As the presence of different techno-economic thresholds in human activities explains the establishment of a hierarchy within urban agglomerations, a technological change has effects on both the magnitude of techno-economic thresholds in the various sectors and therefore on the nature and strength of agglomeration economies. If cumulative processes are also at work within agglomeration economies, polarisation phenomena come into play in urban geography, whose outcomes range between the two extreme conditions of only one megacity and an undifferentiated sprawled settlement, depending on the direction of the cumulative forces.

The current concern for Small and Medium-sized Cities (SMCs) rises precisely within the above sketched frame. If, with the transition from the industrial and post-industrial economy to the so-called knowledge economy, techno-economic thresholds rise, transport/transmission cost lessen and cumulative effects come importantly into being, the role (rather than the mere presence), SMCs play within the main value chain turns out to be at risk. The fact that, on those occasions, SMCs can survive as interstitial, ancillary if not marginal realities beside/below a few leading urban entities or within a sprawled human geography is a wholly different thing than if they work as an essential socio-spatial device within the driving economic process.

Analysing these issues is the aim of this paper. After having outlined, in the next section, a theoretical frame about the forces that affect, in general, the SMCs' role, attention will be directed on ascertaining the opportunities and risks of the advent of the knowledge economy. An empirical analysis on the Italian case will be successively carried on, to test hypotheses that have emerged on the theoretical level. Suggestions for policies will finally follow.

2. SMCs: the weak link in urban geography?

The relatively recent interest and concern for SMCs (one for all, ESPON, 2006) would have been perceived as irrelevant to the authors of the most elegant models in urban geography within, respectively, the classical and the neoclassical schools of economic thought, Richard Cantillon (1680s-1734)[3] and Walter Christaller (1893-1969). Though starting from very

[3] It does not seem unworthy remembering that Stanley Jevons defined Cantillon's *Essai* (1755) as "*the first treatise in economics*" (Jevons, 1905, p. 165; emphasis original) and Friedrich von Hayek described him as "the

different theoretical premises – distributive effectiveness of the social product, the one, and optimal allocation of given resources, the other − they not only provided urban geography with a consistent economic rationale[4], but shared a common view on intermediate urban agglomerations. According to them, SMCs are a 'natural' category within urban geography, in that their presence stems from the normal working of the market forces and is serviceable for it. No concern would therefore rise about their current and future role, being both secured by the market mechanisms.

The common limit of those approaches plainly lies in the stationary and static views the two authors respectively took in outlining their models of urban geography. According to Cantillon, who wrote before the first industrial revolution, no technological progress systematically occurs within an agriculture-based economy, but only sporadic and marginal innovations. On his part, Christaller, who wrote at the beginning of the Fordist era, adhered to such an extent to the neoclassical model to have neutralised any reference to endogenous innovation processes (thus neglecting, together with many others, the contemporary Schumpeterian lesson). The insertion of dynamic elements which can have effects on transport costs, technical thresholds and scale and agglomeration economies, puts clearly into stress those elegant and somehow idyllic constructions, but not necessarily the presence and role of SMCs. Except in case of amazing cumulative effects room remains also for them.

A more attentive examination of Cantillon's urban geography reveals however that SMCs are placed in a weak condition, also within his original stationary view. Unlike smallest and biggest urban agglomerations (i.e. villages and cities), which turn out to be structural components of the entire socio-economic and spatial fabric, SMCs actually appear to play only a functional role, with the consequence that, not so much their presence, but participation in the maintenance of that fabric, though useful, is not essential. The difference is crucial because taking part in the main value chain in a structural or only a functional way means having or not a bargaining power (be it of a political or economic kind) in front of competitors.

The question then arises if, with the advent of an innovation/knowledge-led economy, SMCs are particularly exposed to the risk of losing importance within the main value chain (which is represented by the system of innovation/knowledge-intensive activities). Before dealing with this question, it may be helpful to look into detail at Cantillon's rationale for urban geography, in order to recognise the analytical root of the weak condition of SMCs within the urban hierarchy.

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first person who succeeded in penetrating and presenting to us almost the entire field which we now call economics" (quoted in Rothbard, 1995, p. 345).

[4] Other approaches to urban geography are, of course, and especially to urban hierarchy, the most famous among which is Zipf (1949) (for a review, Fonseca, 1988). Their distinguishing trait is however the stochastic method they make use of, with respect to the deductive method of the two approaches we quote in the text.

2.1. SMCs in Cantillon's urban geography

Richard Cantillon, who died shortly before the first industrial revolution, opened his *Essai* (1755) stating that the material cause of value is the Earth, while Humans are its efficient cause: "The Land is the Source or Matter from whence all Wealth is produced. The Labour of man is the Form which produces it" (p. 3). The entire urban geography he portrays a few pages later is admirably consistent with this basic premise. Villages are the elementary component, not only of urban geography, but of the entire socio-spatial fabric. They allow (the only) wealth producers – the "Farmers or Labourers" (ibid., p. 9) – to meet their needs for both living together (this is matter of agglomeration economies) and having easy recourse to services for agriculture, such as "Farriers and Wheelwrights for the Instruments, Ploughs, and Carts" (ibid.) (which is also matter for scale economies). After having paid the rent to the Landlords, the farmers spent the remaining surplus on buying other basic goods in markets established in some intermediary urban agglomerations – the *bourgs*– "by the Interest of some Proprietor or Gentleman at Court" (ibid., p. 11), where some minor landowners also dwell and other services for agriculture can be found. Landlords "who have several large estates have the means [coming from rents] to go and live at a distance from them to enjoy agreeable society with other Landowners and Gentlemen of the same condition" (ibid., pp. 13-15) (hedonic economies also come into play), thus giving birth to the city. Finally, the city where the Eminent Landowner – the Sovereign –resides and from which s/he draws rents and levies from the entire Kingdom, is the capital city.

As a consequence a whole urban hierarchy takes shape as the natural and necessary outcome of combining agricultural surplus, private land property and agglomeration economies. Transport cost too influence this urban geography, firstly because farmers must dwell close to the land they cultivate, "otherwise the time taken in going to their Field and returning to their Houses would take up too much of the day" (ibid., p. 9), but also because the pleasure or need to live close to each other rapidly lessen with distance.

Whilst in this portrayal both villages and the city play an irreplaceable structural role in social reproduction, the intermediary category of *bourgs* plays only an integrative role. They actually work as a merely functional device in both the circulation of that part of surplus that remains at the farmers' disposal and the productive process (agriculture), being the suitable place for those services that, due to their scale, do not find profitable location within villages. Said differently, SMCs contribute to the efficiency, but not the effectiveness of the socio-economic system, which would be still capable of working without the SMCs, even if at a lesser efficiency level. The obvious question, therefore, is whether this unstable condition continues to characterise SMCs in the industrial and knowledge economies.

2.2. SMCs in the industrial economy

Answering the above question requires first of all the updating of Cantillon's model hypotheses. Western countries have long left aside the traditional agriculture-based economy Cantillon referred to[5], inside which all social affairs (urban geography included) are subject to the inflexible law of a fixed proportion between land product[6] and population (Barucci, 1987; Spengler, 2013). The entry into the industrial era meant initially that recourse to (then reputed) inexhaustible energy sources and prospects for unlimited technological progress became possible, thus allowing western societies to (believe to) have become free from the Malthusian constraint.

The consequences on Cantillon's urban geography are important. First, it loses its stationary image, because population began to grow faster, along with economic growth. Second, manufacture need for large masses of workers and their inedited density per unit of productive surface (especially with respect to agriculture), along with high commuting costs, induced industrial plants to locate within urban agglomerations, thus draining important amounts of people from the countryside and also intermediate towns. In this context, a polarised urban geography would have risen rapidly, with a few industrialised cities, on the one hand, and a handful of villages scattered on the countryside (or abroad), on the other hand, to provide cities with necessary foodstuffs. Intermediate towns, if any, would have served as mere market-*relais* between industrial cities and villages, without playing any substantial part in the industrial chain.

It was the interplay between agglomeration economies and diseconomies to provide SMCs with a substantial role within the industrial era, which was also steadier than before, for at least two reasons. First, because such an interplay puts an upper limit to city growth (Richardson, 1978) and, second, because the presence of different techno-economic thresholds and slopes in agglomeration economies and diseconomies among sectors gives rise to a multi-level urban structure (Camagni et al., 2013). As a consequence, an optimal spatial configuration could be conceived in the industrial era, within which an entire if not "infinite" (ibid.) range of urban-size levels naturally takes shape.

Within such a frame, SMCs would work only on the functional level, similarly to what it happens in the Cantillon's approach: they contribute to enhance the system's efficiency, but without providing it with 'something' essential on the structural level. What has really happened in the industrial era has been however that SMCs, as a category, have turned out to be a crucial device in mobilising social and relational capital within local productive systems,

[5] Another much more disputable question is if contemporary western economies have left aside also mercantilism, the other pillar of Cantillon's approach. Reference to Keynes' (1936) Chapter 23 "Notes on Mercantilism, the Usury Laws, Stamped Money, and Theories of Under-Consumption" is compulsory about this issue. See also Hettne (1993).

[6] More precisely, land extension, according to Cantillon, given the absence of any systematic technical progress.

such as those Alfred Marshall and Giacomo Becattini described as “Industrial Districts”. It is indeed within the urban context that a local specific and shared system of values and ways of seeing things takes shape and, what is more important, is institutionalised and evolves. This means that, if one, SMCs play a structural role as regards “un-sizeable” rather than “sizeable” agglomeration economies.

It is therefore towards the failing of at least one of the above mentioned conditions (significant transport/transmission costs, differences in techno-economic thresholds among sectors and absence of cumulative agglomeration economies, weight of un-sizeable agglomeration economies) that the analysis must be orientated to ascertain if SMCs as a category run the risk of being set aside from the main value chain in passing from an industrial to a knowledge-based economy. By making a general exploration on such conditions separately, it becomes possible to argue preliminarily that:

a) as regards techno-economic thresholds, it is not possible to reject a priori the hypothesis that SMCs will become less important within the dominant value chain. Whilst the presence of a unique high threshold among sectors it is hardly conceivable in a condition of ever more frequent innovation and consequent specialisation, it cannot be excluded that, at the other extreme, thresholds importantly lessen within the knowledge-intensive sector;
b) higher risks may come from diminishing transmission (rather than transportation) costs. Remembering that “If there really were no transport costs, it is certainly true that agglomeration economies could not exist” (Glaeser, Kohlhase, 2004, p. 213),their zeroing would give rise to an undifferentiated sprawled human geography, inside which residual differences in settlement sizes are only due to differences in techno-economic thresholds among sectors;
c) important risks for SMCs can come from the working of cumulative (or, hypothetically de-cumulative) forces in agglomeration economies which would push cities to grow (to decline) without limits, at the detriment of the remaining urban entities;
d) un-sizeable elements are taking rising importance within the knowledge economy, a condition which works at the SMCs’ advantage.

The next Section is devoted to deal with these issues.

3. SMCs in the knowledge economy

3.1. The knowledge economy

This paper is not the suitable place to start or further develop a discussion about the nature of knowledge and the knowledge economy[7]. Some key points must be recalled however, to make clear enough our viewpoint with respect to the current debate, especially within economics:

a) knowledge has to do with both data and information, but confusion between the two terms is highly misleading. Data are pure emergences – differences – within/respect to a certain context, independently on the fact that they are perceived or not: "A datum is a putative fact regarding some difference or lack of uniformity within some context" (Floridi, 2014, sec. 1.3). As the term etymologically means, data exist per se, and the only intrinsic information they convey consists in the probability about their factual occurrence. This formal coincidence lies at the basis of the con-fusion the informational theory legitimately makes between the two terms after Shannon, but lies at the basis of a similar confusion other disciplines (mainly economics) unreflectively (and illegitimately) draw from it (despite Shannon's warnings);

b) on the pragmatical plane, on which knowledge anyway lies on, 'information' takes a wider meaning than the just above 'informational' one, which relates to the mental act of establishing logical relationships between data, from which meanings arise. In this view, information is the 'logical quotient' stemming from that established relationship. It follows that, unlike data, information does not exist per se, but is the outcome of a mental construction[8];

c) consequently, knowledge does not merely consists in data collecting, but in establishing relationships between built information, thus giving them steadiness within mind. On this view, knowledge does not accumulate (as many economists maintain; for example, Romer, 1986; Lucas, 1988), but articulates. This does not exclude that knowledge articulation has cumulative effects, in terms of rising cognitive marginal returns, but confusion between the two processes obscures the significance of learning;

[7] For more detailed discussions we repute consistent with our approach, see Alvesson (1993, 2001), Cusinato (2014).

[8] The just above recalled informational approach to data actually obeys itself too to this rule, in that it implies comparison between probabilities of different 'emergences'.

d) consequently again, learning does not consists in knowledge accumulation, but in the faculty of consciously dealing with knowledge. This leads to the ranking Bateson (1972) put forward for learning, we resume in the following table:

Table 1. Learning levels and related abilities

Learning level	Logical abilities	Knowledge content	Learning abilities
0	$a \begin{matrix} b \\ c \end{matrix} \neg a \neg b$	Unrelated notions	No intelligence
1	$A = \{a, \neg a\}$	Information building	Knowledge
2	$A_i = \{a, \overline{a}_i\}$	Contextualisation of $\neg a$ with respect to a wider set of possibilities $\overline{a}_i$	Knowledge governance/ Creativity
3	$A = \{A_i, \overline{A}_i\}$	Contextualisation of A_i with respect to a wider set of possibilities $\overline{A}_i$	Creativity governance
4 (?)	…	…	…

At the lowest level, Learning zero, no kind of contextualisation occurs. Every experience/notion a, b, c etc., or else ¬a, ¬b, ¬c etc., is singularly lived and impossible to connect to other experiences/notions. At this stage, there is experience without intelligence (and therefore without knowledge). At the Learning 1level, subjects become able to re-cognise data by contextualising them with respect to their respective negation. This allows them to give notions steadiness by means of the double negation ¬(¬a)=a (Piaget, 1954), and thus building information. As regards Learning 2, it differs from Learning 1 in that it entails an act of reflection on Learning 1 processes. Subjects learn to contextualise the specific way by which they build information, by including ¬a into a wider set of possible others contingencies, i.e. a possible complementary set $\overline{a}_i$ to a. Creativity precisely stems at this learning stage, because the choice of the complementary set $\overline{a}_i$ to a is a contingent affair (how many, if not infinite, different sets $\overline{a}_i$ among the possible n can actually be conceived?). Learning 3, which Bateson argues is a very difficult exercise to accomplish and to observe in practice, finally appears when subjects learn to contextualise the specific way by which they contextualise the way(s) they mentally relate to the external world. Becoming able to wield this kind of learning means having access to the matrix of creativity, thus opening the door to shape related attitudes.

With reference to this interpretative frame about knowledge, the knowledge economy cannot be defined anymore as that techno-economic paradigm which is characterised by previously unknown and increasing recourse to knowledge (Machlup, 1962; Drucker, 1968, to quote only the pioneers). Considering that every rational activity implies recourse to knowledge[9],

[9] Jean-Baptiste Say (1803) significantly observed that knowledge is the basic resource for entrepreneurship, by writing that "... the cultivator, the manufacturer, the trader, make in their business to turn to profit the knowledge

and that economy, and especially industry, make systematic and increasing recourse to deliberately 'built' knowledge since the second industrial revolution, that approach would only mean that the entering into the knowledge economy marks the fact that analytical-symbolic activities (Reich, 1992) concur for the most part to GDP formation or total employment (OECD, 1996; Foray, 2000). Though undisputable, this depiction is reductive, if not banal, in that it masks the circumstance that a qualitative rather than quantitative change has occurred in the cognitive praxes within industry in the meantime, as Florida and Kenney (1993) and Gibbons et al. (1994) almost contemporarily maintained in portraying the transition from a solipsistic towards a relational way of learning (from Mode 1 to Mode 2, in the Gibbons' et al. lexicon). The true substance of this qualitative change is however thicker than that these authors referred.

Somehow paradoxically, the advent of ICTs and the connected amazing recourse to codified knowledge and monological communication it made possible (to which the conventional reading substantially refers to in conceptualising the knowledge economy), enhanced the recourse to pragmatical knowledge and dialogical communication within industry (Mode 2) and, more generally, science-based activities. Recourse to the above Bateson's ranking makes it possible to give the anodyne term 'Mode 2' more thickness, by acknowledging that Learning 2and 3 practices are indeed at stake in that connection (Nonaka, Takeuchi, 1995)[10], in order to handle creative attitudes (Cusinato, 2014). This makes it possible to put forward that the distinguishing feature of the knowledge economy is deliberate adoption of Learning 3 practices by industry as the core strategy to handle creativity, beyond/beside all-pervading recourse to codified knowledge and monological communication[11].

3.2. Opportunities and threats for SMCs

Having defined the knowledge economy as characterised by systematic recourse to dialogical practices beyond/besides the monological ones, questions arise about the effects this trend has on agglomeration economies, due to changes in techno-economic thresholds, transportation and/or transmission costs and cumulative effects. Though these aspects are intertwined, it

already acquired, and apply it to the satisfaction of human wants" (pp. 55 of the reprinted version, 1821). So, the idea that economy is a knowledge-based activity dates back to almost two centuries ago. As far as I know, no other eminent economist, either John Smith, had previously established a so explicit link between the entrepreneur's figure and knowledge.

[10] For the sake of truth, Nonaka and Takeuchi (1995) spoke only about the adoption of *Learning 2* practices by enterprises, though in our opinion it is also matter of *Learning 3* because, in the same authors' words, they consist in "establishing *new premises* (i.e., paradigms, schemata, mental models, or perspectives) to override the existing ones" (p. 44; emphasis added).

[11] This interpretation of the knowledge economy is consistent with Alvesson (1993, 2001). According to him, knowledge-intensive organisations do not characterise because of higher recourse to codified knowledge, but systematic recourse to rhetorical practices, to such an extent to nurture myths about their competence and reliability of their 'products'. And what is rhetoric if not but the art of moulding others' (and also one's own) cognitive attitudes, i.e. practicing *Learning 3*?

seems convenient to start with some distinct remarks. As regards techno-economic thresholds, contrasting forces are at work, so that univocal trends are hardly conceivable. On the one side, the practical zeroing of transmission marginal costs of codified information allows enterprises to command and control routinised production phases at distance in real time, thus making segmentation possible of previously unitary processes, along with their relocation all around the world. The coupling automation/flexibility contributes also to the lessening of production thresholds towards the inferior limit represented by plants technical indivisibility. Furthermore, the separation which takes place within industry between monological and dialogical communication circuits eases the ex-novo formation or outsourcing of specialised knowledge-intensive activities (KIS), having low if not negligible techno-economic thresholds. As we shall see in section 4 of this paper, contrasting consequences descend from the circumstance that KIS work in a networked way and, for some of them, in conditions of physical proximity, so that thresholds can rise at the level of KIS systems rather than KIS themselves, individually considered. Moreover, since the global informational network requires important infrastructures and nodes, big dedicated plants are expected to emerge though, from a pure technical viewpoint, they do not necessarily locate in urban contexts. Facing this multifaceted prospect, no univocal threat or opportunity trend for SMCs stems from evolutions in techno-economic thresholds. As announced in the previous section, higher opportunities or risks come from changes in transportation/transmission costs.

Progresses in transportation infrastructures and techniques along with advancements in logistics have importantly lessened the transport cost of material items in the last two centuries[12.] If this trend will last in the future, threats for urban agglomerations cannot be excluded, especially when it matches with lower technical thresholds, as the not infrequent and not insignificant situations of urban sprawl (concerning both dwelling and industry) show in advanced countries (Richardson, Bae, 2004; Couch et al., 2008).Doubts remain however about the possibility that such a trend will cause the "death of distance" Cairncross (2001) forecasted, essentially because transport costs do not lessen at the same pace in all sectors. As for material items, we are actually in the presence of rising congestion costs, especially in roads and maritime ports, prospects of rising fuel prices (at least until oil remains the main fuel for automotives) (Hummels, 2007; Fender, Pierce, 2012) and rising security costs, in particular as regards people mobility (Glaeser, Kohlhase, 2004). With reference to immaterial items[13], unitary transmission costs of codified information are, on the contrary, rapidly lessening, to such apace to induce someone to foresee the close coming up of a Zero Marginal Cost Society (Rifkin, 2014).

[12] Glaeser, Kohlhase (2004) estimate that the average cost of moving a ton a mile in the US has dropped about 90 percent in real terms from 1890 to 2001.

[13] Rigorously speaking, informational 'bits' are material items, but due to their infinitesimal mass it is possible to assimilate them to immaterial entities.

Noticing further that codified information is taking importance within the economic system (and society at large) at a previously unknown level, and that amountsof 'moved information' are increasing at an amazing pace with respect to moves of material items[14], some scholars and opinion makers forecasted the "death of cities" beyond that of distance, if not else but as regards their capacity of playing a significant role within the main value chain (Toffler, 1980; Pascal, 1987; Gilder, 1995, 2000; Drucker, 1998; for discussions, Graham, Marvin, 1996; Kolko, 2000). At best, according to these views, cities would remain mere consumer devices (Glaeser et al., 2001), and maybe places for some important infrastructural nodes (though it is not certain that they prefer urban location).

There is another immaterial good, however, which, unlike bits of codified information, is not physically countable, but which has become crucial within an innovation-led economy, this good being tacit knowledge and, specifically, its part intervening within Learning 2-3 practices. It follows that, inasmuch as (a) this kind of learning practices is gaining strategic room within the economic system, (b) it requires a dialogical context and (c) dialogue suffers from physical distance among the parties involved − not so much because it becomes impossible (Cristea, 2014), but because it lacks some important factors, such as body language, emotional involvement and fair reciprocation (Boden, Molotch, 1991; Bayles, 2012; Cusinato, 2014) – agglomeration economies continue to matter within a knowledge-led economy. According to this line of thought, someone else notes that also infrastructural nodes "disproportionately [locate] in the largest metropolitan regions [... because they] are vital, not passive, technical aspects of networks" (Gorman, 2002, p. 526): their design and management actually need for dense, continual and overall evolutionary interactions among global players and recourse to wide and composite teams of high-skilled professionals and services.

The question rises about the rank of cities remaining involved in that play. According to Saskia Sassen(2001), a process of polarisation in the urban geography is taking shape at the world level. A very few "global cities" are monopolising the strategic functions, while only selected second-order cities can play subsidiary roles thanks to differences in thresholds among services, and the remaining and most part (SMCs, *in primis*) would lie bounded within a local-dependent condition. If any, according to Forman et al. (2005), they can play the role of market places for ICT furniture and services to the 'industrial countryside' and people in general, similarly to what Cantillon devised for *bourgs* in an agriculture-based economy, without having however any determinant part within the strategic net.

As suggested above, the main threats for SMCs come from the working of cumulative processes within agglomeration economies, be them of a Marshallian or Jacobsian kind (Jacobs, 1961). The basic hypothesis is that both kinds of processes are at work in a

[14] Whilst, for example, total inland freight of material items and passengers almost doubled between 1970 and 2009 in the EU(26) (OECD/ITF, 2012), the monthly global internet traffic increased from 0.001 to 20,634 petabytes (1 petabyte = 10^{15} bytes) between 1990 and 2011 (Source:www.Cisco.com, "Visual networking Index").

knowledge-led economy. A key point of economists who deal with knowledge refers to its cumulative character (basically, Romer, 1986; Lucas, 1988) is that, the higher the attained cognitive stage, the wider the possibility to gain new relevant knowledge. Though disagreeing with this informational approach, it is hardly disputable that advancements in knowledge articulation (rather than accumulation) provide subjects with ever more fine-tuned abilities to build (rather than collect) new information, at least within a certain techno-economic paradigm[15]. Moreover, considering that higher sophisticated forms of learning (like Learning 2 and 3) are intrinsically relational affairs, rising barriers are expected to form against the entry of competitors into specialised knowledge-intensive circles or "clubs"[16] of workers, organisations and businesses. The ceaseless cognitive evolution that takes shape inside those circles, along with the formation of a common pool of tacit knowledge and shared conventions in socialising and externalising it[17], actually entail possessing context-specific and evolving competences, which can be got only through co-optation and training. Insofar as these competences articulate and refine within and through those same circles, also increasing scale economies appear at the level of, not so much single operative units, but circles themselves. Tendencies towards spatial agglomeration have therefore to be expected in knowledge-intensive activities, at increasing paces with the rising of the learning level at which they operate. Finally remembering that creative learning takes great advantage from being located within heterogeneous and vivid contexts, such as, essentially, urban milieus (Cusinato, 2007), not only Marshallian but also Jacobsian agglomeration economies are importantly at work in the knowledge domain (Doloreux, Shearmur, 2010). These cumulative tendencies do not plainly work at the SMCs' benefit.

In our opinion, prospects for SMCs are more open to opportunities than the above depiction suggests, in that differences in the optimal scale within circles of knowledge-intensive activities can be supposed to subsist, especially with respect to the need for proximity to local industrial systems, and especially Small and Medium-sized Enterprises (SMEs). If so, SMCs can act as proactive socio-economic devices which concur to enhance (i) interpretative (rather than merely 'absorptive'[18]) capacities of local players with respect to external knowledge and stimuli; (ii) attitudes towards creativeness and innovativeness and (iii) producers' abilities to become price-setters in the global market. These opportunities are particularly important in local systems where SMEs play a major role, because of their difficulty to make indoor research and directly relate to the global market. The flourishing of variously labelled systems of knowledge-intensive services, especially within cities, seems to meet those needs, but the question remains still open if also SMCs are (or can be) involved in this process. Answers

[15] Scientific revolutions and, more widely, cultural change actually make rapidly obsolete the till then 'accumulated' knowledge.
[16] Cf. Steiner, Ploder (2008); Wink (2009).
[17] Reference is here to Nonaka and Takeuchi's (1995) "knowledge spiral".
[18] Reference clearly is to Cohen, Levinthal (1990).

mainly depend on the actual presence of different thresholds and the presence and ways of working of cumulative agglomeration economies in local knowledge-led systems (cf. Drejer, Vinding, 2005). Let us then set up the methodological premises to investigate this issue on the empirical ground.

3.3. A methodological frame for empirical investigation

The above discussion has led to argue that the main threats for SMCs in a knowledge-led economy originate from the presence of cumulative processes, through increasing marginal returns in both industrial (Marshall) and urban (Jacobs) agglomeration economies. In this sub-section a methodological toolbox will be established to test such a general hypothesis on empirical grounds (§ 4). Bearing in mind that knowledge-intensive activities are not defined here by the incorporation of a higher quantity of knowledge/information respect to other economic activities but by the recourse to a more sophisticated quality of learning (Table 1), the first methodological step is to classify activities according to this criterion. More specifically, we consider as knowledge-intensive activities those businesses, organisations and companies which make ordinarily recourse to Learning 2-3 practices in order to enhance creativeness and attitudes towards creativity governance. Though many manufacturing and service activities can comply with this criterion, knowledge-intensive manufactures cannot be practically identified within the current statistical classification of economic activities (NACE) because of its product-oriented rather than process-oriented approach[19]. This problem is quite less constraining however when only services are taken into consideration, because of a stricter correspondence between their outcomes (on the basis of which they are statistically classified) and the processes they make recourse to. In Compagnucci, Cusinato (2011) and Cusinato, Philippopoulos-Mihalopoulos (2014) such a criterion has been utilized with encouragingoutcomes in terms of heuristic power, in comparison with the results obtained by more usual classifications, mainly KIBS classification (Miles et al., 1995), which suffer from an (anyhow admitted) informational-cognitivist approach.

According to the proposed approach, the notion of 'Knowledge-creating Services – KCS' is established, as referring to those service activities which are reputed to make systematic recourse to Learning 2-3practices. Given their relation-based nature, they can be considered as systems, within which different sub-classes at different learning levels may co-exist and interact. Three main categories of KCS have thus been identified :

- *Core KCS*: services whose core activity consists in or presupposes recourse to Learning 2-3 practices;

[19] This problem was first pointed out by Machlup (1962), with specific reference to the notion of "knowledge industry" he established.

- *Core-related KCS*: services whose core-activity consists in knowledge application (Learning 1), but which are indirectly part of Learning 2-3practices through systematic interaction with Core KCS;
- *Collateral Activities to KCS*: Service or manufacturing activities working at the Learning 1 level but which support the above categories.

A subordinate distinction is also made inside the first two categories, between the public and private sectors, depending on whether the services normally work in the market or not. A more detailed frame is further possible within Private Core KCS, by drawing from Asheim et al. (2010) the distinction into 'analytical' (science based), 'synthetic' (engineering and customer/supplier relationships-based based) and 'symbolic' (arts based)knowledge base they normally make recourse to. With reference to the Ateco 91 nomenclature of economic activities (the Italian version of NACE Rev.1), KCS are finally classified in Table 2:

Table 2. KCS classification

Ateco 91	Economic activity	Asheim	Ateco 91	Economic activity	Asheim
Private Core KCS					
22110	Publishing of books	Symbolic	74145	Public relations	Synthetic
22120	Publishing of newspapers	Symbolic	74201	Architectural activities	Symbolic
22130	Publishing of journals and periodicals	Symbolic	74202	Engineering activities	Synthetic
22140	Publishing of sound recordings	Symbolic	74204	Aerial photogrammetry and cartography activities	Synthetic
72100	Hardware consultancy	Synthetic	74401	Advertising	Symbolic
72200	Software consultancy	Synthetic	74811	Photographic activities	Symbolic
72601	Telematic, robotics, eidomatic activities	Synthetic	74813	Aerial cinematography activities	Synthetic
72602	Other computer related activities	Synthetic	74845	Design activities	Synthetic
73100	Research and experimental development on natural sciences and engineering	Analytical	73200	Research and experimental development on social sciences and humanities	Analytical
91111	Activities of business and employers' organizations	Symbolic	91112	Economic organisations	Synthetic
74111	Legal activities	Synthetic	91120	Activities of professional organizations	Synthetic
74112	Notarial activities	Synthetic	91200	Activities of trade unions	Synthetic
74122	Auditing activities	Synthetic	91320	Activities of political organizations	Synthetic
74130	Market research and public opinion polling	Synthetic	92110	Motion picture and video production	Synthetic
74141	Financial consultancy	Synthetic	92200	Radio and television activities	Symbolic
74142	Labour consultancy	Synthetic	92310	Artistic and literary creation and interpretation	Symbolic
74143	Agrarian consultancy	Synthetic	92400	News agency activities	Symbolic
74144	Business and management consultancy activities	Synthetic			
Private Core-related KCS					
63302	Activities of tourists guides		74206	Other technical activities	
72300	Data processing, hosting and related activities		74302	Quality checking and labelling	
72400	Database activities		74500	Activities of employment placement agencies	
74121	Accounting, book-keeping and auditing activities; tax consultancy		74831	Organisation of conventions and trade shows	
74123	Management of human resources		74833	Translation and interpretation activities	
74146	Information service activities		74846	Other service activities	
74150	Activities of holding companies		80422	Other education activities	
74203	Integrated engineering activities		92320	Operation of arts facilities	
Public Core KCS					
80301	Higher education - undergraduated courses		92510	Library and archives activities	
80302	Higher education - master courses		92520	Museums activities and preservation of historical sites and buildings	
80303	Higher education - specific training schools and centres		99000	Extra-territorial organizations and bodies	
85114	University hospitals				
Public Core-related KCS					
75132	Activities related to agricultural activities, forestry, hunting and fishing		75133	Activities related to mining, manufacturing; construction of public engineering projects	
75121	Regulation of the activities of agencies that provide health care		75134	Activities related to the construction of roads and motorways	
75122	Regulation of the activities of agencies that provide education		75135	Activities related to the construction of waterways, harbour	
75123	Regulation of the activities of agencies that provide housing		75136	Activities related to transports and communications	
75124	Regulation of the activities of agencies that provide social services		75137	Other activities	
75131	Activities related to fuels and energy		75230	Justice and judicial activities	
75112	General (overall) public service activities		91113	Chambers of Commerce	
Collateral Activities to KCS					
22150	Other publishing		74301	Technical testing and analysis	
51641	Wholesale of accounting and computing machinery		74402	Provision of space for advertising agencies	
52471	Retail sale of books		74812	Photographic laboratories	
52472	Retail sale of newspapers and stationery		92344	Other amusement and recreation activities	
52473	Retail sale of office supplies such as pens, pencils, paper, etc.		72500	Maintenance and repair of office, accounting and computing machinery	
52481	Specialised retail sale of office equipment				

The KCS breakdown of the economic activity allows to put forward a set of hypotheses, as follows:

H1: Public KCS location rationale is mainly depending on spatial equity criteria, while Private KCS mainly respond to market opportunities and to connected agglomeration economies.

Corollary 1: SMCs are involved in supplying Public KCS.

With specific reference to the Private KCS sector,

- Since Analytical knowledge-based KCS make substantial recourse to codified and especially scientific knowledge, they prefer to locate close to high-tech industries and similar Public KCS services. The "Triple Helix" model (Etzkowitz, Leydesdorff, 2000) was devised with specific reference to this kind of interrelationships, making privileged reference to analytical knowledge. This means that analytical knowledge-based KCS are mostly sensitive to highly specific (infra-sectorial) Marshallian agglomeration economies. Urban agglomeration economies can also come into play, but only in an indirect way, thanks to the need this kind of activities have for being close to research institutions, and chiefly university. Hence,

  H2: 'Analytical knowledge-based Private Core KCS' benefit from agglomeration economies with similar knowledge-based activities and, only indirectly, from urban agglomeration economies.

  Corollary 2: Metropolitan areas at large, rather than Metropolitan cities, are privileged locations for 'Analytical knowledge-based Private Core KCS'.
- As regards Synthetic knowledge-based KCS, they mainly relate with material production and customers/suppliers relationships. As a consequence, they prefer to locate in urban contexts which are close to manufacturing systems:

  H3: 'Synthetic knowledge-based Private Core KCS' are most influenced by Marshallian economies, with regards to the relationships they establish with both manufacture and Core KSC.

  Corollary 3: SMCs lying within manufacturing systems are suitable locations for 'Synthetic knowledge-based Private Core KCS'.
- Symbolic knowledge-based KCS are typically devoted to shape cultural codes (Learning 3 and maybe 4), so that urban milieus − the buzz generators par excellence − are their vocational place. Since important evolving/cumulative processes are also at work, they tend to locate in major cities, so that:

  H4: 'Symbolic knowledge-based Private Core KCS' are mainly influenced by urban agglomeration economies.

  Corollary 4: Major cities are the privileged location for 'Symbolic knowledge-based Private Core KCS'.
- As regards Private Core-related KCS, they are both influenced by location patterns of Core KCS and manufacture because of their supporting function. We hence expect that:

  H5: 'Private Core-related KCS' are susceptible to both Marshallian and Jacobsian agglomeration economies, mainly regarding ties with manufacture and other KCS.

  Corollary 5: SMCs lying within manufacturing systems are suitable locations for 'Private Core-related KCS'.

- More manufacture-pulled location patterns are expected with regard to Collateral Activities to KCS, which only occasionally relate to high-level KCS, and anyway in an ancillary condition:

  H6: 'Collateral activities to KCS' location rationale obeys to Marshallian agglomeration economies, mainly regarding ties with manufacture.

  Corollary 6: SMCs lying within manufacturing systems are suitable locations for 'Collateral activities to KCS'.

If the hypotheses hold, the urban geography that would emerge in the knowledge era would echo the Cantillon's depiction. Beside few dominant cities specialised in highly sophisticated knowledge-based activities, a 'manufacturing countryside' appears in industrialised regions. Within it, a system of SMCs (*bourgs*) works as connector between the major cities and the local manufacturing systems. As said at the beginning of this paper, this does not exclude that SMCs, and cities in general, can also (if not predominantly) play a role as consumer or hedonic places for highly specialised "symbolic workers" (Reich, 1992), but this aspect lies outside the aims of this paper.

The major difference with Cantillon's urban geography lies in the highly evolving character of an innovation/knowledge-led economy with respect to the stationary nature of an agriculture-based economy, and mainly in the working of cumulative processes of agglomeration economies. One could argue however, that not all kinds of knowledge-intensive services benefit from the cumulative property at the same degree, as stated above, and that 'classical' Marshallian agglomeration economies are also at work, so that SMCs can still play a substantial though secondary and varying role in the knowledge economy.

4. An empirical enquiry on KCS: the Italian case[20]

4.1. General trends of the KCS sector

The goal of the empirical section is twofold: a) testing the above hypotheses about the location rationales of the various kinds of KCS (considered representative of the wider category of knowledge-based activities) and b) drawing suggestions about the role of SMCs within the knowledge economy (as defined in § 3.1). Regarding the latter, the issue at stake does not concern the permanence or disappearance of SMCs. What matters is their role within the new economic paradigm. Are they essentials within the knowledge-based value chain, though acting as secondary devices respect to metropolitan and large metropolitan areas? Or

[20] Data related to 2011 are from Istat Census of Industry and Services. The elaborations have been carried out at the Laboratory for the Analysis ofelementary data (ADELE) of Istat and in accordance with the rules on the protection of statistical confidentiality and personal data. The resultsand opinions expressed herein are solely those of the authors and do not constitute official statements or positions of Istat. Analyses have been carried out without the use of weights.

do they play only a subsidiary role as minor "consumer cities" or as functional support for local industrial systems?

In order to address these issues, a descriptive and multivariate statistical analysis has been carried out at both the macro-regional and the urban levels of the Italian territory, on the basis of the employees' records of the Industry and Services Censuses in 1991, 2001 and 2011. Four macro-regions are defined according to the Italian Institute for Statistic (ISTAT), namely North-West (NW), North-East (NE), Centre (CE), and Mezzogiorno (ME)[21], while the urban level is represented by 686 SLLs (*Sistemi Locali del Lavoro*, Local Labour Systems), the Italian proxy to the functional urban areas (Istat, 2006).

In 2011, the KCS sector employed nearly 2.95 million workers, accounting for14.8% of total national employment. Distinguishing KCS according to the proposed categories (see § 3.3), Private Core and Private Core-related KCS show the largest employment shares (respectively 37.4% and 42.4%of total KCS, with about 2,35 million workers in the aggregate), while lower shares characterise Public Core KCS and Public Core-related KCS, as well as Collateral Activities to KCS(respectively 7.5%, 5.9% and 6.8%) (Tables 3 and 4).

Against a slight increase in total population (+4.7%) and a growth in overall employment equal to 12.7%,KCS as a whole almost doubled the employed workforce between 1991 and 2011, though with notable differences according to the subdivisions. A major role was played by the private KCS component respect to public KCS, (+147% and +3.8% respectively). More specifically in the private KCS, the less sophisticated component (Private Core-related KCS) increased at a much greater rate than the most sophisticated one(Private Core KCS) with, respectively, + 258.8%and + 82%.This evidence gives rise to opposite readings. On one side, an adjustment of the Private KCS internal composition, due to the need the most advanced KCS have to be supported by a rising cohort of auxiliary KCS, in other word the existence of a time-effect. On the other side, a general trend towards a less sophisticated supply of KCS. At this point a comparison with OCSE countries would help to disentangle the effects, but data are hardly available at the required detail level to KCS, so that both interpretations remain currently possible.

As for Private Core KCS breakdowns, it is worth noting that the major contribution to the overall increase came from Synthetic activities (the largest KCS category), whose growth rate has been equal to 122%, while Analytic and Symbolic activities scored respectively +28.9% and +26.3%.

21 Istat suggests five macro-regions: North-West, North-East, Centre, South and Islands. In this work, the last two have been jointly labelled as *Mezzogiorno* (ME).

Table 3. Area, population and total number of employees by macro region, KCS and manufacturing breakdowns – 1991, 2001 and 2011

rip_geo	area_km2	pop_91	emp_91	kcs_91	prco_91	prre_91	puco_91	pure_91	coll_91
NW	56,901	14,984,738	5,688,359	478,568	221,270	131,036	22,973	40,222	63,067
NE	61,145	10,354,723	4,013,630	290,089	116,098	79,688	21,464	38,069	34,770
CE	57,061	10,942,100	3,589,962	367,889	146,612	75,931	41,489	67,436	36,421
ME	121,752	20,496,470	4,406,574	368,116	122,209	62,004	43,169	107,038	33,696
Ita	**296,858**	**56,778,031**	**17,698,525**	**1,504,662**	**606,189**	**348,659**	**129,095**	**252,765**	**167,954**
rip_geo	**area_km2**	**pop_01**	**emp_01**	**kcs_01**	**prco_01**	**prre_01**	**puco_01**	**pure_01**	**coll_01**
NW	56,901	14,815,762	5,991,281	750,312	333,640	285,789	30,090	41,290	59,503
NE	61,145	10,536,178	4,438,057	440,251	164,271	178,948	28,752	35,196	33,084
CE	57,061	10,848,694	3,880,437	532,053	228,523	158,711	46,552	64,279	33,988
ME	121,752	20,435,798	4,612,258	520,575	178,147	132,371	65,089	110,367	34,601
Ita	**296,858**	**56,636,432**	**18,922,033**	**2,243,191**	**904,581**	**755,819**	**170,483**	**251,132**	**161,176**
rip_geo	**area_km2**	**pop_11**	**emp_11**	**kcs_11**	**prco_11**	**prre_11**	**puco_11**	**pure_11**	**coll_11**
NW	56,901	15,802,094	6,265,332	991,893	392,482	458,180	40,270	33,594	67,367
NE	61,145	11,406,711	4,628,742	577,478	205,972	253,037	52,714	22,505	43,250
CE	57,061	11,651,132	4,205,658	697,948	280,980	268,318	53,168	53,411	42,071
ME	121,752	20,573,807	4,847,218	683,751	223,773	271,585	76,454	64,092	47,847
Ita	**296,858**	**59,433,744**	**19,946,950**	**2,951,070**	**1,103,207**	**1,251,120**	**222,606**	**173,602**	**200,535**
rip_geo	**analy_91**	**symb_91**	**synt_91**	**man_91**	**melo_91**	**hime_91**			
NW	12,582	87,070	121,618	2,096,601	1,307,058	789,543			
NE	5,998	42,168	67,932	1,378,559	1,003,448	375,111			
CE	15,392	49,746	81,474	928,334	715,270	213,064			
ME	7,377	34,314	80,518	823,976	617,030	206,946			
Ita	**41,349**	**213,298**	**351,542**	**5,227,470**	**3,642,806**	**1,584,664**			
rip_geo	**analy_01**	**symb_01**	**synt_01**	**man_01**	**melo_01**	**hime_01**			
NW	13,719	98,572	221,349	1,828,780	1,155,458	673,322			
NE	8,538	45,992	109,741	1,409,376	977,138	432,238			
CE	16,879	71,148	140,496	868,389	657,356	211,033			
ME	10,966	39,789	127,392	798,511	599,344	199,167			
Ita	**50,102**	**255,501**	**598,978**	**4,905,056**	**3,389,296**	**1,515,760**			
rip_geo	**analy_11**	**symb_11**	**synt_11**	**man_11**	**melo_11**	**hime_11**			
NW	12,591	105,584	274,307	1,480,271	948,372	531,899			
NE	9,330	51,670	144,972	1,186,521	781,116	405,405			
CE	20,039	70,293	190,648	734,254	545,515	188,739			
ME	11,321	41,940	170,512	672,896	506,554	166,342			
Ita	**53,281**	**269,487**	**780,439**	**4,073,942**	**2,781,557**	**1,292,385**			

*rip_geo: macro region; area_km2: surface area (square kilometers); pop_: population; emp_: total employment; kcs_: KCS employment; prco_: Private Core KCS employment; prre_: Private Core-related KCS employment; puco_: Public Core KCS; pure_: Public Core-related KCS; coll_: Collateral Activities to KCS; analy_: Analytical Private Core KCS; symb_: Symbolic Private Core KCS; synt_: Synthetic Private Core KCS; man_: Total manufacturing employment; melo_: Medium-low-tech manufacturing employment; hime_: Hi-medium-tech manufacturing employment

Table 4. Population and total employees by macro region, KCS and manufacturing breakdowns – percentage change 1991-2011

rip_geo	pop	emp		kcs	prco	prre	puco	pure	coll
NW	*5.5*	*10.1*		*107.3*	*77.4*	*249.7*	*75.3*	*-16.5*	*6.8*
NE	*10.2*	*15.3*		*99.1*	*77.4*	*217.5*	*145.6*	*-40.9*	*24.4*
CE	*6.5*	*17.2*		*89.7*	*91.6*	*253.4*	*28.1*	*-20.8*	*15.5*
ME	*0.4*	*10.0*		*85.7*	*83.1*	*338.0*	*77.1*	*-40.1*	*42.0*
Ita	*4.7*	*12.7*		*96.1*	*82.0*	*258.8*	*72.4*	*-31.3*	*19.4*
rip_geo		**emp**		**melo**	**hime**	**analy**	**symb**	**synt**	**synt**
NW		*-29.4*		*-27.4*	*-32.6*	*0.1*	*21.3*	*125.5*	*125.5*
NE		*-13.9*		*-22.2*	*8.1*	*55.6*	*22.5*	*113.4*	*113.4*
CE		*-20.9*		*-23.7*	*-11.4*	*30.2*	*41.3*	*134.0*	*134.0*
ME		*-18.3*		*-17.9*	*-19.6*	*53.5*	*22.2*	*111.8*	*111.8*
Ita		*-22.1*		*-23.6*	*-18.4*	*28.9*	*26.3*	*122.0*	*122.0*

Table 5. KCS and manufacturing employment in Italy: percentage – 1991, 2001 and 2011

	1991	2001	2011
out of total employment			
KCS	8.5	11.9	14.8
Manufacturing	29.5	25.9	20.4
out of KCS			
Private Core KCS	40.3	40.3	37.4
Private Core-related KCS	23.2	33.7	42.4
Public Core KCS	8.6	7.6	7.5
Public Core-related KCS	16.8	11.2	5.9
Collateral activities to KCS	11.2	7.2	6.8
out of Private Core KCS			
Analytical	6.8	5.5	4.8
Symbolical	35.2	28.2	24.4
Synthetic	58.0	66.2	70.7
out of manufacturing			
Medium-low-tech	69.7	69.1	68.3
Hi-medium-tech	30.3	30.9	31.7

The slow increase in the Public KCS (+3.8%) resulted from a rise in Public Core KCS (+72.4%)and an important drop in Public Core-related KCS (-31.3%). Collateral Activities to KCS, finally, progressed by 19.4%.(Table 4).

When comparing to manufacturing activities (table 4 and 5), a process of convergence with KCS activities as regards participation to total workforce can be observed. Employment in manufacturing covered 20.4% of the total workforce in 2011 (while it amounted to 29.5% in 1991), experiencing unlike KCS a significant slowdown (-22.1%), which affected both High-medium and Medium-low-tech industries[22] (-18.4% and -23.6% respectively). Within this trend, Medium-low-tech activities constantly captured the lion share within the Italian

[22] Manufacturing industry has been articulated according to the OECD definitions of High-technology, High-Medium-technology (which have been jointly considered in this paper), Medium-Low-technology and Low-technology industries (which have been jointly considered in this paper) (OECD, 2011).

manufacturing sector, accounting for about 70% within the period, confirming the orientation of the national economic system towards medium and medium-low skilled activities.

On the basis of this preliminary evidence, a first set of stylised facts can be outlined:

1. KCS impact on total employment remains lower with respect to manufacturing activities, notwithstanding its remarkable growth between 1991 and 2011, and the simultaneous decrease of manufacture. On a mere statistical viewpoint, it is possible to maintain that the Italian economy has moved important paces towards a knowledge-based economy, while maintaining a prevailing manufacture-based structure.
2. Examining KCS composition, the Private component plays a major and increasing role with respect to the Public one, representing the driving force among knowledge-based services. This means that the knowledge economy development in Italy relies more on the interplay of market forces than public commitment.
3. The distinction between Private and Public KCS remains relevant when considering the role of Core and Core-related activities. Within Private KCS, the 2011 picture show a more balanced distribution than 20 years before, with the once predominant Core KCS losing their leading position in favour of the Core-related KCS. The same convergence trend has been followed by Public KCS, albeit in this case Core activities are now slightly higher than Core-related, inversely from 1991.
4. Finally, Collateral activities to KCS, notwithstanding a growth path, remain of marginal importance.

Table 6. Delta index - 1991, 2001 and 2011

	Delta_1991	Delta_2001	Delta_2011
Population	0.41	0.41	0.44
Total Employees	0.46	0.47	0.49
KCS	0.57	0.57	0.57
Private Core KCS	0.60	0.61	0.59
Private Core-related KCS	0.54	0.54	0.55
Public Core KCS	0.75	0.75	0.76
Public Core-related KCS	0.57	0.58	0.63
Collateral activities to KCS	0.57	0.55	0.54
Analytical	0.76	0.70	0.72
Symbolical	0.62	0.62	0.62
Synthetical	0.57	0.60	0.59
Manufacturing	0.52	0.50	0.51
Hi-medium-tech	0.59	0.57	0.57
Medium-low-tech	0.50	0.49	0.50
	1 = max concentration		

Performing the Delta index[23] allows us drawing further stylised facts(Table 6).

5. First of all, it indicates a greater spatial concentration for KCS than population, total employment and employment in manufacturing activities over the period. It also shows that
6. Public KCS are the most concentrated sector across space, followed by Private KCS, which is symptomatic of the policy-driven location rationale of public knowledge-based activities (such as higher education, university hospitals and political bodies)[24].By considering the breakdowns of the knowledge-creating chain, data confirm intuitive expectations: Collateral Activities to KCS are those less concentrated across space, while Core-related ones are placed in an intermediary position.

With respect to manufacture, Hi-medium-tech activities show the same Delta value than Private Core KCS. This could mean that 'traditional' R&D activities, which are normally carried out within bigger companies, benefit from the same scale and maybe agglomeration economies than the most sophisticated KCS sub-sector. Finally, Medium-low-tech manufacturing activities score the lowest concentration value, almost equal to that regarding total employment and anyway lower than any KCS category.

In a dynamic view, Table 6 shows that between 1991 and 2011, KCS and manufacturing activities followed similar spatial paths, being both basically steady – with a slightly decreasing level of concentration in the manufacture. As for KCS breakdowns, the most significant changes affected Collateral activities and Analytical Private Core KCS, by a process of spatial diffusion, and inversely Public Core-related KCS and Synthetic Private Core KCS, by an increased level of concentration.

On the basis of the depicted ongoing processes and by considering knowledge-based services as a basic factor within advanced economies (Doloreux, Shearmur, 2010;Malerba, 2010; Martinez-Fernandez, 2011), other stylised facts can be outlined.

7. Core KCS (be them of private or public kind) are characterised by higher scarcity at the wider territorial level, which can be compared only with Hi-medium-tech manufacturing activities.
8. As a consequence, Core KCS represents a (further) source of regional unbalances (Compagnucci, Cusinato, 2014).
9. The different levels in spatial concentration of KCS breakdowns and the (light) decline of some of them between 1991 and 2001 opens to figure out some possible

[23] Delta Index is calculated as follows: $\delta = \frac{1}{2}\sum_{i=1}^{n} \left|\frac{x_i}{X} - \frac{a_i}{A}\right|$, where $\frac{x_i}{X}$ is the share of a given variable in sub-area *i* with respect to total area and $\frac{a_i}{A}$ is the share of the extension of the sub-area *i* on the extension of the total area. The index allows us taking into account the spatial extension of a sub-area *i* when aiming at assessing concentration with respect to a given phenomenon. It ranges between 0 and 1: higher values of Delta Index indicate a greater concentration of a given variable in a relatively small number of sub-areas, while, when closer to 0, a more uniform distribution affects the area.

[24] See Compagnucci (2014, forthcoming).

roles played by SMCs within the knowledge economy, an issue which will be properly addressed by the following paragraphs.

4.2. KCS regional patterns

With respect to the territorial distribution of KCS employment (Table 7), Private KCS are mainly located in NW Italy, being, on the contrary, the Mezzogiorno the macro-region hosting the highest shares in Public KCS. In dynamic terms, a slight increase in KCS shares emerges within both Northern regions (NW and NE), whereas Central and Southern regions slightly decline. These trends result from different paths: NW and NE, while lowering their percentages in Private KCS, increase those concerning Public KCS (with the exception of Public Core-related within NE); CE increases its contribution to Private Core and Public Core-related KCS; within ME, finally, the decline of Public Core-related KCS has not been completely compensated by the increase of all the other KCS breakdowns.
The observed changes in KCS macro-regional distribution, though confirming their uneven distribution across the country, show a convergence process, as regions tend to lower their shares in the 1991 leading sectors, while increasing their shares in sectors affected by initial lower percentages.

Table 7. Employees' distribution by macro region and KCS breakdowns – 1991, 2001 and 2011

rip_geo	**kcs_91**	**prco_91**	**prre_91**	**puco_91**	**pure_91**	**coll_91**
NW	31.8	36.5	37.6	17.8	15.9	37.6
NE	19.3	19.2	22.9	16.6	15.1	20.7
CE	24.4	24.2	21.8	32.1	26.7	21.7
ME	24.5	20.2	17.8	33.4	42.3	20.1
ITA	100.0	100.0	100.0	100.0	100.0	100.0
rip_geo	**kcs_01**	**prco_01**	**prre_01**	**puco_01**	**pure_01**	**coll_01**
NW	33.4	36.9	37.8	17.6	16.4	36.9
NE	19.6	18.2	23.7	16.9	14.0	20.5
CE	23.7	25.3	21.0	27.3	25.6	21.1
ME	23.2	19.7	17.5	38.2	43.9	21.5
ITA	100.0	100.0	100.0	100.0	100.0	100.0
rip_geo	**kcs_11**	**prco_11**	**prre_11**	**puco_11**	**pure_11**	**coll_11**
NW	33.6	35.6	36.6	18.1	19.4	33.6
NE	19.6	18.7	20.2	23.7	13.0	21.6
CE	23.7	25.5	21.4	23.9	30.8	21.0
ME	23.2	20.3	21.7	34.3	36.9	23.9
ITA	100.0	100.0	100.0	100.0	100.0	100.0

A further analytical step consists in performing the KCS Location Quotients (LQ)[25] in order to identify the level of specialisation of a region in KCS (Table 8).

Table 8. LQs by macro-region and KCS and manufacturing breakdowns – 1991, 2001 and 2011

rip_geo	kcs_91	prco_91	prre_91	puco_91	pure_91	coll_91		analy_91	symb_91	synt_91		man_91	melo_91
NW	1.21	1.38	1.42	0.67	0.60	1.42		1.15	1.55	1.31		1.52	1.36
NE	1.06	1.05	1.25	0.91	0.83	1.14		0.80	1.08	1.06		1.45	1.51
CE	1.27	1.25	1.13	1.67	1.38	1.13		1.93	1.21	1.20		0.92	1.02
ME	0.68	0.56	0.49	0.93	1.17	0.56		0.49	0.45	0.63		0.44	0.47
	kcs_01	**prco_01**	**prre_01**	**puco_01**	**pure_01**	**coll_01**		**analy_01**	**symb_01**	**synt_01**		**man_01**	**melo_01**
NW	1.28	1.41	1.45	0.67	0.63	1.41		1.04	1.47	1.41		1.43	1.30
NE	1.05	0.98	1.27	0.91	0.75	1.10		0.92	0.97	0.99		1.54	1.55
CE	1.24	1.32	1.10	1.43	1.34	1.10		1.76	1.46	1.23		0.92	1.01
ME	0.64	0.55	0.49	1.06	1.22	0.59		0.61	0.43	0.59		0.45	0.49
	kcs_11	**prco_11**	**prre_11**	**puco_11**	**pure_11**	**coll_11**		**analy_11**	**symb_11**	**synt_11**		**man_11**	**melo_11**
NW	1.26	1.34	1.38	0.68	0.73	1.26		0.89	1.47	1.32		1.37	1.28
NE	1.02	0.97	1.05	1.23	0.68	1.12		0.91	1.00	0.97		1.52	1.46
CE	1.21	1.30	1.09	1.22	1.57	1.07		1.92	1.33	1.25		0.92	1.00
ME	0.67	0.59	0.63	0.99	1.07	0.69		0.61	0.45	0.63		0.48	0.53

Note: LQ ≤ 1 "not specialised", and LQ > 1 "specialised"

While confirming the above mentioned uneven regional distribution of KCS, they depict three main regional patterns, with a further differentiation:

a) The first main pattern refers to NW and CE, which are regions clearly specialised in KCS. In addition, two secondary though clear patterns emerge between the two regions:
   a1) as for the NW pattern, specialisation essentially concerns Private KCS, Public KCS LQ being, on the contrary, considerably lower than one. Within Private Core KCS, Symbolic and Synthetic KCS activities are playing a leading role, inversely from Analytical ones;
   a2) regarding CE pattern, all KCS breakdowns show LQ values higher than one, especially Public Related and Private Core KCS. As for these latter, Analytical activities show the highest value among the four macro-regions.
b) the NE regions are barely specialised in KCS activities as a whole. Their specialisation regards essentially Public Core KCS and Collateral activities to KCS. Interestingly, the most sophisticated sector of the knowledge chain (Private Core KCS) is constantly declining. Synthetic and Analytical LQs, on the contrary, are constantly lower than one, notwithstanding an increasing trend of the latter.

[25] LQ is obtained as follows: $LQ = \frac{E_{i,j}/p_j}{E_i/P}$, where $E_{i,j}$ is the number of employees in the industry i of SLL j, p_j is the population of SLL j, E_i is the Italian workforce in the industry i, and P is the Italian population.

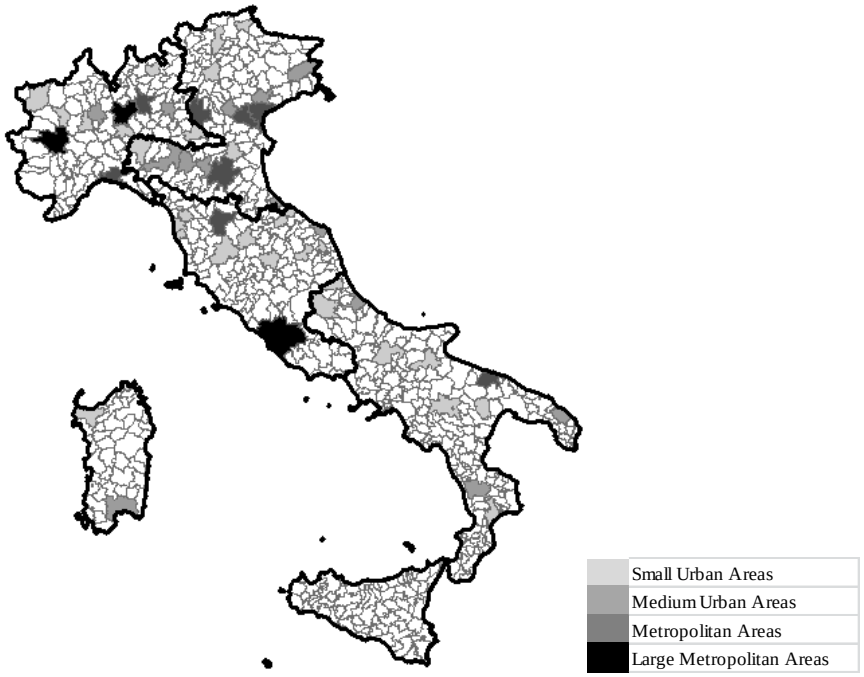
c) Finally, ME, which shows LQs slightly higher than one only in the less sophisticated field of Public KCS.

These different patterns intuitively relate to regional specificities, such as industrialisation and technological patterns, industry specialisation, urban structure, connection to the global market (and network, in general), intensiveness and effectiveness of interactions between enterprises, institutions and research centres (Etzkowitz, Leydesdorff, 2000), and also public assets: elements which are deeply interlinked in a path-dependent way. The following section is devoted to scrutinise these aspects, aimed at searching for regularities in KCS location rationales.

4.3. KCS urban patterns

Refining the KCS analysis at the SLL level by means of their LQs makes it possible, not only to further detail a descriptive geography, but to put forward (ant test) interpretative models about its determinants.

Figure 1: SLL specialised in KCS (LQ > 1) – 2011



In the descriptive part of this section, after performing LQs on SLL, KCS-specialised SLL have been classified according to their respective belonging macro region and typology of urban areas[26] (Table 8 and Figure 1).

Table 9. Distribution of SLL, by LQ, typology of urban areas and macro-region -2011*

			NW macro region						NE macro region					
			SLL_KCS_91		Total	SLL_KCS_11		Total	SLL_KCS_91		Total	SLL_KCS_11		Total
			LQ≤1	LQ>1		LQ≤1	LQ>1		LQ≤1	LQ>1		LQ≤1	LQ>1	
cla_SLL	1	Number of cases	0	2	2	0	2	2	0	0	0	0	0	0
		% within cla_SLL	*.00*	*1.00*	*1.00*	*.00*	*1.00*	*1.00*	*.00*	*.00*	*.00*	*.00*	*.00*	*.00*
		% within SLL_KCS	*.00*	*.15*	*.02*	*.00*	*.17*	*.02*	*.00*	*.00*	*.00*	*.00*	*.00*	*.00*
		% out of total	*.00*	*.02*	*.02*	*.00*	*.02*	*.02*	*.00*	*.00*	*.00*	*.00*	*.00*	*.00*
	2	Number of cases	3	1	4	2	2	4	0	4	4	0	4	4
		% within cla_SLL	*.75*	*.25*	*1.00*	*.50*	*.50*	*1.00*	*.00*	*1.00*	*1.00*	*.00*	*1.00*	*1.00*
		% within SLL_KCS	*.03*	*.08*	*.04*	*.02*	*.17*	*.04*	*.00*	*.20*	*.03*	*.00*	*.24*	*.03*
		% out of total	*.03*	*.01*	*.04*	*.02*	*.02*	*.04*	*.00*	*.03*	*.03*	*.00*	*.03*	*.03*
	3	Number of cases	5	2	7	5	2	7	2	9	11	2	9	11
		% within cla_SLL	*.71*	*.29*	*1.00*	*.71*	*.29*	*1.00*	*.18*	*.82*	*1.00*	*.18*	*.82*	*1.00*
		% within SLL_KCS	*.05*	*.15*	*.06*	*.05*	*.17*	*.06*	*.02*	*.45*	*.09*	*.02*	*.53*	*.09*
		% out of total	*.04*	*.02*	*.06*	*.04*	*.02*	*.06*	*.02*	*.08*	*.09*	*.02*	*.08*	*.09*
	4	Number of cases	93	8	101	95	6	101	98	7	105	101	4	105
		% within cla_SLL	*.92*	*.08*	*1.00*	*.94*	*.06*	*1.00*	*.93*	*.07*	*1.00*	*.96*	*.04*	*1.00*
		% within SLL_KCS	*.92*	*.62*	*.89*	*.93*	*.50*	*.89*	*.98*	*.35*	*.88*	*.98*	*.24*	*.88*
		% out of total	*.82*	*.07*	*.89*	*.83*	*.05*	*.89*	*.82*	*.06*	*.88*	*.84*	*.03*	*.88*
Total		Number of cases	101	13	114	102	12	114	100	20	120	103	17	120
		% within cla_SLL	*.89*	*.11*	*1.00*	*.89*	*.11*	*1.00*	*.83*	*.17*	*1.00*	*.86*	*.14*	*1.00*
		% within SLL_KCS	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
		% out of total	*.89*	*.11*	*1.00*	*.89*	*.11*	*1.00*	*.83*	*.17*	*1.00*	*.86*	*.14*	*1.00*

			CE macro region						ME macro region					
			SLL_KCS_91		Total	SLL_KCS_11		Total	SLL_KCS_91		Total	SLL_KCS_11		Total
			LQ≤1	LQ>1		LQ≤1	LQ>1		LQ≤1	LQ>1		LQ≤1	LQ>1	
cla_SLL	1	Number of cases	0	1	1	0	1	1	1	0	1	1	0	1
		% within cla_SLL	*.00*	*1.00*	*1.00*	*.00*	*1.00*	*1.00*	*1.00*	*.00*	*1.00*	*1.00*	*.00*	*1.00*
		% within SLL_KCS	*.00*	*.08*	*.01*	*.00*	*.08*	*.01*	*.00*	*.00*	*.00*	*.00*	*.00*	*.00*
		% out of total	*.00*	*.01*	*.01*	*.00*	*.01*	*.01*	*.00*	*.00*	*.00*	*.00*	*.00*	*.00*
	2	Number of cases	0	1	1	0	1	1	0	3	3	2	1	3
		% within cla_SLL	*.00*	*1.00*	*1.00*	*.00*	*1.00*	*1.00*	*.00*	*1.00*	*1.00*	*.67*	*.33*	*1.00*
		% within SLL_KCS	*.00*	*.08*	*.01*	*.00*	*.08*	*.01*	*.00*	*.15*	*.01*	*.01*	*.07*	*.01*
		% out of total	*.00*	*.01*	*.01*	*.00*	*.01*	*.01*	*.00*	*.01*	*.01*	*.01*	*.00*	*.01*
	3	Number of cases	3	2	5	3	2	5	10	5	15	9	6	15
		% within cla_SLL	*.60*	*.40*	*1.00*	*.60*	*.40*	*1.00*	*.67*	*.33*	*1.00*	*.60*	*.40*	*1.00*
		% within SLL_KCS	*.03*	*.15*	*.04*	*.03*	*.15*	*.04*	*.03*	*.25*	*.05*	*.03*	*.43*	*.05*
		% out of total	*.02*	*.02*	*.04*	*.02*	*.02*	*.04*	*.03*	*.02*	*.05*	*.03*	*.02*	*.05*
	4	Number of cases	111	9	120	111	9	120	294	12	306	299	7	306
		% within cla_SLL	*.93*	*.08*	*1.00*	*.93*	*.08*	*1.00*	*.96*	*.04*	*1.00*	*.98*	*.02*	*1.00*
		% within SLL_KCS	*.97*	*.69*	*.94*	*.97*	*.69*	*.94*	*.96*	*.60*	*.94*	*.96*	*.50*	*.94*
		% out of total	*.87*	*.07*	*.94*	*.87*	*.07*	*.94*	*.90*	*.04*	*.94*	*.92*	*.02*	*.94*
Total		Number of cases	114	13	127	114	13	127	305	20	325	311	14	325
		% within cla_SLL	*.90*	*.10*	*1.00*	*.90*	*.10*	*1.00*	*.94*	*.06*	*1.00*	*.96*	*.04*	*1.00*
		% within SLL_KCS	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
		% out of total	*.90*	*.10*	*1.00*	*.90*	*.10*	*1.00*	*.94*	*.06*	*1.00*	*.96*	*.04*	*1.00*

*cla_SLL: 1 - Large Metropolitan Areas;2 - Metropolitan Areas; 3 – Medium Urban Areas;4 - Small Urban Areas.

[26] Typologies of Urban Areas are defined considering different population thresholds. According to Brezzi et al. (2012), four population thresholds allows to identify four typologies of urban areas: 1) SLL population < 0.2 m - Small Urban Areas; 2) 0.2 m < SLL population < 0.5 m - Medium Urban Areas; 3) 0.5 m < SLL population < 1.5 m - Metropolitan Areas; 4) SLL population > 1.5 m - Large Metropolitan Areas.

Interpreting the results on the basis of the three main KCS macro regional patterns previously depicted (§ 4.2) makes the crucial role played by Large Metropolitan Area, and, secondarily, by Metropolitan Areas, emerge. In fact:

a) as for the first pattern, which concerns the sole macro regions specialised in KCS (NW and CE), it is worth noting that they host three (Milan, Turin for NW and Rome for CE) out of the four Italian Large Metropolitan Areas with LQs higher than one both in 1991 and 2011. Moreover, NW witnesses an increasing contribution of Metropolitan Areas specialised in KCS over the period, from 1 to 2[27] out of 4.

With respect to SMCs, their numeric contribution to the overall macro regional KCS specialisation is constant in the case of CE (2 Medium Urban Areas out of 5, and 9 Small Urban Areas out of 120[28] both in 1991 and 2011) and slightly declining for NW (2 Medium Urban Areas out of 7 and 8 Small Urban Areas out of 101, which decreased to 6[29] in 2011).

At this point we can wonder whether SMCs specialisation is affected by the borrowing size effect (Alonso, 1973), or whether they follow an endogenous development trajectory? A first though partial answer can be provided by considering if SMCs belong to a Functional Urban Region – FUR (Hall and Hay, 1980; Compagnucci, 2012), or not. With respect to NW, most of the SMCs can be considered part of or surrounding the Turin and Milan FURs, which might support the hypothesis of an exogenous process. On the contrary, in CE, none of SMCs specialised in KCS is part of or surrounds a FUR. In this case, they might not directly benefit from metropolitan externalities and, ultimately, be of great importance for a more balanced and polycentric territorial distribution of KCS.

b) As for the NE pattern barely specialised in KCS, the main urban feature is the lack of Large Metropolitan Areas. The presence of four Metropolitan Areas (Bologna, Padua, Verona and Venice) with LQs higher than one apparently does not succeed in granting a convenient critical mass to trigger a peculiar knowledge specialisation. With respect to SMCs, there is evidence of a major role played by Medium Urban Areas (9[30] out of 11 are specialised in KCS), while the contribution of Small Urban Areas is slightly declining (7 out of 105, which decreased to 4[31] in 2011).

c) ME, finally, showing the worst KCS performances, hosts just one Large Metropolitan Area (Naples), which, however, is not specialised in KCS. The role of Metropolitan Areas, in addition, has considerably decreased between 1991 and 2011, in that the number of those specialised in KCS drops from 3 to 1 (Bari). As for SMCs, here again, there is evidence of a

[27] Bergamo joins Genoa in 2011.

[28] Perugia and Ancona (Medium Urban Areas).Pisa, Urbino, Siena, San Severino Marche, Arezzo, Macerata, Pesaro, Lucca and Livorno (Small Urban Areas).

[29] Brescia and Novara (Medium Urban Areas). Ivrea, Aosta, Pavia, Vercelli, Sondrio and Mantova (Small Urban Areas).

[30] Trieste, Parma, Modena, Udine, Vicenza, Piacenza, Treviso, Reggio nell'Emilia and Rimini.

[31] Bolzano, Trento, Ferrara and Brunico.

decreasing contribution of Small Urban Areas (from 12 to 7[32] out of 306), while Medium ones increase from 5 to 6[33] out of 15.

Coming to interpretative models, an econometric model has been set up, to identify the determinants of location rationales of the various KCS branches. The basic idea is that, whilst Public KCS location rationale is policy-driven (whose analysis goes beyond the purposes of this chapter), Private KCS location rationale is market-driven, based on three main proximity factors: proximity to supply market(s), to end market(s) and to externality sources (both Marshallian and Jacobsian).

Taking firstly Private Core KCS into examination, it is worth remembering that the 'raw materials' they make recourse to are codified and tacit knowledge, as well as specialised and non-specialised buzz. Unlike codified knowledge, the access to tacit one requires mental and physical proximity . Moreover, with respect to the most sophisticated knowledge-based activities (Core KCS), benefiting from reciprocation, they will locate close to the sources of specialised knowledge. In this connection buzz represents a basic public good, be it engendered within specialised circles or by the broader social arena. Because of its locally specific, interactional and evolutionary character, access to it requires, not only physical and cultural proximity, but fair participation to the local milieu's life (be the milieu constituted by a scientific community, an epistemological one or else a city), which ceaselessly reshapes it (Storper, Venables, 2002). Furthermore, cumulative processes are likely at work, in that competences in Learning 3 evolve and refine on time according to path-dependence logics.

As regards end markets, Private Core KCS essentially shape attitudes towards creativity by training 'customers' to learn Learning 3 practices. Here again, physical proximity and cultural contiguity are necessary conditions.

Consequently, we can hypothesise that Private Core KCS tend to cluster in knowledge-intensive milieus, following a cumulative path. The kind of milieu, however, depends on the kind of knowledge they rely upon. The Asheim's distinction into Analytical, Synthetic and Symbolic knowledge, enables us to argue that Private Core KCS, by making substantial recourse to analytical knowledge prefer to locate nearby both research centres (be them private or public entities) and high-tech industry and similar rank services. Also considering that high-tech industry generally locates in the neighbourhoods of main urban centres, it follows that analytical knowledge-based Private Core KCS would preferably locate within metropolitan regions, and not necessarily within the core metropolitan cities (see Mazzoleni, Pechmann, 2014; Compagnucci, 2014).To test the hypotheses framed in § 3.3, a set of variables is firstly established, to represent the magnitude of respectively Marshallian and urban agglomeration economies, along with cumulative processes. Thereafter, an OLS model

[32] L'Aquila, Matera, Teramo, Catanzaro, Potenza, Campobasso and Foggia.
[33] Messina, Cagliari, Sassari, Cosenza, Pescara and Lecce.

is performed to identify which variables are significantly correlated with KCS LQs (eight OLS models are run, according to the eight KCS subdivisions).
The set of variables can be framed as follows:

pop_11	SLLs' population in 2011
rip_geo	macro region (NW, NE, CE and ME) to which the SLL belongs
dist_01	dummy 0-1 according to the fact that a SLL is not/is an Industrial District[34] in 2001
sll_prov	dummy (0-1) indicating whether the SLL is not/is a provincial capital
lq_prco11	LQ of Private Core KCS
lq_ana11	LQ of Analytical Private Core KCS
lq_sym11	LQ of Symbolic Private Core KCS
lq_syn11	LQ of Synthetic Private Core KCS
lq_prre11	LQ of Private Core-related KCS
lq_puco11	LQ of Public Core KCS
lq_pure11	LQ of Public Core-related KCS
lq_coll11	LQ of Collateral Activities to KCS
Rlqhi_me_11	LQ value of High-medium-tech manufacturing of the administrative region a SLL belongs to in 2011
Rlqme_lo_11	LQ value of Medium-low-tech manufacturing of the administrative region a SLL belongs to in 2011

The general specification of the OLS model is:

$$lq_{i}\_11 = \beta_0 + \beta_1 pop\_11 + \beta_2 dist\_01 + \beta_3 Rlqhi\_me\_11 + \beta_4 Rlqme\_lo\_11 + \beta_5 sll\_prov$$

$$+ \beta_6 lq\_all\text{-}kcs\_11 + \beta_7 rip\_geo + \varepsilon$$

where:
lqi_11 represents SLLs' LQ values of the *i* KCS branch in 2011;
lq_all-kcs_11SLLs' LQ values of all the other KCS breakdowns different from *i* in 2011
β_0 represents the constant, β_1 - β_7 the parameters and ε is the statistical error.

[34] For the Istat definition of Industrial District, see Istat (2006).

Table 10. OLS regression results for all KCS breakdowns – 2011

a) Private Core KCS			**b) Analytical Private KCS**			**c) Symbolical Private KCS**			**d) Synthetic Private KCS**		
R2=0.7506	Coef	p > | t |	R2=0.2058	Coef	p > | t |	R2=0.6352	Coef	p > | t |	R2=0.7585	Coef	p > | t |
pop_01	3.46E-07	0.000***	pop_11	2.19E-07	0.280	pop_11	3.03E-07	0.000***	pop_11	1.97E-07	0.000***
dist_01	-0.2164	0.166	dist_01	-0.1392	0.165	dist_01	-0.0111	0.615	dist_01	-0.0075	0.620
Rlqhi_me01	-0.0795	0.002**	Rlqhi_me11	0.0388	0.814	Rlqhi_me11	-0.0793	0.029*	Rlqhi_me11	-0.0467	0.060
Rlqme_lo01	0.1236	0.000***	Rlqme_lo11	-0.0049	0.976	Rlqme_lo11	0.1327	0.000***	Rlqme_lo11	0.0647	0.007**
sll_prov	0.0576	0.030*	sll_prov	-0.2199	0.199	sll_prov	0.0087	0.817	sll_prov	0.069	0.007**
lq_prre01	0.2729	0.000***	lq_sym11	-0.2052	0.242	lq_ana11	-0.0099	0.242	lq_ana11	0.0226	0.000***
lq_puco01	0.0502	0.000***	lq_syn11	1.0003	0.000***	lq_syn11	0.4777	0.000***	lq_sym11	0.2235	0.000***
lq_pure01	0.0417	0.003**	lq_prre01	0.0964	0.607	lq_prre01	0.1519	0.000***	lq_prre01	0.2000	0.000***
lq_coll01	0.1649	0.000***	lq_puco01	0.3071	0.000***	lq_puco01	-0.0077	0.478	lq_puco01	0.0337	0.000***
rip_geo	-0.0284	0.003**	lq_pure01	0.1657	0.070	lq_pure01	-0.0145	0.471	lq_pure01	0.0377	0.006**
_cons	0.2282	0.000***	lq_coll01	-0.3089	0.045*	lq_coll01	0.1299	0.000***	lq_coll01	0.128	0.000***
			rip_geo	-0.0319	0.603	rip_geo	-0.04928	0.000***	rip_geo	-0.0041	0.658
			_cons	0.2282	0.976	_cons	0.1309	0.041*	_cons	0.1714	0.000***
e) Private Core-related KCS			**f) Public Core KCS**			**g) Public Core-related KCS**			**h) Collateral Activities to KCS**		
R2=0.6662	Coef	p > | t |	R2=0.3916	Coef	p > | t |	R2=0.6142	Coef	p > | t |	R2=0.5557	Coef	p > | t |
pop_11	3.58E-08	0.39	pop_11	-1.31E-07	0.409	pop_11	-1.24E-07	0.146	pop_11	-9.16E-08	0.070
dist_01	0.0071	0.732	dist_01	-0.1393	0.076	dist_01	-0.0631	0.136	dist_01	-0.0026	0.917
Rlqhi_me11	-0.0074	0.828	Rlqhi_me11	-0.0149	0.908	Rlqhi_me11	-0.1062	0.127	Rlqhi_me11	0.0268	0.515
Rlqme_lo11	0.0587	0.071	Rlqme_lo11	0.2858	0.021*	Rlqme_lo11	-0.1274	0.056*	Rlqme_lo11	0.0376	0.342
sll_prov	0.0675	0.055	sll_prov	0.7877	0.000***	sll_prov	1.0341	0.000***	sll_prov	0.0837	0.050
lq_ana11	0.0041	0.607	lq_ana11	0.1876	0.000***	lq_ana11	0.0295	0.07	lq_ana11	-0.0192	0.045*
lq_sym11	0.1326	0.000***	lq_sym11	-0.0972	0.478	lq_sym11	-0.0533	0.471	lq_sym11	0.1672	0.000***
lq_syn11	0.3733	0.000***	lq_syn11	0.9085	0.000***	lq_syn11	0.2962	0.006**	lq_syn11	0.3520	0.000***
lq_puco01	-0.0160	0.115	lq_prre01	-0.2310	0.115	lq_prre01	0.2816	0.000***	lq_prre01	0.3281	0.000***
lq_pure01	0.0669	0.000***	lq_pure01	0.1663	0.020*	lq_puco01	0.0484	0.020*	lq_puco01	-0.005	0.686
lq_coll01	0.2227	0.000***	lq_coll01	-0.0488	0.686	lq_coll01	-0.0255	0.695	lq_pure01	-0.009	0.695
rip_geo	-0.0349	0.006**	rip_geo	0.1095	0.022*	rip_geo	0.0581	0.025*	rip_geo	-0.0078	0.612
_cons	0.1926	0.001**	_cons	-0.7501	0.001***	_cons	0.0407	0.741	_cons	0.1617	0.026*

Significance levels: *** at 99%; ** at 98%; * at 95%.

The outcomes of the OLS regressions allows us to confirm or reject the §3.3 hypotheses.

H1: Public KCS location rationale is mainly depending on spatial equity criteria, while Private KCS mainly respond to market opportunities and to connected agglomeration economies.

Corollary 1: SMCs are involved in supplying Public KCS.

With respect to Private Core KCS as a whole (Table 10.a), regression results suggest accepting (or not refusing) H1. Their location rationale, in fact, mainly depends on city size (the greater the SLL population, the higher the LQ of Private Core KCS), while the contribution of the provincial capitals is lower. This means that Private Core? KCS are mainly located in larger provincial capitals, where they can find the most convenient environment both in terms of suppliers (tangible and intangible "raw materials") and end markets (local, regional and global ones). Jointly with urban economies, Private Core KCS further benefit from the cumulative effects related to the co-location of all the other KCS activities, as well as from the unrelated variety granted by regional specialisation in Medium-low-tech manufacturing activities. The parallel inverse and significant relation with High-medium-tech manufacturing activities could presumably imply that Private Core KCS supply the lack of knowledge-based skills in traditional productions and Made in Italy in general, while High-

medium-tech firms more likely source them internally. Belonging to a certain macro region matters too, in that being located outside NW lowers the likelihood to be specialised in Private Core KCS. Summarising, results suggest that SMCs do not play a crucial role regarding the Private Core KCS, when considered as a whole. In the following steps we shall ascertain if these remarks hold for the various Private Core KCS branches.

Public KCSs location rationale (Table 10.f and 10.g), on the contrary, mainly depends on spatial equity criteria. Public Core and Public Core-related KCS are indeed significantly and positively related with the presence of provincial capitals, whose population ranges from the category of Small Urban Areas to that of Large Metropolitan Area, and, unlike metropolitan areas, are evenly distributed across the country, supplying a wide range of "given" services to citizens and firms. At the same time, Public KCS not significant relation with cities size in terms of population suggests the relevance of SMCs within these knowledge fields, which contribute to counterbalance the concentration propensity characterising Private Core KCS. Public KCS further benefit from the co-location with Private Core KCS, especially from the Analytical and Synthetic ones, confirming our expectations. In particular, Public Core KCS (universities and university hospitals) and Analytical KCS (basically represented by research centres)are presumably taking mutual advantage from the related variety they provide as well as from the skilled labour pool provincial capitals supply. Finally, in the case of Public Core KCS, a significant and positive relationship with Medium-low-tech manufacturing emerges. This is particularly evident when manufacturing activities are not organised in Industrial Districts, whose presence rather decreases the likelihood for a SLL to be specialised in Public Core KCS.

H2: 'Analytical knowledge-based Private Core KCS' benefit from agglomeration economies with similar knowledge-based activities and, only indirectly, from urban agglomeration economies.

Corollary 2: Metropolitan areas at large, rather than Small and Medium ones, are privileged locations for 'Analytical knowledge-based Private Core KCS'.

As for Analytical knowledge-based Private KCS (Table 10.b), outcomes suggest that their location rationale is not affected either by SLL size, or the presence of a provincial capital. This means that they do not directly benefit from urban agglomeration economies. Analytical activities, in fact, being based on codified knowledge, are those less dependent on face-to-face relationships, so that their location is more footloose with respect to local relational features (Shearmur, 2012). At the same time they benefit from the co-location of complementary competences (the so-called unrelated variety), as the statistically significant connection with Synthetic KCS shows, and from the co-location of related industrial sectors (the so-called related variety), as the connection with Public Core KCS proves. This means that this kind of

Core KCS, though being science-based, is strongly rooted in pragmatic grounds, as technological research generally is.
Corollary 2 is rejected on the basis of the OLS results, in that there is no significant connection with cities size, and so, with metropolitan areas. Obviously, when checking the SLL specialised in Analytical KCS, metropolitan areas are included, but greater is the number of Small Urban Areas not hosting provincial capitals. Consequently, we can assert SMCs play an important role within this knowledge field.

H3: 'Synthetic knowledge-based Private Core KCS' are most influenced by Marshallian economies, with regards to the relationships they establish with both manufacture and Core KSC.

Corollary 3: SMCs lying within manufacturing systems are suitable locations for 'Synthetic knowledge-based Private Core KCS'.

Synthetic knowledge-based KCS(Table 10.d), mainly relying on customer-supplier relationships, can be considered as context-led. Their location have to maximise their interlinking nature, such as urban environments lying within local manufacturing systems and districts, and benefiting from both related and unrelated variety. In this regard, it is worth noting the cumulative effect descending from the positive and significant co-location with all the KCS breakdowns.
The assumption these KCS locate in urban contexts which lie within manufacturing systems is partially confirmed by the positive and significant connection with regional specialisation in Medium-low-tech manufacturing. At the same time, however, the higher significance level of SLL demographic size than that related to the presence of a provincial capital, suggests that especially larger cities are specialised in Synthetic KCS and, consequently, that also urban economies matter. On these bases, we can assume that SMCs have room in this knowledge field, even though playing a secondary role with respect to Metropolitan and Large Metropolitan Areas.

H4: 'Symbolic knowledge-based Private Core KCS' are mainly influenced by urban agglomeration economies.

Corollary 4: Major cities are the privileged location for 'Symbolic knowledge-based Private Core KCS'.

H4 is confirmed by the OLS results (Table 10.c), as symbolic activities are strongly and positively related to the SLL demographic size, while the presence of a provincial capital is not significant. This twofold and apparent contradictory outcome actually strengths the idea that activities which are "arts or, better, culture based" are more influenced by the milieu effect of the city, rather than by specific services (as those related to the presence of a provincial capital). With respect to the positive connection with Synthetic knowledge-based

KCS and Medium-low-tech manufacturing activities, it is worth remembering that Symbolic activities include industrial design, which importantly relates to the Italian traditional manufacturing (such as fashion, furniture, etc.). These outcomes signal the (relative) irrelevance of SMCs for these activities.

H5: 'Private Core-related KCS' are susceptible to both Marshallian and Jacobian agglomeration economies, mainly regarding ties with manufacture.

Corollary 5: SMCs lying within manufacturing systems are suitable locations for 'Private Core-related KCS'.

As regards Private Core-related KCS (Table 10.e), given their supporting function, evidences show that their location rationale is mainly driven by Marshallian economies, internal to both the KCS sector and the industry in general. Significant relationships are observed with the location patterns of Private Core KCS, Collateral Activities to KCS, Public KCS and also manufacture, though only for the Hi-medium-tech section. On the other side, urban economies appear to shape their location choices only on the functional side, in that only the presence of a provincial capital, with its endowment of public services, and not city size, shows a significant, though weak, connection with them. This implies that also SMCs can play a role with respect to these kinds of activities.

H6: 'Collateral activities to KCS' location rationale obeys to Marshallian agglomeration economies, mainly regarding ties with manufacture.

Corollary 6: SMCs lying within manufacturing systems are suitable locations for 'Collateral activities to KCS'.

A similar pattern emerges as regards Collateral Activities to KCS (Table 10.h), whose location rationale mainly depends on Marshallian economies from the KCS sector (Private Core and Private Core-related KCS) and weakly on urban economies (only those provided by the presence of a provincial capital, which includes also Small and Medium Urban Areas). Here again, cities size does not significantly matters, which suggests a further specialisation field for SMCs.

Table 11 finally summarises the outcomes of the econometric analysis by cross-tabulating the different kinds of agglomeration economies and KCS branches and suggests the role SMCs can play in this connection.

Table 11. Relevant kinds of agglomeration economies to KCS and connected opportunities for SMCs

KCS branches	Infra-sectorial agglomeration economies	Inter-sectorial agglomeration economies	Urban agglomeration economies		Opportunities for SMCs
			Urban milieu	Urban services	
Analytical Private Core	+++				-
Synthetic Private Core	+++	++	+++	++	++
Symbolical Private Core	+++	++	+++		-
Private Core-related	+++	++		+	+
Public Core	++	+		+++	+++
Public Core-related	++	++		+++	+++
Collateral activities	++	++		+	+

5. Conclusions and directions for policies

The sharpness of outcomes obtained from the empirical analysis and the substantial validation (or not-falsification) they provide to the underlying analytical frame make it easier to draw conclusions and outline directions for policies aimed at strengthening or at least safeguarding the role of SMCs within the main value chain in the present innovation/knowledge-led economy. A preliminary remark is needed before formulating conclusions, concerning the quantitative and qualitative relevance of the SMCs in the Italian and European scene. In this regard, it is worth remembering the 2014 draft opinion of the Commission for Territorial Cohesion "Towards an Integrated Urban Agenda for the EU". While aiming at drawing up a joint integrated urban agenda in the form of a White Paper, the draft opinion stresses the role towns and cities play within the knowledge-based economy. Moreover, it focuses on the role of large, medium-sized and small towns and cities (about 200 million people live in towns of fewer than 100,000 inhabitants) which, thanks to their polycentric structure, provide services and facilities in a more evenly distributed way across the territory.

In Italy, the role of SMCs is a key issue. Municipalities with less than 100,000 inhabitants host 77 percent of total population while 84 percent is hosted by municipalities with less than 200,000 inhabitants. Moreover, only two municipalities exceed one million inhabitants or more, namely Milan and Rome, which confirms that Italy is a (or the) country of "mille campanili". In front of this quantitative importance, what is the qualitative role SMCs can play within the innovation/knowledge-led economy? First of all, our results show that size matters, in that both cumulative processes and transmission costs drop in codified knowledge are at work. It follows that SMCs are more exposed than larger cities to be relegated to a

marginal role within the knowledge value chain. However, once the distinction is made within the composite set of knowledge-based activities according to the level of the learning process, SMCs are supposed to be able to play a substantial, though second-order role.

A more articulated depiction of opportunities and threats for SMCs can be outlined as follows:

- high-level innovation-led activities dealing with analytical knowledge follow a locational rationale regardless of local and urban aspects, which fundamentally obeys to the Triple Helix logics embedded in metropolitan areas/regions. Consequently, SMCs lying within metropolitan areas and/or regions can strive for taking part to this sub-sector of knowledge-based activities.
- Lower orders of knowledge-led activities, having recourse to synthetic knowledge, show to be importantly connected with material production, on the one side, and the urban context on the other side, without important internal cumulative effects. These features match well with SMCs, when they are inserted within a manufacturing environment (as the Mezzogiorno counter example shows, deprived as it is of both components). Furthermore, the local supply of wide urban public services (such as those provided by provincial capital cities) seems to attract these activities, a condition which further reinforces the chances for SMCs.
- SMCs also show to be suitable places for public knowledge-based activities, in that these ones do not depend on spontaneous locational choices but on political options, obeying to criteria such as spatial equity (it is not a coincidence that the Mezzogiorno shows to be highly specialised in this sector), lobbing and/or electoral manoeuvres.
- The sector where SMCs lose importance is that of the symbolic-knowledge based activities, whose location rationale is strictly related to city size. The fact that this kind of activities is also sensitive to proximity with manufacture (think, for example, to industrial design and advertising) leave, however, some little room for SMCs to play a role, provided that they are again located in manufacturing environments.
- This last remark calls into play the opportunity SMCs have to be suitable, agreeable places for the high-skilled high-paid workers of the knowledge-intensive sector, who could dwell in them and daily commute to their respective workplaces. As said above, it is not matter here to deal with functional aspects, especially when they are related to consumption or wellbeing, but hedonic aspects can structurally relate to the productive side by a twofold way: first, because they enhance creative attitudes and, second, because, after Florida (2002), the question rises if it is the creative class to pull creative industry (as he maintains) or vice versa, but this would be matter for another research work.

With respect to the normative side, public policies come into play to prevent, mitigate or remove market failures, or else to change the structural reference frame for individual choices. Thus the question becomes if the spontaneous work of individual actions is hindered or

blocked by some obstacle, such as lack of positive externalities, lack of information or rather interpretative capacities and prisoner's dilemmas. With specific reference to the issue of SMCs, outcomes from the above analysis suggest that the lack of positive externalities, such as the absence of a manufacturing environment, adequate supply of urban services or a vivid urban milieu, is the main cause negatively affecting SMCs capability to play a substantial role in the knowledge economy. Such deficiencies can be partially compensated by belonging to a metropolitan area, even though this may not be a sufficient condition. For this to actually become a proactive condition, strategies have to be designed and implemented however at a higher level than the individual SMCs, because the blocking logics of the prisoner's dilemma would otherwise come into play.

To this aim, the recent institution of nine "Metropolitan cities" in Italy (Law 7 Avril 2014, n. 56), notwithstanding the doubts their spatial identification arises (Compagnucci, 2013), could represent an important step. As intermediary levels of local government with important powers in 'territorial' planning, they could be the suitable device to design and implement policies aiming, among other goals, at exploiting the potentialities of SMCs in the current knowledge-driven economy. A preliminary condition in this regard is that they should move towards the attainment of a spatial correspondence between the metropolitan city (which is their starting administrative dimension, which coincides with the present respective province) and the metropolitan area (which is the factual dimension of relevant socio-economic phenomena).

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