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Smart Specialization, Regional Growth and Applications to European Union Cohesion Policy

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MCCANN P. and ORTEGA-ARGILÉS R. Smart specialization, regional growth and applications to European Union Cohesion policy, *Regional Studies*. The aim of this paper is to achieve two objectives. Firstly, it examines the smart specialization concept and explains the challenges involved in applying this originally sectoral concept to an explicitly spatial and regional setting. Secondly, it explains the ways in which this might be achieved so as to make the concept suitable as a building block of a reformed European Union cohesion policy.

Smart Specialization European Union Cohesion policy Innovation Place-based

MCCANN P. and ORTEGA-ARGILÉS R. 灵活专业化、区域成长及其于欧盟凝聚政策的应用, *区域研究*。本文旨在达成下列两项目标。首先, 本文检视灵活专业化的概念, 并解释将此一源自于部门的概念应用于明确的空间及区域脉络所涉及到的挑战。再者, 本文解释达成上述目标的方式, 使得此一概念更适合做为革新的欧盟凝聚政策之基石。

灵活 专业化 欧盟 凝聚政策 创新 基于地方的

MCCANN P. et ORTEGA-ARGILÉS R. La spécialisation intelligente, la croissance régionale et les applications à la politique de cohésion de l'Union européenne, *Regional Studies*. Les buts de ce présent article sont à deux temps. Primo, on examine la notion de spécialisation intelligente et explique les défis en jeu pour appliquer ce concept, qui à l'origine était sectoriel, à un milieu qui est explicitement spatial et régional. Secundo, on explique les manières pour y parvenir afin de rendre le concept propice comme pierre d'assise d'une politique de cohésion réformée de l'Union européenne.

Intelligent Spécialisation Union européenne Politique de cohésion Innovation Territorial

MCCANN P. und ORTEGA-ARGILÉS R. Intelligente Spezialisierung, regionales Wachstum und Anwendungen auf die Kohäsionspolitik der Europäischen Union, *Regional Studies*. Mit diesem Beitrag werden zwei Ziele verfolgt. Erstens wird das Konzept der intelligenten Spezialisierung untersucht, und es werden die Herausforderungen erläutert, die mit der Anwendung dieses ursprünglich sektoralen Konzepts auf eine ausdrücklich räumliche und regionale Umgebung verbunden sind. Zweitens wird erläutert, auf welche Weise sich diese Anwendung verwirklichen lässt, um das Konzept zu einem geeigneten Baustein für eine reformierte Kohäsionspolitik der Europäischen Union zu machen.

Intelligent Spezialisierung Europäische Union Kohäsionspolitik Innovation Ortsabhängig

MCCANN P. y ORTEGA-ARGILÉS R. Especialización inteligente, crecimiento regional y aplicaciones en la política de cohesión de la Unión Europea, *Regional Studies*. Este artículo tiene dos objetivos: primero, examinar el concepto de la especialización inteligente y explicar los retos que implica aplicar este concepto originalmente sectorial a un entorno explícitamente espacial y regional. Segundo, explicar cómo se puede conseguir esto para adaptar este concepto y convertirlo en un elemento esencial de una política de cohesión reformada de la Unión Europea.

Inteligente Especialización Unión Europea Política de cohesión Innovación Basado en lugares

JEL classifications: O31, O33, R11, R58

INTRODUCTION

The *smart specialization* concept evolved as a response to the challenges associated with innovation policy design in the European context, and more recently it has become of widespread interest for a range of other Organisation for Economic Co-operation and Development (OECD) countries. The smart specialization concept contains many elements that were already evident in the innovation systems literature, the entrepreneurship and growth literatures, and in the various transactions costs literatures (OECD, 2012a). However, as the OECD (2012a) makes clear – as will be shown in this paper – the distinctive feature of the smart specialization concept is that it builds on these literatures in order to provide a clear policy-prioritization logic which is well suited to promoting innovation in a wide variety of regional settings, and in particular in the heterogeneous environment of European Union (EU) regions.

The smart specialization concept is now a major driving force behind both the new ‘Innovation Union’ flagship programme of the European Commission and also the EU cohesion policy reforms.¹ The aim of the Innovation Union initiative is to foster the dissemination and the realization of EU-wide economies of scale in high-technology and knowledge-intensive sectors, while the aim of the EU cohesion policy is to promote the development of many of Europe’s weaker regions. These aims may at first appear to be somewhat incompatible, but as will be explained below, the way that the smart specialization concept is being applied in Europe potentially allows for both sets of objectives to be addressed. The reason is that from a regional policy perspective the smart specialization approach offers a range of advantages for the design of appropriate innovation policy-making, while allowing for the varied evolutionary nature of regional economies.

The aim of this paper therefore is to achieve two objectives. Firstly, it examines the smart specialization concept and explains the challenges involved in applying this originally sectoral concept to an explicitly spatial and regional setting. Secondly, it explains the ways in which this might be achieved so as to make the concept suitable as a building block of a reformed EU cohesion policy.

The paper is organized as follows. The next section explains the origins of the concept, and the third section outlines its early suggested links to regional issues. The fourth section examines the analytical challenges in linking the concept to economic geography and the fifth section provides a defence of the concept in a regional policy context. The sixth section discusses its future role in European cohesion policy.

THE ORIGINS OF THE SMART SPECIALIZATION CONCEPT

The smart specialization concept originated in the literature analysing the productivity gap between the United

States and Europe, a gap which had become evident since 1995 (ORTEGA-ARGILÉS, 2012). This is a wide-ranging literature that attempts to identify the key factors which underpinned the increasing productivity gap (ORTEGA-ARGILÉS *et al.*, 2010, 2011). One common theme that emerged was the critical role which technological linkages and spillovers between sectors and regions, and in particular those related to information and communications technologies, play in explanations of this productivity gap. European policy attempts to close this gap were in part reflected in the European Research Area (ERA) programmes. However, a more fundamental rethinking of the productivity challenges facing Europe was undertaken by the ‘Knowledge for Growth’² expert group (K4G) advising the former European Commissioner for Research, Janez Potočnik. This group of scholars suggested a conceptual framework for thinking about a possible policy-prioritization logic aimed at promoting EU growth, a framework which they labelled *smart specialization*.

The original smart specialization concept assumes that context matters for the potential technological evolution of innovation systems (*knowledge ecology*). In other words, the potential evolutionary pathways of an innovation system are explicitly argued to depend on the inherited structures and existing dynamics, ranging from widespread incremental change to even radical transformations of the system. As such, the smart specialization concept made explicit the implicit assumptions behind the ERA, which were that different countries and regions would tend to specialize in different knowledge-related sectors depending on their capabilities, and then proceeded to develop a policy-prioritization logic from this standpoint.

In order to develop a policy-prioritization logic aimed at promoting growth the aspatial smart specialization argument (FORAY *et al.*, 2009, 2011; DAVID *et al.*, 2009) employs the concept of a *domain*, and argues that entrepreneurs will search out the innovation opportunities within their domain. Finding ways to enhance these *entrepreneurial search* processes is essential as it is these that drive the identification and exploitation of the potential advantages of general purpose technologies (GPTs) to regenerate the targeted economic domain, often via the co-invention of new applications (DAVID *et al.*, 2009).

The smart specialization argument highlights the importance of the *relevant size* of the domain, whereby size relates not to aggregate gross domestic product (GDP), but to the range of the relevant sectors or activities in which new technological adaptations can most likely be applied and which can best benefit from knowledge spillovers (DAVID *et al.*, 2009). The original aspatial thinking in terms of potential impacts was driven primarily by the assumption of intra-sectoral spillovers, although inter-sectoral spillovers are not ruled out. Finally, as well as the promoting the entrepreneurial

search processes and identifying the relevant sectors with the requisite size, the third issue to be considered is the issue of the *connectedness* of the domain. Domains that are highly connected with other domains will offer greater possibilities for learning than less connected domains, an idea which is central to all forms of network analysis.

The concept of smart specialization therefore emphasizes issues of economic potential, and the mechanisms whereby such potential is most likely to be realized, and can be summarized as follows. Within a particular domain, the entrepreneurial search process leads to the identification of the *distribution* of potential opportunities for technological improvements to be embodied in a range of sectors, activities and occupations; the relevant size issue relates to the potential *magnitude* of the innovation outcomes associated with these opportunities; and the connectedness issue relates to the potential for *learning* about both these opportunities and magnitudes.³

A NON-SPATIAL REGIONAL INTERPRETATION OF THE SMART SPECIALIZATION LOGIC

The original smart specialization concept emerged from aspatial sectoral lines of thinking, but it increasingly shifted towards addressing regional growth issues as fundamental building blocks of national and European growth issues. In order to make the smart specialization logic applicable to a regional context, the proponents of the concept interpreted the idea of a domain in terms of that of a region, and applying the smart specialization logic in this manner, DAVID *et al.* (2009) argue that one of the features of many European regions is a weak correlation between the region's research and development (R&D) capabilities, its training specializations, and its industrial structure. A regional policy recommendation from the smart specialization proponents was therefore that rather than either pursuing 'one-size-fits-all' skills-training policies or alternatively always prioritizing high-technology sectors over others, governments should foster human capital formation for the new 'knowledge needs' of the region's *traditional* industries which are starting to adapt and apply these new technologies. As such, this argument emphasizes the critical role of knowledge diffusion processes between sectors, activities and occupations, and explicitly avoids automatically prioritizing high-technology sectors by taking a broader systems perspective.

The aim of such a policy would be, for example, to promote a local skills base that can facilitate widespread local incremental improvements across a range of the region's economic activities, as well as developing more specialized application technologies in the region. Exactly how this might be achieved is also sketched out by DAVID *et al.* (2009), who suggest that subsidizing a follower-region's access to the problem-

solving expertise from researchers in a leader-region could be a fruitful way forward. Such a policy response could take the form, for example, of a network-development programme linking specialists in different regions. Obviously, inadequately designed schemes could inadvertently foster undesirable lock-in effects, becoming in effect sources of indirect subsidies to specific industries in particular regions. Therefore, in order to avoid the types of moral hazard, adverse selection and opportunism problems that could lead to such undesired outcomes, the policy needs to be carefully designed (DAVID *et al.*, 2009).

The novelty of the smart specialization concept was that although it emerged from the literature on the economics of knowledge and technology, it provided a policy-prioritization logic and a policy agenda which was rather different to most of the currently popular technology policy recommendations that tended to emphasize heavily the importance of high-technology sectors. As such, although smart specialization built on many previous literatures, it provided a major twist in terms of contemporary policy thinking, and much of this logic appeared to be highly relevant to the case of regions. However, translating the original smart specialization logic to regional policy is somewhat less straightforward than this example implies. The original sectoral concept can indeed be adapted and adopted in the regional policy context, but there are some major economic geography issues that need to be first considered in order for this to be the case.

ECONOMIC GEOGRAPHY AND THE SMART SPECIALIZATION LOGIC

The systems way of thinking underpinning the smart specialization approach explicitly acknowledges that for reasons of history and hysteresis regions vary not only in terms of their technological and industrial competences, but also in terms of their potential evolutionary trajectories. However, in order to apply the smart specialization logic to the regional context, it is necessary to translate each of the key elements of the aspatial sectoral argument – namely the entrepreneurial search process, the relevant size and the level of connectedness – into an explicitly spatial argument.

To do this one must first note that from the urban systems literature there are more or less ubiquitous features to the patterns of all spatial distributions, which are best captured by Zipf's Law (DURANTON, 2007). Core city-regions tend to be both fewer in number and also the largest and most densely populated regions. In addition, these core regions tend to be the most sectorally and structurally diversified regions. In contrast, smaller urban centres are not only much larger in number, but also they are more specialized sectorally. This combination of scale and diversity tends to imply that the larger core-region centres continuously

exhibit greater knowledge-related advantages associated with the learning, sharing and matching of agents, actors and activities (DURANTON and PUGA, 2004). This is the geographical backdrop against which entrepreneurial processes operate, given that the success or otherwise of entrepreneurial processes depends on the level of credit availability, the number and variety of emerging business opportunities, the likelihood of success of these opportunities, and the scale of the markets to be reached.

Given each of these considerations, in terms of the vast literature covering the links between economic geography, entrepreneurship and innovation one can summarize broadly the overall consensus by pointing to the following five stylized facts, which although not ubiquitous are widely observed. Firstly, entrepreneurship and innovation tends to be higher in cities and more densely populated regions than in lower population density regions (ACS, 2002; CARLINO *et al.*, 2007); secondly, entrepreneurship and innovation tends to be higher in more sectorally diversified regions (VAN OORT, 2004); thirdly, entrepreneurship and innovation tends to be higher in regions that are less dominated by a small number of large firms (CHINITZ, 1961; DURANTON and PUGA, 2001); fourthly, entrepreneurship and innovation tends to be higher in regions with large numbers of multinational companies which are internationally engaged (MCCANN and ACS, 2011); and fifthly, entrepreneurship and innovation tends to be higher in regions with large market potential. Conversely, entrepreneurship tends to be lower in regions with lower population densities, lower in regions that are more sectorally specialized, lower in regions dominated by a small number of large firms, lower in regions with firms of limited international engagement, and lower in regions with low market potential.

In addition, a sixth stylized fact is that in many parts of the world including in most OECD countries, the adoption, adaptation, and application of information and communications technologies (ICTs) across of wide range of industries appears to have *exacerbated* the differences between core and non-core regions over the last two decades (MCCANN, 2008; MCCANN and ACS, 2011). The reason for this is that ICTs are complements for knowledge-intensive activities requiring highly frequent face-to-face interactions (GASPAR and GLAESER, 1998; MCCANN, 2007), while at the same time they are substitutes for routinized activities (IAMMARINO and MCCANN, 2013). The result is that a more uneven interregional and international spatial distribution of activities has emerged according to the degrees of knowledge intensity embodied in activities (MCCANN, 2008; MCCANN and ACS, 2011).

In other words, following the above terminology, the economic geography literature suggests that core regions offer greater potential rewards to the entrepreneurial search process in terms of the *distribution*, the *magnitude* and the capacity for *learning*.

Although in reality there are widespread exceptions to these stylized facts, and particularly so in the European context (STERNBERG, 2012; DIJKSTRA *et al.*, 2013), these economic geography arguments *prima facie* suggest that the smart specialization logic ought naturally to favour core regions at the expense of weaker regions. This is because lagging or peripheral regions often exhibit weaknesses in entrepreneurship and innovation due to a combination of reasons, which can be variously sectoral, structural, transactional, technological, behavioural, related to resources and capabilities, related to risk and financial flows, related to externalities and issues of market failure, and also related to commercial and cultural perceptions. Typically, lagging or peripheral regions tend to face weaknesses in at least two of the three key elements of the smart specialization schema. In purely statistical or microeconomic programming terms, one would describe this problem as being one in which there are insufficient degrees of freedom, or alternatively too many variables and too few equations. In public policy terms, one might describe this problem as being one in which there are 'insufficient levers to pull' or 'too few buttons to press', given the regional challenges being faced, and more recent terminology which is currently popular in EU policy circles refers to the 'missing links' that need to be connected or to the 'bottlenecks' that need to be unblocked. However, whichever way one may wish to characterize the challenges facing these regions, it is exactly these types of areas, namely regions facing combinations of challenges, that regional policy in all parts of the world, and in the specific case of the EU, European cohesion policy, tends to target. A *prima facie* problem with translating the smart specialization concept of a *domain* to that of a real *region* is that everything that is known from economic geography indicates that the targets of regional policy are precisely those regional domains that tend to lack sufficient levels of at least two of the three key elements that the smart specialization schema requires in order to be an operational policy. In contrast, the regions that appear to be the most conducive and favourable for the operation of smart specialization-type processes are the buoyant core regions, and as such precisely the types of regions which EU cohesion policy does not prioritize. Moreover, the adoption and widespread adaptation of ICTs, which was one of the main catalysts for the original development of the smart specialization concept, if anything, has worsened the problem of regional disparities in many parts of the world by favouring the core regions.

All aspects of the smart specialization logic *prima facie* therefore appear to favour places that are not the primary target of regional policy. This apparent contradiction therefore raises the question as to whether employing a smart specialization logic in the service of regional policy is internally inconsistent and likely to undermine the very policy which it is intended to

serve. If it is indeed a self-contradictory and internally inconsistent approach, then the outcomes of a combined smart specialization-regional policy approach are at best likely to be undesirable, and at worst doomed to failure. This is a real operational and implementation problem, and as such the first fundamental question regarding the application of smart specialization principles to regions is as follows:

How is the smart specialization concept to be applied as a regional policy tool when the smart specialization logic appears to favour other types of places?

If the regions that are most favourable and conducive for the operation of smart specialization processes are core regions, then this suggests that all the market signals associated with the various aspects of the smart specialization logic will favour the core regions. As price signals provide information about markets and welfare, then this fact raises doubts not only regarding the efficacy, but also the rationale for the policy, in terms of whether the wrong places are being targeted. If all aspects of the smart specialization approach naturally favour core regions rather than lagging regions, then the second question is:

Why should the smart specialization concept to be applied as a regional policy tool when the smart specialization logic favours other types of places?

In essence, the 'how' question is a positive question in that it relates primarily to the likely outcomes of the policy, given the operational and implementation challenges to be faced. In contrast, the 'why' question is essentially a normative question in that it relates to the justification for the intentions and objectives of the policy.

Taken together, these two questions raise doubts about the wisdom of promoting the smart specialization logic as a key ingredient of EU regional policy, because prima facie, the smart specialization logic appears to discriminate against lagging regions, and to contradict the design, if not the very rationale for regional policy itself. On the basis of the first how question and the second why question the third question is:

Do the answers to the first two 'how' and 'why' questions imply the death-knell of smart specialization as a regional policy tool for EU cohesion policy?

Rather surprisingly to some observers, in spite of the serious methodological and philosophical challenges posed by the first two questions, the answer to the third question is actually 'No', and that, yes, smart specialization can indeed be justified as a tool for cohesion policy.

THE JUSTIFICATION FOR USING SMART SPECIALIZATION IN REGIONAL POLICY

The justification for the defence of smart specialization as a regional policy tool actually comes in two parts. The first part of the defence addresses the second 'why'

question, while the second part of the defence addresses the first 'how' question. This section will therefore deal with the answer to the third question by dealing with the responses to the first two questions in reverse order.

Response to the why question: space-neutral versus place-based policies

In order to answer the second 'why' question it is necessary to understand that in actual fact the problems raised by the second 'why' question are not specific to the smart specialization logic at all, but relate to the more general arguments regarding the case for regional policy per se. The reasons for regional disparities are very complex, and the elements included in the smart specialization concept are only a small part of the overall story, although they are important elements. More broadly, however, the why question here relates to the much wider questions raised by the debate regarding the rationale and efficacy of space-neutral and sectoral approaches versus place-based approaches to policy (OECD, 2009a, 2009b, 2011a; BARCA *et al.*, 2012). This is a debate that is well beyond the remit or aims of this paper, but it is sufficient to say that it is this place-based approach which is the philosophical approach that underpins the current reforms of EU cohesion policy aimed at the new policy period beyond 2013.

As already shown, the smart specialization concept is essentially a way of thinking about local knowledge-enhancement and learning-enhancement systems. Therefore, the justification for using a local knowledge and learning enhancement concept such as smart specialization as part of regional policy is actually already contained in the overall justification for using a local and regional territorial place-based development policy approach to cohesion policy, rather than employing a space-neutral or purely sectoral approach. The reason is that the defence of the place-based approach already deals explicitly with these types of questions across a much broader range of issues than smart specialization alone. The place-based approach explicitly advocates employing appropriately designed local knowledge- and learning-enhancement tools in regional policy, and the smart specialization argument is one such tool. Whether it is the most appropriate regional policy tool in comparison with other alternative concepts or tools is discussed in the next section.

The important point here, however, is that the first part of the defence case for using smart specialization as part of EU cohesion policy is basically the same as that much broader defence of employing (at least in part) a place-based approach to regional development policy over a purely space neutral approach.

Response to the how question: embeddedness, relatedness and connectivity

Because regions differ so much in terms of their innovation characteristics (IAMMARINO and MCCANN,

2006), the answer to the *how* question will depend very much on the specific regional context, exactly as the place-based approach postulates. However, if one focuses on the innovation and smart growth agenda of the Europe2020 strategy, one can sketch out here the broad outlines of a general response to the first *how* question. In order to do this the OECD (2011b) typology of different types of innovation regions is followed, a typology that reflects the dominant features of the relationship between innovation and geography, and which closely mirrors the TÖDTLING and TRIPPL (2005) regional innovation classification scheme. In terms of understanding regional innovation systems, the OECD typology groups regions into three broad types, namely: knowledge regions, industrial production zones and non-science and technology (S&T)-driven regions, which typically represent the lagging regions. This classification approach is useful in demonstrating the salient and dominant features of a region's innovation system, and is also very useful in highlighting the major innovation challenges faced by the various different types of regions. For present purposes, the use of this typology also allows one to identify the key issues that need to be addressed in order to work out how a smart specialization concept could be applied to regional policy. In economic geography terminology, the key issues are embeddedness, relatedness and connectivity.

The easiest way of explaining this is by using the same domain-regeneration example originally offered by the proponents of the smart specialization concept (DAVID *et al.*, 2009), namely that of the perceived mismatch between regional skills, human capital training-provision and the demand requirements of the region. One of the central themes in regional policy concerns the need for local human capital and skills enhancement. Yet, in addition to the general level of skills, the smart specialization logic also suggests that there should be a close matching between supply of skills training and the region's medium- or long-term skills demand. But this raises the challenge of how to determine the appropriate pattern of provision of labour training so as to minimize this apparent mismatch, given that one is considering the medium- or long-term skills demands of the region driven by entrepreneurial search processes. Moreover, an additional challenge relates to the induced effect of such a programme, because it is also known that as people acquire more human capital, they become more geographically mobile, and the likelihood of such people leaving less prosperous regions and moving to buoyant regions increases (FAGGIAN and MCCANN, 2006, 2009a, 2009b). In terms of the OECD (2011b) classification above, this implies that a local skills-enhancement programme in a lagging region which is undertaken under the auspices of regional policy actually increases the likelihood of human capital outflows from this same lagging region. These human capital outflows from a lagging region

could be primarily to either industrial production zones or, more likely, to knowledge regions, but in each case the actual pattern will depend on the inter-regional spatial distribution of the employment possibilities. Obviously, not all recipients of local skills training will move away; a greater local skills match reduces labour outflows, whereas a greater local skills mismatch will increase outflows. However, the point remains that in terms of its intended local development objectives, the regional policy itself be undermined by the induced out-migration, unless sufficiently strong countervailing processes are also operating to ensure that enough gainful local employment opportunities are available. In other words, the relationship between skills training and regional development depends on the links between the policy and changes in the local labour supply and how these changes dovetail with the local labour demand requirements.

In terms of economic geography, less prosperous non-core regions often have more specialized industry structures, dominated by a smaller range of sectors which are highly embedded in the region, in the sense that their local input-output linkages are strong and/or longstanding. As such, in order to reduce the skills mismatch problem in these types of regions, following the smart specialization logic, one argument is that the skills-enhancement programmes should be specialized and closely allied to the requirements of the existing local industries which are already highly embedded within the region, so as also to increase the overall *embeddedness* of both the local labour force and the local industries. Here, the degree of embeddedness of local activities must be seen in the context of evolving global value chains, in which the economic linkages between regions are changing. In the case of the EU, over time its regions are becoming both more interconnected within each other and also with wider global value chains, and much of this increasing interconnection also takes place via the increasing fragmentation of value chains.

From a policy perspective, given that it is impossible to predict long-term trends, the most sensible approach is to focus on the medium-term, and here it is known that existing industrial structure is the best indicator of the medium-term regional industrial structure. The reason for this is that very few regions make fundamental structural or sectoral shifts in the short- to medium-term. The levels of embeddedness of different sectors can be identified via regional input-output models, computable regional general equilibrium (CGE) models, or more simply by means of employment patterns (MCCANN and DEWHURST, 1998). In addition, such approaches can be bolstered with information regarding the organizational (MCCANN, 1997) and institutional behaviour of the various sectors, including local university-industry links, and other regional evidence of knowledge spillovers, knowledge exchanges, or social and institutional participation. Whatever

approaches are employed, another novelty of the smart specialization logic shifts local policy discussions from a tendency towards being often rather introspective and myopic to being much more explicitly.

Yet, this raises a problem. Emphasizing the regional embeddedness in the context of evolving global value chains may appear both to increase the vulnerability of the region to external shocks and also to reduce the possibilities for knowledge spillovers, precisely because it implies increasing the specialization of the region. Therefore, in order to counter these problems, it is necessary to develop a strategy to allow the less prosperous regions actually to *diversify*, not to specialize. While this may appear *prima facie* to run counter to the smart specialization logic, this is not the case. The smart original specialization concept promotes the idea of technological diversification within a particular domain which has a realistic specialization advantage due to its relevant scale. In a regional policy context, this implies that a labour-enhancement programme should be designed to foster the *technological diversification* strategies of the major locally embedded industries, because it is these sectors that have the relevant scale. Such a strategy is consistent with the technological relatedness argument of FRENKEN *et al.* (2007). This technological *relatedness* argument from evolutionary economics (FRENKEN and BOSCHMA, 2007; BOSCHMA and FRENKEN, 2011), for which there is now strong supporting empirical evidence (BOSCHMA and IAMMARINO, 2009; NEFFKE *et al.*, 2011; BOSCHMA *et al.*, 2012), posits that the most promising pathways forward for a region to promote its growth is by diversifying into technologies which are closely related to the existing dominant technologies. The argument here is that it allows regional assets to shift more easily between technologies because they are still able to build on their existing skills and capabilities. Inflows of new firms and the founding of new local firms are both systematically higher in fields which are technologically diversified, but also closely related to the existing dominant fields of the region, while outflows of firms or firm failures are more likely in sectors unrelated to the existing regional technological profile (NEFFKE *et al.*, 2011). As such, it is not diversification per se that is important for growth, but the patterns of *specialized diversification* across related technologies that are important for growth. Indeed, the evidence suggests that the impact of this technological relatedness argument is even more pronounced at the regional scale than at the national scale (BOSCHMA *et al.*, 2012). This argument is also consistent with many other findings from the regional growth literature that imply that industries which are the dominant and most relatively specialized in a region, but which also are in a region with diversified industrial structure, are likely to exhibit high growth (MAMELI *et al.*, 2008, 2013).

Taken together, the combination of the *embeddedness* and *relatedness* principles in economic geography

translates the aspatial smart specialization idea of a *relevant size* domain into a realistic set of regional policy priorities.

The third element of the aspatial-sectoral smart specialization concept that one must translate into spatial-regional terms is the issue of *connectedness*. The original connectedness idea emerged from a sectoral way of thinking, whereby the national innovation system is comprised of a set of sectoral innovation systems and inter-sectoral linkages and knowledge spillovers. Applying this sectoral approach to regions leads one to the types of networking policies suggested by DAVID *et al.* (2009). However, innovation-related knowledge flows are embodied in both the face-to-face interactions (MCCANN, 2007) between people and also the mobility of human capital, and as is known from New Economic Geography the Krugman shadow effect associated with centrifugal forces (KRUGMAN and VENABLES, 1995; FUJITA *et al.*, 1999) means that policies designed to reduce spatial transactions costs may actually work in the opposite direction of the ideas suggested by DAVID *et al.* (2009). As such, once one moves from a sectoral to an explicitly spatial argument, it becomes clear that the smart specialization idea of connectedness does not translate so directly to a regional context, and that some additional issues need to be taken account of.

In order to consider the implications of this, one must first clarify that in economic geography the idea of connectedness is defined in terms of *connectivity*, a concept widely employed in the global cities literature (SASSEN, 2002) and originally borrowed from sociology, whereby connectivity relates to all the transactions associated with trade, transportation, passenger movements, information flows, knowledge interactions, financial flows, funds management, and international decision-making capabilities, which are situated at a particular location. From here on this paper will therefore use the terminology of connectivity (MCCANN and ACS, 2011) rather than connectedness, so as to distinguish clearly the spatial from the sectoral approach, respectively. On this point, if the knowledge inflows into regions are related to the region's existing technological fields, then this fosters growth (BOSCHMA and IAMMARINO, 2009). Setting this connectivity concept within the OECD (2011b) regional-innovation typology allows one to reconsider the role of the connectedness-connectivity element of the basic smart specialization argument.

One aspect of regional policy, exactly as the smart specialization argument posits, is to focus on a peripheral region's most connected industries, so that the regional industrial base is best able to learn from the more advanced regions. In terms of the OECD (2011b) regional-innovation typology, in the case of lagging regions this would imply ways of fostering learning-linkages with either industrial production zones or knowledge regions, whereas for industrial production zones it

would imply fostering linkages with either knowledge regions or sometimes other industrial zones. Importantly, however, the networking effect must not lead to an adverse Krugman shadow effect (FUJITA *et al.*, 1999) whereby the networking actually promotes further outflows of knowledge of skills. Therefore, in order for a smart specialization-type policy to work in a regional context, the analytical focus must centre on ways to maximize the knowledge spillovers and learning linkages within the regions which are the targets of the policy, as well as between regions.

The smart specialization-based regional policy-design challenge

The preceding discussion suggests that if smart specialization is to be successfully integrated into regional policy, it is necessary to develop regional policies that promote technological diversification amongst the most embedded industries which have the relevant scale to generate significant local impacts, whilst at the same time promoting the connectivity of the region without inadvertently creating an adverse Krugman shadow effect.

In response to this challenge, four major points can be made:

- In large and highly diversified urban centres and leading knowledge regions (OECD, 2011a) the smart specialization argument will be less relevant as almost all sectors and technological fields will be present. Moreover, in general their buoyancy implies such centres will not be a target for regional policy funding. However, for intermediate regions with both urban and rural areas, as well as for many smaller sized regions with urban centres, the smart specialization argument would seem to be very well suited. A sufficiently large population base is required in order to generate agglomeration or network effects. Moreover, intermediate and smaller regions account for well over half, and also an increasing share, of economic growth in OECD countries (OECD, 2012b), and particularly in Europe (DIJKSTRA *et al.*, 2013). As such, both in terms of their growth potential and also the concentration possibilities offered by their spatial structure, these intermediate regions appear to be ideal targets for smart specialization policies. Of these regions, industrial production zones would be particularly suited to a mix of R&D, training and networking programmes, precisely because of their scale. For very isolated regions, however, the smart specialization argument appears to offer only very limited possibilities, because the lack of scale is likely to reduce the effectiveness of the policy approach. In these cases, rather than funding R&D, the priorities might centre on the promotion of connectivity in certain natural environmental or tourism activities, via, say, for example, wireless ICT systems
- to more central core regions, so as to foster non-R&D-driven innovation in key sectors.
- The smart specialization logic applied in a regional context, in which the issues of embeddedness, relatedness and connectivity are explicitly discussed, puts the onus onto the policy designers and potential funding recipients to identify clearly the perceived market failures which are being corrected, and to justify exactly how the smart specialization approach to the tailoring and provision of public goods is to be applied, monitored and evaluated. This model is consistent with the approach of RODRIK (2004) and BARCA (2009) in which partnerships between the public and private sector are essential in order to elicit the knowledge regarding the most severe obstacles to growth, the major bottlenecks or missing links, and the optimal remedies. This form of policy-tailoring will also require appropriate results/outcome indicators to be carefully chosen which are amenable to being tracked through the life of the programme and projects.⁴ This is not because the results/outcomes can be known in advance, but rather as a means to facilitate and enhance the policy process (RODRIK, 2004). As such, the smart specialization logic, when it is appropriately translated to an explicitly spatial regional context, would appear to be a powerful lens through which policy-makers can design and articulate local development policies.
- The smart specialization logic suggests that in a regional context the policy recommendations may be very different in different places, depending on the region's technological profile, its industrial structure and its geography. Relevant scale naturally points towards the agglomeration potential of bigger population centres, particularly in the dominant category of intermediate urban-rural regions, which will allow for comprehensive policy scenarios. At the same time, the possibilities offered by network systems point towards wireless information technology-based solutions in many more remote regions. There is no 'one-size-fits-all' policy, and the smart specialization logic forces priorities to be chosen amongst competing alternatives.
- The problems of local rental capture must also be addressed head on, and there are two aspects to this problem. Firstly, the smart specialization logic emphasizes prioritization and concentration of resources around key themes. As such, the framework must be translated into a policy-design logic that explicitly aims at building a policy-prioritization process based on fostering a region's technological diversification opportunities on the basis of the embeddedness, relatedness, and connectivity characteristics of the region's activities, institutions and sectors. This type of policy-process, which necessarily involves gathering evidence and data, building public-private partnerships in the policy-design stages, and also necessitates the monitoring of all policy actions and interventions,

will help avoid the types of fragmented and localized sectoral rent-seeking likely to undermine the drive for resource prioritization and concentration. Secondly, it is necessary to engage with local elites in order to extract local knowledge and to tailor the policy. However, policy design at the regional level involves not only issues of externalities, but also the information asymmetries and principal-agent problems associated with engagement with local elites. The specialized diversification aspect of the smart specialization policy logic implies newness, variation and differentiation, and these very features may undermine some of the monopoly positions of local elites. As such, even if the policy is indeed translated into explicitly spatial and regional terms in the manner described here, it is necessary to ensure that the architectures of the policy-design, policy-delivery, and policy-evaluation systems are open and inclusive, and allow for a broad range of stakeholders and interested parties to participate. Otherwise they may be subject to rental capture by local elites who will subvert the process by *limiting* openness and by *restricting* the pursuit of the novelties and variations to arenas over which they maintain control. The way this can be achieved is by the use of both conditionalities and also outcome indicators, as argued on numerous occasions by The World Bank, the OECD and the European Commission, and as also discussed in detail by the BARCA (2009) report.

SMART SPECIALIZATION AND EUROPEAN UNION COHESION POLICY

In light of the regional policy-design challenges just described, this section will now examine the major elements of the smart specialization logic and it reconsiders how they might best be incorporated into a reformed EU cohesion policy. The major aim here is to design policies that will foster maximum learning linkages both within the target regions as well as between regions. In order to do this one must first translate the smart specialization logic from a sectoral innovation system approach to a regional innovation system viewpoint. In addition, it is necessary to think in terms of a national innovation system as being comprised not only of a set of distinct regional innovation systems, but also of an overarching *inter-regional* innovation system. This inter-regional element highlights the issue of how knowledge does, or does not, flow between regions, and the ways in which such flows might best be fostered and regions better connected.

Adopting a regional and interregional innovations-systems logic, if one now reconsiders both the technological aspects of diversification and also the issue of connectivity, as already shown, the original sectoral smart specialization logic, which initially emerged from the sectoral literature on the transatlantic

productivity gap, emphasized the importance of the adoption, adaptation and diffusion of general purpose technologies (GPTs), and in particular ICTs. In many cases, tailored skills training or actor-networking related to ICTs may well be a sensible regional policy priority. Moreover, such an approach is also appropriate for regions in which innovation is primarily not research based. However, on the basis of the arguments in this paper, in a regional policy setting the local adoption of ICTs may not necessarily be the priority, given that EU interregional disparities are not primarily due to ICT issues. Moreover, focusing exclusively on this ICT issue raises the risk of inadvertently subsidizing a particular sector across regions, which as noted by the proponents of the concept reflects the type of lock-in danger that must be avoided (DAVID *et al.*, 2009). As such, in addition to the ICT-related networking suggestions discussed earlier (DAVID *et al.*, 2009), other complementary approaches may be very appropriate, including the upgrading of local supply chains, the redesign of local labour-training systems, the promotion of university-industry linkages, or other local institutional reforms, exactly as recommended by the BARCA (2009) report. As such, there is no reason why the appropriate policy solutions should necessarily centre on ICT-related issues *per se*, although this is likely to play a key role in many policy actions.

The final issue relates to the role of entrepreneurship. In the original smart specialization logic it is the entrepreneurial search processes that are assumed to identify the medium-term smart specialization opportunities in the region. The emphasis in the smart specialization concept on promoting entrepreneurial search processes is in no way inconsistent with EU cohesion policy which is the largest source of credit to small and medium-sized enterprises (SMEs) within the EU policy portfolio. However, the fact that in the original policy concept it is the entrepreneurs and not the regional policy-makers who are assumed to be best equipped for identifying the smart specialization opportunities therefore also poses an additional policy-design challenge. In particular, designing smart specialization-based regional policies that link local SMEs and technological diversification to regional embeddedness and connectivity means that there may need to be place-specific criteria for credit availability. In particular, SME credit may need to be prioritized for firms whose entrepreneurial goals are to promote technological diversification amongst the region's most embedded industries and activities. At the same time, ironically, in order to ensure that such a policy is successful, aggregate R&D funding in its early stages would need to be explicitly space-neutral in the sense that it is *not* applied primarily to the dominant knowledge centres, but spread evenly, or at least randomly, across all places in response to funding applications. Indeed, in the United States there are National Research Council policies that work exactly according to this logic (WESSNER,

2008). Only after a peer-review performance evaluation process that takes place after a predefined period of time after the seed-funding has been granted is the continuation of funding ensured. This is both a genuinely place-neutral and also explicitly not a capital-city policy, and as such provides a powerful counter-argument to the argument that smart specialization favours strong regions.

To some observers, smart specialization may appear to raise concerns regarding 'picking winners' (DAVID *et al.*, 2009). However, the smart specialization concept was never conceived of as a strategy for 'picking winners' or for imposing sectoral specialization by means of top-down government planning (OECD, 2012a). Rather, it was always seen as being a partnership-based policy process of discovery and learning on the part of both policy-makers and entrepreneurs, and was always framed within the recent trend towards reconsidering the role and logic of industrial (RODRIK, 2004), knowledge (TRAJTENBERG, 2009; SOETE, 2009a, 2009b), and regional (TÖDTLING and TRIPPL, 2005) policies. However, as the original smart specialization proponents themselves acknowledge (DAVID *et al.*, 2009), the logic of the concept does imply a policy-prioritization logic based broadly on a fledgling-industry-type of argument, but with a twist. A problem with fledgling-industry arguments in general is that the medium- to long-term outcomes of the policy are by definition unknown, and as such are very risky. In contrast, however, if one applies the smart specialization logic in a regional context, emphasizing the principles of embeddedness, relatedness and connectivity, then the empirical evidence (FRENKEN *et al.*, 2007; BOSCHMA and IAMMARINO 2009; BOSCHMA and FRENKEN, 2011; BOSCHMA *et al.*, 2012) suggests that the policy-prioritization principles are built on a much sounder footing than the usual fledgling-industry arguments. This is a powerful argument in favour of using the smart specialization concept in regional policy design, and also makes the approach highly relevant to a wide range of regions, well beyond the core city-regions. Smart specialization as a policy-design framework therefore does not inherently favour core city-regions, but can be tailored to addressing the challenges of many types of regions. This is achieved by using the approach to consider the potential innovation and entrepreneurial opportunities associated with the region's existing characteristics, its realistic diversification potential, and to design appropriate policy interventions on the basis of these features and intended outcomes.

As well as being appropriate for a wide range of regions, the smart specialization approach also militates against recommending off-the-shelf or 'one-size-fits-all' policy solutions, and instead points to tailored policy recommendations, contingent on the region's existing knowledge assets. At the same time, the smart specialization approach also emphasized the public-

private policy-learning agenda, and this requires the use of results/outcome indicators, ongoing monitoring and evaluation, combined with pilots, policy experiments and test cases, as is made clear by the authors of the original concept (DAVID *et al.*, 2009). These elements are all required so as to ensure that policy interventions do not in effect end up leading to the strengthening of existing monopoly positions and the associated negative lock-in effects associated with this. Making progress on these matters is an urgent issue if the policy is to be successful, and this can only be achieved if a smart specialization regional policy logic is accompanied by a rigorous self-assessment of a region's knowledge assets, capabilities and competences, the establishment of empirical baselines, and the explicit ex-ante linking of policy priorities to ongoing monitoring and the use of results/outcome indicators.

Smart specialization as a policy-prioritization logic builds on the existing regional innovation systems literature (MCCANN and ORTEGA-ARGILÉS, 2013), and many of the leading scholars in the innovation systems field have been involved in these aspects of the EU cohesion policy reforms. However, it is important to remember that while smart specialization is a major element of the overall EU cohesion policy reforms, it is one element, and other elements of the reforms are designed to deal with the associated problems of institutions, governance, cross-border cooperation, and limitations in absorptive capacity, all of which are typically faced by weaker regions attempting to upgrade their economic capabilities (MCCANN and ORTEGA-ARGILÉS, 2012).

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NOTES

1. See <http://s3platform.jrc.ec.europa.eu/s3pguide> and http://ec.europa.eu/regional_policy/newsroom/detail.cfm?id=361&LAN=EN/.
2. See http://ec.europa.eu/invest-in-research/monitoring/knowledge_en.htm/.
3. The smart specialization concept originally emphasized the importance of R&D, and in particular R&D in high-technology sectors. However, as one moves through the nine policy briefs produced by the Knowledge for Growth expert group between 2006 and 2009 and on towards the subsequent papers (DAVID *et al.*, 2009; FORAY *et al.*, 2011), it is possible to discern a marked shift away from the

early emphasis on R&D, and in particular on multinational R&D, through to institutional and governance issues relating to science, and finally towards technological specialization based on the adoption, dissemination and adaptation of GPTs, primarily understood as ICTs, across a wide range of sectors and activities. As such there was also an increasing emphasis on enhancing the linkages between knowledge-generation processes in all their forms (including R&D) and the promotion and dissemination of entrepreneurship and innovation across all sectors, activities and occupations within the context of global value chains.

4. In the EU context, the definitions regarding the nature and use of results indicators are contained in BARCA and MCCANN (2011) and examples of such indicators are given in the two Complementary Notes on Outcome Indicators for Some EU2020 Objectives entitled

‘Meeting Climate Change and Energy Objectives’ and ‘Improving the Conditions for Innovation, Research and Development’ (see http://ec.europa.eu/regional_policy/sources/docgener/evaluation/performance_en.htm).

These were subsequently updated in response to the deliberations during 2011 of the High Level Group on Outcome Indicators as ‘Outcome Indicators and Targets – Towards a New System of Monitoring and Evaluation in EU Cohesion Policy’, June 2011, on the DG Regio Website (see http://ec.europa.eu/regional_policy/sources/docgener/evaluation/doc/performance/outcome_indicators_en.pdf). For the most recent guidance, see http://ec.europa.eu/regional_policy/information/evaluations/guidance_en.cfm and http://ec.europa.eu/regional_policy/information/evaluations/guidance_en.cfm#1/.

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