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**Relatedness as driver behind regional  
diversification: a research agenda**

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## **Abstract**

The regional diversification literature claims that regions diversify in new activities related to their existing activities from which new activities draw on and combine local capabilities. The paper makes a critical assessment and identifies a number of crucial issues for future research. The paper calls for: (1) a disentanglement of the various types of capabilities that make regions diversify; (2) the inclusion of more geographical wisdom in the study of regional diversification, like a focus on the effects of territory-specific contexts (like institutions) and non-local relationships; (3) an investigation in the conditioning factors of related and unrelated diversification in regions; (4) a micro-perspective on regional diversification that assesses the role of economic and institutional agents in a multi-scalar perspective.

## **1. Introduction**

Economic diversification of regions is high on the agenda of scientists and policy makers alike. There is increasing awareness that the existing set of local capabilities conditions which new activities will be feasible to develop. Indeed, studies (e.g. Neffke et al. 2011; Rigby 2015) show that regions tend to diversify in new activities related to their existing activities from which they draw and combine local capabilities. To an increasing extent, the concept of related diversification is incorporated in regional strategies of smart specialization in the EU that aim to renew the economic structure of regions and to develop new regional growth paths (Foray 2014; McCann and Ortega-Argilés 2014).

These recent insights on regional diversification have led to ongoing debates concerning a number of outstanding issues (e.g. Tanner 2014). These concern the meaning and measurement of relatedness, the identification and relative importance of related versus unrelated diversification, the significance of local capabilities versus non-local linkages for regional diversification, the territory-specific nature of relatedness (can relatedness be considered a global phenomenon?), and the role of micro-agents including individuals, firms, policy makers and other institutional actors. The objective of this paper is to discuss these outstanding issues, and to set out a future research agenda on regional diversification.

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First, the literature on regional diversification claims that related activities demand similar capabilities. Capabilities are often broadly defined, and empirical studies employ different measures of relatedness, such as technological relatedness (Breschi et al. 2003), product relatedness (Hidalgo et al. 2007) and skill relatedness (Neffke and Henning 2013). Relatedness is often defined in terms of similarities between activities that captures the cognitive dimension of capabilities (and thus implies learning). Less attention has been focused on complementarities, that is, the need to combine different activities in order to diversify. This has led scholars to question what relatedness actually stands for (Tanner 2014), and to be more specific about what types of capabilities matter in regional diversification.

Second, recent studies show that related diversification is the rule, and unrelated diversification the exception. This dichotomy comes close to the distinction between new path creation (the emergence of entirely new sectors or products) and path renewal which refers to activities switching to new but related activities (Isaksen and Trippel 2014). We argue this necessitates a discussion of how unrelated diversification is defined. Because both related and unrelated capabilities are likely to be combined in regional diversification, the paper proposes to go beyond a simple dichotomy of related and unrelated diversification, and investigate what factors facilitate regional diversification of a more related and a more unrelated type.

Third, the literature on regional diversification is in need of more geographical wisdom. It tends to treat relatedness between activities as a global phenomenon (Hidalgo et al. 2007; Boschma et al. 2013). However, the degree and nature of relatedness might differ from region to region: some activities might be related in region A, but not in region B, depending on their particular histories. Moreover, it is still unclear what type of diversification prevails in certain regions as compared to other regions (Xiao et al. 2016). This requires comparative studies of countries and regions to determine the territory-specific nature of relatedness. Furthermore, evidence suggests that non-local capabilities, besides local capabilities, influence regional diversification (Isaksen 2015; Trippel et al. 2015). This calls for a multi-scalar perspective to assess the relative importance of local and non-local capabilities (Binz et al. 2014).

Fourth, the regional diversification literature needs to incorporate a micro-perspective in which the focus is on the role of agency and the identification of agents that drive the process of regional diversification. This requires a comprehensive micro-perspective that accounts for the role of and interplay between individuals (like key entrepreneurs, star scientists), firms (like start-ups, spinoffs, diversifiers, local, multi-local and non-local firms) and a set of institutional players (including policy makers), and which types of agents are responsible for what type of (more or less related) diversification in regions (Binz et al. 2014; Dawley 2014).

The structure of the paper is as follows. Section 2 gives a brief overview of the main quantitative studies on related diversification in regions, and how these studies have measured relatedness. Section 3 takes a critical stand towards the treatment of capabilities and relatedness. Section 4 discusses different forms of regional diversification. Section 5 calls for the need for comparative regional studies. Section 6 discusses the need for a comprehensive micro-perspective on regional diversification. Section 7 concludes.

## 2. Regional diversification and relatedness

There is a large body of literature that refers to local capabilities<sup>1</sup> to explain why regions specialize, and why those specialization patterns tend to be persistent over time. Capabilities are often used as an umbrella concept for local assets that consist of a wide range of dimensions. In a highly-cited paper, Maskell and Malmberg (1999) refer to local capabilities as a combination of the region's infrastructure and built environment, natural resources, institutional endowment, and knowledge and skills. Local capabilities are depicted as the outcome of a long history that are hard to copy by other regions, due to the myopic behaviour of local agents, the tacitness of the local knowledge base (Gertler 2003), untraded interdependencies (Storper 1995), and their systemic nature (Asheim and Isaksen 1997).

Recently, scholars have shifted attention from capabilities sustaining existing specializations in regions to capabilities driving the creation of new specializations in regions<sup>2</sup>. Besides providing crucial assets on which existing specializations in regions can thrive, country- and region-specific capabilities can also be considered a key source of regional diversification, as they can provide opportunities to make new combinations that give birth to new activities. However, the current set of local capabilities also sets limits to regional diversification. If a region does not possess the capabilities required for a specific activity, it will be harder to develop it. Therefore, one expects regions more likely to diversify into new activities that are related to existing local activities, to build on their local capabilities.

This focus on regional diversification is not a new topic in economic geography. Since the 1980s, if not before, studies have provided invaluable information on how regions have managed, or not, to move into new specializations, Silicon Valley being the classic case (e.g. Markusen et al. 1986). The recent revived interest in the topic is new in the sense that it has led to quantitative studies investigating the diversification process in many regions simultaneously, instead of focusing on particular regional cases, like the usual suspects (Silicon Valley), the perceived doomed (Detroit), or the peculiar cases (Dubai). These quantitative studies claim that new activities are no random events or historical accidents but embedded in territorial capabilities. Regional diversification is depicted as an emergent branching process (Frenken and Boschma 2007) in which new activities draw on and combine related local activities (Martin and Sunley, 2006; Fornahl and Guenther 2010).

This branching phenomenon has been analyzed first by Hidalgo et al. (2007) at the level of countries. Branching is here captured by building a comparative advantage in export products that are new to the country and related to existing export products in the country<sup>3</sup>. They test in

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<sup>1</sup> In the organization literature, the concept of capabilities (Dosi et al. 2000) has been widely used and diffused. Well-known types are combinatory capabilities (Kogut and Zander 1992) and dynamic capabilities (Teece et al. 1997).

<sup>2</sup> Now and then, the concepts of regional specialization and specialization in regions are used as interchangeable, as if they would mean the same thing. However, regional diversification means the creation and development of a new specialization in a region, which may result in regional specialization (in the case of the absence of any other specializations in the region) or not (when other specializations in the region are already present).

<sup>3</sup> In the regional diversification literature, new industries are identified as new to the region, not new to the world, because these studies work with data of existing categories of industries and products.

their paper whether national capabilities condition which new export products are more feasible to develop. Capabilities are taken up by the proximity concept that captures all possible dimensions that make products co-locate in the same country. Hidalgo et al. construct a 'product space' that specifies the degree of proximity between products based on the frequency of co-occurrence of products in countries' export portfolios. Two products are considered proximate if many countries have a revealed comparative advantage in both products, because that would reflect the two products demanding similar capabilities. Hausmann and Klinger (2007) demonstrated that countries tend to develop new export products that are related in product space with existing export products, and that countries that have many related export products have more options to diversify into new export products<sup>4</sup>.

Similar logic has been applied to understand regions becoming active in new product markets. Neffke et al. (2011) was the first paper that systematically investigated diversification of regions in industries that are new to a region. They tested the idea that regional capabilities condition which new products are more feasible to develop. Following Teece et al. (1997), capabilities are captured by product relatedness which specifies technological relatedness between products based on the frequency of co-occurrence of products in the product portfolios of plants. Neffke et al. (2011) analyzed 2,766 events of a new industry entering a Swedish region in the period 1969-2002, and found that an industry had a higher probability of entering a region when technologically related to pre-existing industries in that region. This finding on related industrial diversification has been replicated in follow-up studies, like Boschma et al. (2013) for 50 Spanish regions in period 1988-2008 (using the proximity indicator of Hidalgo et al.), Essletzbichler (2015) for 360 US metropolitan regions in the period 1977-1997 (using a relatedness measure based on intensity of input-output linkages between 362 US manufacturing industries), and He and Rigby (2015) for 337 Chinese prefectures in the period 1998-2008 (using proximity indicator of Hidalgo et al., based on co-occurrence of specializations in Chinese regions). Muneeppeerakul et al. (2013) conducted an analysis on occupational diversification in US metropolitan regions, using a relatedness measure of 787 occupations, based on the frequency of co-location of occupational specializations in MSA's. Brachert (2016) did a similar study on occupational diversification for German regions, and came to the same conclusion that relatedness matters.

The same line of reasoning has been applied to technological diversification of regions. Rigby (2015) was the first study on technological diversification of regions using patent data. Capabilities are captured by technological relatedness between knowledge claims based on the frequency of co-occurrence of technology classes on patent documents. When two technology classes are mentioned on the same patent document over again, it reflects the fact that they are technologically related in 'technology space'<sup>5</sup>. Rigby (2015) found that technologies related to pre-existing technologies in an US metropolitan region had a higher

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<sup>4</sup> Some studies account for the complexity of new export products, as it is better to develop new export products that add complexity to an economy. This is the case when the new export product is non-ubiquitous which means there are only very few competitors in the same product (Hausmann and Hidalgo 2011).

<sup>5</sup> An alternative measure of relatedness is the intensity of patent citations between technology classes.

probability to enter that region in the period 1975-2005. This finding has been replicated (Kogler et al. 2013; Boschma et al. 2015), and has also been confirmed for the rise of eco-technologies in European regions 1982-2005 (Van den Berge and Weterings 2014), fuel cell technology in European regions 1992-2007 (Tanner 2014; 2015), nano-technologies in European regions 1986-2006 (Colombelli et al. 2014), bio-technologies in 276 world cities 1989-2008 (Boschma et al. 2104; Heimeriks and Boschma 2014), and rDNA technology across US metropolitan areas in the period 1980-2005 (Feldman et al. 2015).

In sum, these studies provide systematic evidence that the existing set of local capabilities conditions which new activities are more likely to develop in regions, despite differences in the dependent variable (new products, industries, technologies, professions), relatedness measures (e.g. product-relatedness, technological relatedness, skill-relatedness, input-output relatedness), spatial units of analysis (e.g. countries, regions, cities, labor market areas) and the time periods covered.

### 3. Capabilities and relatedness

In these studies on regional diversification, activities are considered related when they require similar capabilities. This has led to a debate what is exactly meant by the notion of capabilities, how relatedness has been defined and measured, and what types of capabilities matter for regional diversification (Tanner 2014).

In the regional diversification literature, capabilities are often defined in a very broad manner and embody a wide range of dimensions that can potentially make activities related. This is most pronounced in the study of Hidalgo et al. (2007) who do not specify what determines the relatedness between products, but indirectly derives a relatedness measure from the frequency of co-location of the same pairs of products. If there is a substantial and frequent presence of the same combination of two products in the same location, this is not regarded as a coincidence but a reflection of the two products demanding similar capabilities<sup>6</sup>. So, the exact nature of local capabilities is not directly observed, but by using information on the co-location of products, scholars identify which products share similar capabilities (Neffke et al. 2016). This principle of similar resource requirements has been applied widely at the level of organizations to determine relatedness between industries (Teece et al., 1994).

Studies on regional diversification have also opted for a more narrow definition of relatedness. The product relatedness measure by Neffke et al. (2011), for instance, captures technological relatedness in production between products. Co-occurrence analysis is done at the plant level, not at the firm level, as the latter would also take up product market-relatedness, and also similarities in marketing and distribution capabilities (Teece et al. 1994).

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<sup>6</sup> This broad measure of relatedness derived from the co-location of products is not unproblematic when applied to the study of diversification at the same spatial scale with the same dataset. It might lead to a bias towards related diversification when measuring relatedness and assessing the impact of relatedness on diversification with the same data at the same spatial scale (like countries).

Products are considered related when requiring similar skills or machines in plants to produce them, reflecting economies of scope<sup>7</sup>. Neffke et al. (2016) used another skill-relatedness measure that accounts for similarities in workers' skill requirements in industries, using information on the intensity of human capital flows between industries. This focus on inter-industry labor flows takes up similar skill requirements, as workers have the incentive to move to industries where their skills are still valued highly, and firms are more willing to recruit workers from industries with relevant skills (Neffke and Henning 2013). Essletzbichler (2015) used yet another relatedness indicator, that is, input-output relatedness between industries that is based on the similarities of supplier-buyer relationships between industries. This relatedness measure takes up an input-output externality that exists across industries.

Relatedness has often been treated as a symmetric measure: product A is considered as much related to product B, as B is related to A. In reality, however, there is likely to be asymmetry: A is related to B, but not necessarily the other way around, like hardware computer skills might be relevant for the software industry, but software skills may be of lesser value to the computer industry. Using this information might lead to new insights on regional diversification: it might imply that the local presence of a hardware industry facilitates diversification towards software, but the local presence of a software industry would not necessarily increase the probability of a region diversifying in computer hardware. The application of asymmetry to the study of regional diversification would bring it more in line with other asymmetric forces that are studied in economic geography, like unequal trade, brain drain, and unbalanced knowledge flows.

Relatedness is often understood in terms of both similarity and complementarity (Makri et al. 2010). Breschi et al. (2003) defines relatedness being similar when knowledge is proximate in the cognitive dimension, providing opportunities for interactive learning, and when the same type of knowledge is used in more than one technology. This is different from relatedness in terms of complementarities which refers to the necessity of using different technologies or products together and the combination potential between activities (Broekel and Brachert 2015). Though some studies on regional diversification explicitly refer to relatedness in terms of similarity, focusing on the potential for knowledge spillovers between activities that share common knowledge (Neffke et al. 2011), most studies are less specific, accounting for relatedness in terms of both similarity and complementarity. Future research could make an effort to disentangle these two types of related capabilities, in order to determine the relative importance of similarities versus complementarities for regional diversification.

In sum, there is clearly no single measure of relatedness, as it encompasses many dimensions. Some studies on regional diversification have used broad measures of relatedness, while other studies have applied more narrowly defined relatedness measures. So far, the various relatedness measures have simply been employed in robustness analyses, to check whether the finding of relatedness as driver of regional diversification is independent of the use of the

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<sup>7</sup> A problem of using product data to measure relatedness is its prime focus on manufacturing industries, as there are less detailed product categories in services in product datasets (Janssen 2015; Shearmur 2015).

specific relatedness measure. By and large, studies show that the same finding holds, irrespective of the relatedness measure. However, the various relatedness measures are also likely to take up different types of capabilities that are not captured separately in current studies. A promising next step would therefore be to assess which types of related capabilities are drivers of regional diversification. One could, for instance, differentiate between the three Marshallian types of related externalities (knowledge spillovers, labour skills, input-output linkages), and investigate simultaneously the effect of each type on regional diversification, as these reflect different transfer channels of resources across related activities. Such studies would contribute to our understanding of what types of capabilities cause regions to diversify.

#### **4. Related and unrelated diversification**

As presented in section 2, studies show that related diversification predominates, although unrelated diversification also occurs. This is not unexpected, as new capabilities required for related diversification are easier to acquire when being close to existing local capabilities, while unrelated diversification requires completely new capabilities that involve high costs and risks (Saviotti and Frenken 2008). This shows that relatedness is not a necessary condition for regional diversification, which finds confirmation in case studies that document successful cases of unrelated diversification. This calls for a clarification of how related and unrelated diversification have been defined and analyzed.

Studies on regional diversification have investigated whether the entry probability of a new activity in a region is affected by the degree of relatedness with existing local activities. A positive effect of relatedness would indicate related diversification, while a negative effect implies that regions make jumps in their industrial evolution, and unrelated diversification prevails (Boschma and Capone 2015a). Following Neffke et al. (2016), we argue that the more radical the transformation in the underlying local capabilities is needed to develop a new activity, the more it concerns unrelated diversification. This would be the case when a region diversifies from clothing to aerospace to pharmaceuticals, as each of these new industries require new and very different capabilities. In contrast, if a region diversifies from motor cycles to cars to trucks, this would reflect related diversification, as the three industries are likely to draw on similar capabilities, like an engineering knowledge base. In reality, however, one expects related diversification in regions to be more a matter of degree (more or less related), as new activities are likely to build on both local related capabilities and unrelated capabilities. This implies one needs to leave behind the sharp distinction between related versus unrelated diversification.

The recombinant approach might be relevant here, as radical breakthroughs are considered to be the result of recombinant search processes (Weitzman 1998; Fleming 2001). Combining knowledge in new ways, leading to radical breakthroughs, corresponds to explorative, distant search, while combining knowledge along well-defined paths, leading to incremental change, is associated with exploitation and local search (March 1991; Arts and Veugelers 2015). In such a recombinant framework, related diversification can be redefined as new combinations between (local) capabilities that have been combined before, while unrelated diversification

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embodies new combinations of (local) capabilities that were not previously combined (Castaldi et al. 2015). However, in reality, new activities are unlikely to emerge from new combinations between either completely related, or completely unrelated activities, but tend to make combinations between both types. Such a recombinant approach has been applied in studies on research collaborations and technical alliances (Gilsing et al. 2008; Boschma and Frenken 2010), but has not yet been applied to the study of regional diversification.

The recombinant approach to regional diversification has interesting features. To start with, it would leave behind the static treatment of relatedness in studies on regional diversification. Relatedness would become dynamic itself: previously unrelated activities become related as soon as they are connected in successful new combinations (Desrochers and Leppälä, 2011; Castaldi et al. 2015). A telling example is the self-driving car that emerges out of new combinations of technology fields in automotives, sensor-based safety systems, communication and high-resolution mapping that have not been combined before. A key research question is to assess whether unrelated activities in the same location are more likely to be combined and become related, as compared to unrelated activities that do not share the same location. Moreover, local related industries might also become unrelated once they lose their combinatory potential and are not combined anymore. This has implications for the resilience of regions, as positive spillovers between local related activities will cease to exist.

Such a recombinant approach could also exploit further network properties of the product space introduced by Hidalgo et al. (2007) which is constructed on the basis of relatedness between pairs of products. What has been ignored so far are the indirect connections between products (Janssen 2015), like two products might be related through triad closure (indirectly connected through another product), or through short paths (indirectly connected through a chain of related products). The probability of regions to diversify can be affected by these network properties. This has also implications for our discussion on the nature of unrelated diversification, because if two unconnected (unrelated) nodes become linked through a common link with a third node, it comes close to bridging (Janssen 2015).

This issue of related versus unrelated diversification needs to be taken up in future research. A promising line of research is to determine whether more related or more unrelated diversification prevails in certain regions as compared to other regions. Moreover, a crucial question is whether regions can keep relying on more related diversification to sustain long-term development, or whether regions need to diversify in unrelated activities to avoid lock-in in the long run, as these may open up complete new markets opportunities (Saviotti and Frenken 2008). There are no studies yet to date that have provided systematic evidence. Furthermore, there is a need to increase our understanding of the conditioning factors that facilitate more related or more unrelated diversification in regions (Boschma and Capone 2015a; Quatraro and Montresor 2015). This requires adding more geographical wisdom to the study of regional diversification, a topic to which we turn now.

## **5. Need for more geographical wisdom**

There is a need to include more geographical wisdom into research on regional diversification on at least three grounds. First, we need more understanding of the types of diversification that take place in different types of regions, and which factors, such as institutions, influence the various types of diversification. Second, relatedness tends to be treated as a global universal measure, but the degree and nature of relatedness might differ from region to region. This calls for comparisons between countries and regions to determine the territory-specific nature of relatedness. Third, studies focus primarily on local capabilities driving regional diversification, but we have little understanding of how non-local capabilities may influence regional diversification, and at what spatial scale (Isaksen 2015).

There is yet little knowledge of which types of regions have a stronger ability to diversify, what type of diversification prevails in which types of region, and which regions contribute to radical changes in product space (Xiao et al. 2016). Are urban regions more capable of diversifying, as compared to old industrial regions or peripheral regions? And do core urban regions have more of a tendency to diversify in more unrelated activities, because there are more opportunities to make new combinations between local activities? And what about the effect of related versus unrelated variety (Castaldi et al. 2015)? There is an increasing amount of single regional case studies on new path creation that provide new and important insights (see e.g. Isaksen 2015), but no studies yet exist that compare the intensity and type of diversification in many regions simultaneously in a systematic way.

Scholars are starting to investigate the conditions that make regions more likely to diversify into related or unrelated activities. An emerging research strategy is to interact the relatedness variable with conditioning factors, as to see whether the positive impact of relatedness on regional diversification is strengthened (more related diversification) or weakened (more unrelated diversification) by these factors. Boschma and Capone (2015b) found a remarkable difference within Europe. Broadly speaking, West European countries tend to diversify in more unrelated industries, while East European countries tend to diversify into new industries that are more closely related to their existing industries. Petralia et al (2015) showed that high-income countries have a higher tendency to diversify into unrelated technologies, in contrast to lower-income countries. So, it seems that the economic level of countries influences the nature of diversification. Within advanced countries, Boschma and Capone (2015a) tested whether institutions do matter for the types of diversification that prevail in countries. They found evidence that institutions associated with so-called ‘liberal market economies’ (i.e. institutions that regulate less tightly labor, capital and product markets) give countries more freedom to diversify in more unrelated activities. This stands in contrast to institutions that coordinate more tightly such market relations, known as ‘coordinated market economies’, which make countries to focus more on related diversification because their institutions make them to stick more close to what they have been doing in the past.

This need for more focus on institutions in the regional diversification literature opens up possibilities to connect to the international catch-up literature that focuses on the role of technological and social capabilities in countries to catch up and decrease the distance to the technology frontier (Lall 1992; Fagerberg and Srholec 2008). Typical of this literature is to stress that social capabilities are crucial to turn technological capabilities into economic

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development. Fagerberg et al. (2014) refers to technological capabilities as the ability to make effective use of knowledge to create new knowledge and innovations through innovation and finance capabilities. They take a broad definition of social capabilities that includes the public knowledge infrastructure, a well-functioning labor market, and the prevalence of norms, values and other institutions that support the functioning of society, such as income equality. This complementary role of technological and social capabilities has resemblance with the work of Rodríguez-Pose and Crescenzi (2008) who claim that knowledge is not sufficient, but that the right institutions are needed to turn this latent capacity into economic development.

Cortinovis et al. (2016) has investigated the effect of regional institutions on the ability of European regions to diversify. They found no direct effect of the quality of government in regions, but they found a positive effect of ‘bridging social capital’ in a region, while ‘bonding social capital’ (with more focus on intra-group interactions) had no or even a negative effect on regional diversification. This suggests that diversification requires making combinations between different activities that is facilitated by social capital that can bridge different social groups. Interestingly, in the case of low quality of government in regions, bridging social capital had an even stronger positive effect on regional diversification, while bonding social capital had a stronger negative effect. So, bridging social capital in regions seems to be a crucial enabling factor, especially when strong formal institutions are lacking.

Another enabling factor of regional diversification is the local presence of Key Enabling Technologies (Meliciani 2015). Quatraro and Montresor (2015) found that European regions with a strong presence of Key Enabling Technologies (KETs) had a tendency to diversify into more unrelated technologies. Based on patent application data, they found a weaker effect of relatedness (local pre-existing related technologies) for technological diversification in regions endowed with all KETs during the period 1980-2010.

Isaksen and Trippel (2014) have linked different types of regional innovation systems to the question whether regions are more likely to develop new growth paths, and if so, whether regions focus on new path creation versus path renewal. Another potential application of a system approach to regional diversification is to draw a product space in every region, and then include region-specific network variables to estimate their effect on the probability of regions to diversify. Network hypotheses developed previously can then be refined and tested, like whether networks that consist of a high number of nodes with few connections (which might give access to new and non-redundant knowledge) favor new path development, in contrast to a closely tied core in a network (Crespo et al. 2014), or whether a network structure with strong relationships within cliques and structural holes between cliques favours more unrelated diversification in regions (Fleming et al. 2007; Balland et al. 2013).

Another way to include more geographical wisdom in the regional diversification literature is to be more specific about whether the product space differs from country to country, and from region to region. So far, studies have used an universal global measure of relatedness, like studies that employed export data of both advanced and developing countries to determine product relatedness. From a geographical point of view, a relevant question is: does product space differ from country to country, and from region to region, and if so, to what extent? So,

is relatedness between activities independent of their spatial context? Or is there a geographical dimension to that: are some activities related in country A, but not in country B, reflecting their own specific geographical history? This is an empirical question, but one also needs to theorize about why some industries are expected to be related in one spatial context, and not in another, to leave behind the a-contextual view of relatedness in many studies. This makes even more relevant the search for regional factors that enable more related or more unrelated diversification, as outlined above.

What is more, the literature on regional diversification has primarily focused on the role of local capabilities, showing that relatedness at the local scale is a crucial driver of diversification. Studies have also shown that industries are more closely related to one another (i.e. more coherent) at the regional than the national scale (Neffke et al. 2011). Boschma et al. (2013) demonstrated in a study on Spain that regional capabilities are more important than national capabilities for regional diversification. However, a current weakness of this prime focus on national and regional capabilities is that it has neglected the role of extra-regional linkages and actors that might affect regional diversification (Asheim and Isaksen 2002; Moodysson 2008; Dahl Fitjar and Rodríguez-Pose 2011; Trippel et al. 2015).

Recent papers have focused on the role of neighbour countries (Bahar et al. 2014) and regions (Boschma et al. 2016) to develop comparative advantage in new industries. These studies found that regions are more likely to develop new export industries in which their neighbour regions are specialized, and neighbor regions tend to have more similar export structures when they are highly connected (Boschma et al. 2016). A promising research avenue is to assess the role of extra-regional linkages more systematically, as new combinations are likely to depend on both local and non-local inputs. Andersson et al (2013) found a positive effect of high-quality imports on the introduction of new high-quality export products in regions, suggesting import spillover effects at the regional scale. The same study found that openness of a regional economy had a positive influence on such economic renewal in regions. Isaksen (2015) makes the point that peripheral regions may depend more on external investments or people, which might also favor a tendency of more unrelated diversification in peripheral regions. As this reliance on external sources may be induced by individuals (like migrated entrepreneurs) and organizations (like multinationals) coming from other regions, we discuss it in the next section that deals with the role of agency in new path creation.

## **6. Need for a micro-perspective on regional diversification**

So far, we discussed how capabilities at various spatial scales condition the nature of diversification, but little to no attention has yet been paid to the role of agency, and the different types of agents that may drive regional diversification. First, we argue that the regional diversification literature should incorporate a micro-perspective to understand which types of firms (like non-local firms) and which types of individuals (entrepreneurs, migrants) make a difference. Second, we argue that such a micro-perspective also requires a focus on institutional agents, besides firms, that change institutions to enable the diversification process

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in regions. We argue this requires more understanding of why agents in some regions, and not in other regions, are more successful in doing so.

The work of Klepper on the emergence of new industries (Klepper and Simons 2000; Klepper 2007) can be regarded as a first step to a micro-foundation of the regional branching literature (Boschma 2015). For long, a key topic is whether new start-ups or incumbents develop radical innovations and new industries. For Klepper, it were start-ups founded by entrepreneurs with experience in related industries (i.e. spinoffs from incumbents in related industries), rather than start-ups *per se*, and incumbents that diversified from related industries, rather than incumbents, that played a decisive role in the formative stage of an industry. His observation of spinoffs and diversifiers from related industries giving birth to new industries provided strong empirical support at the micro-scale for the process of related regional diversification.

In a study on Sweden, Neffke et al. (2016) found that new plants induce more unrelated diversification in regions. In the short run, this is especially true for new plants set up by entrepreneurs, as compared to new plants (subsidiaries) set up by incumbents. In the long-run, the difference between the two types of new plants disappears, because it is harder for stand-alone entrepreneur-owned plants than for subsidiaries to survive in regions that offer little to no local related externalities, as subsidiaries can still draw on firm-internal resources.

There is increasing evidence that more unrelated diversification comes from the outside, through the inter-regional mobility of entrepreneurs and firms. Neffke et al. (2016) showed that new plants from outside the region, and not so much local start-ups, introduce more unrelated diversification in regions. Especially new subsidiaries that are established by large firms in other regions induce structural change, because the ownership link subsidiaries have with their parent in their home region allows them to develop activities that rely on resources that do not exist in the host region and, so, can overcome the liability of newness. This is in line with work on MNE's that shift specializations of regions into new directions (Iammarino and McCann 2013; Crescenzi et al. 2015). There still is, however, a need to increase understanding of how MNE's influence regional diversification. This is likely to depend on the investment strategies of MNE's: when they invest in a host region to exploit their technological superiority and take benefit from low local costs to produce standardized goods, more unrelated diversification is more likely to occur, with little spillovers to the local economy. Instead, when MNE's make R&D investments in activities that are related but not identical to activities in host region, with the purpose of exploiting local learning opportunities (while avoiding knowledge leakage to competitors), more related diversification occurs, with positive spillovers to the host region (Cantwell and Iammarino 2003).

Not only the inflow of firms but also the inflow of individuals like star scientists, top managers or key employees may matter for regional diversification (Feldman et al. 2005; Trippel 2013). Numerous studies have documented the importance of migrants for the development of new specializations in regions (Bahar and Rapoport 2014). Transnational entrepreneurs, like successful return migrants (Saxenian 2006), have played a crucial role in early industry formation in certain places (Drori et al. 2009; Sonderegger and Taube 2010), but only when they became anchored in their regional context (Vale and Carvalho 2013; Binz

et al. 2016). Hartog (2015) found that the inflow of top managers and top technicians that possess skills that were unrelated to the plant's core activity increased the probability of a plant to diversify, but no systematic studies yet exist that have assessed the impact of new labour recruitments on regional diversification (Hausmann and Neffke 2016). A focus on the inter-regional mobility of labour would also shed more light on the channels through which pre-existing (related and unrelated) industries give birth to new industries in regions.

So, the inflow of non-local firms may induce regional diversification, but local firms may also induce diversification through non-local linkages. There is a growing body of literature that focuses on innovative firms in peripheral regions that cannot draw on local resources and, therefore, rely on non-local linkages instead (Isaksen and Karlsen 2012; Grillitsch and Magnuson 2015; Isaksen 2015; Shearmur 2015). These firms have strong firm-internal capabilities which is a prerequisite to build crucial non-local linkages. The question is whether such a combination of strong firm-internal capabilities and non-local linkages make peripheral regions more likely to diversify in more unrelated activities. In more advanced regions, one could argue that both firm-internal capabilities and local capabilities matter for regional diversification. Studies show that local related externalities increase the export performance of more productive firms (Poncet and De Waldemar 2012), the survival rates of high-impact firms (Borggren et al. 2015), the productivity of better performing firms (Howell et al. 2015), and the tendency of firms to conduct a related diversification strategy (Cainelli and Iacobucci 2015). Recent studies (Lo Turco and Maggioni 2015; Hazir et al. 2016) found that relatedness both at the firm and local level has a positive effect on firm diversification in new products. In advanced regions, firm diversification seems to rest more on local capabilities, possibly due to the involvement of local firms in relatively more complex products which makes them more dependent on a large diverse local knowledge base. This may imply that firms in advanced regions are more prone to related diversification and firms in peripheral regions to more unrelated diversification, but systematic evidence is lacking.

A micro-perspective on regional diversification should not be limited to economic actors (like firms and entrepreneurs) as the sole agents of change. Public agencies, like universities, can play a major role in developing new industries in regions unrelated to their existing development paths (Lester 2007; Tanner 2014; Gilbert and Campbell 2015). Moreover, it is crucial for our understanding of regional diversification to include institutional agents, as embodied in collective actions by firms, interest groups, policy makers and so forth, because early industry formation necessitates new institutions and the adaptation of existing ones (Nelson 1994; Binz et al. 2016). This requires a deep understanding of why agents in some regions are more successful in creating, abolishing and changing institutions, as compared to other regions, which agents are responsible for such institutional change (Sine and Lee 2009), and what regional conditions facilitate the implementation of such collective actions.

The institutional entrepreneurship literature looks at the role of agency in institutional change (Maguire et al. 2004). It describes how institutional entrepreneurs manipulate structures in which they are embedded (Garud et al. 2002; Borrás and Edler 2014), and how agents engage in collective action to mobilize knowledge, resources and public opinion, as to build legitimacy and create new institutions or shape existing institutions at various spatial scales to

enable new industry formation in regions (Strambach 2010; Sotarauta and Pulkkinen 2011; Marquis and Raynard 2015). Saxenian (2006) has looked at successful return migrants (or ‘diasporas’) as key institutional agents of change, because they are well positioned to get access to and persuade public officials and other agents in their home region to adapt and redesign local institutions. This makes that the role of public actors in local industry formation cannot be studied in isolation from other agents and without taking a multi-scalar perspective (Dawley et al. 2015). The question is whether there are regional conditions that provide more opportunities for strategic action, make (local) actors more prone to engage in institutional entrepreneurship, and more successful in changing institutions (Battilana et al. 2009).

Another promising research avenue is to link to the literature on entrepreneurial experimentation that focuses on the role that niches play for the emergence of radical new technologies in the presence of an overarching regime (Schot and Geels 2008). Niches are considered incubation spaces in which new radical activities are protected against market selection and institutional pressures from a regime and allow actors to learn about novel technologies and their uses through experimentation (Coenen et al. 2010). Niches also foster forms of empowerment through which they ‘fit and conform’ or ‘stretch and reform’ existing regimes in ways favorable to the emergence of new activities (Smith and Raven 2012). This literature puts emphasis on resistance and counter-forces that may block institutional change, in particular when new activities challenge others and dislodge established regimes. There is increasing understanding of how vested interests of incumbents conduct strategies that may range from blockage of institutional change, to frustration, to collaborative attitudes (Wesseling 2015). However, there is yet little understanding of the geographical aspects of niche formation (Hansen and Coenen 2014; Sengers and Raven 2015). Following a Darwinian logic, one could hypothesize that successful niche formation requires geographical isolation, especially in case of unrelated diversification, and places where vested interests are either not well represented or unable to dominate the design of local institutions, as is more likely to be the case in large urban and diversified regions.

## **7. Concluding remarks**

The paper has discussed implications for future research of a key finding in evolutionary economic geography, that is, the accumulating evidence on related diversification in regions (Kogler 2015). We argued there is need for more clarity on concepts of capabilities and relatedness, the identification and importance of related and unrelated diversification, the territory-specific nature of relatedness, the significance of local capabilities and non-local linkages for regional diversification, and the role of economic and socio-institutional agency. This opens up a whole new research agenda on regional diversification that needs to combine insights from many strands in the scientific literature, including complexity theory, economic geography, institutional theory, network theory, organizational studies, political sciences, population ecology, sociology and the sustainable transition literature.

To start with, we claim that more clarity is needed around the claim that related activities demand similar capabilities. Scholars from diverse literatures have struggled with the question

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of how to define capabilities, and have come up with different proxies, including broad and indirect measures. The regional diversification literature is no exception to that rule. Having said that, we argued there is a need to unravel relatedness both in terms of similarities and complementarities in studies, and to be more specific on what types of related capabilities are shared across activities and matter for regional diversification. In other words, there is a need to explore which enabling factors make some activities more likely to emerge from other specific activities in a region: is it because they share a similar knowledge base, a common network, a specific set of institutions, a particular set of skills, et cetera?

Moreover, we argue there is a need to be more precise about the distinction between related and unrelated diversification. Unrelated diversification has been associated with jumps in the industrial evolution of regions (from bananas to computers) (Boschma and Capone 2015a), a radical shift in underlying (local) capabilities (Neffke et al. 2016), or new combinations of (local) capabilities that have not been combined before (Castaldi et al. 2015). While studies found more evidence of related diversification than unrelated diversification, in reality, we argue it will be more a matter of degree, in which related and unrelated activities are being combined. This implies there is a need to go beyond the dichotomy of related and unrelated diversification, and to investigate what types of new combinations are made between existing activities (related/unrelated, local/non-local) that lead to new activities in regions.

We claim that the study on regional diversification is in need of more geographical wisdom for four reasons: (1) we need more understanding of the types of diversification that prevail in different types of regions (Xiao et al. 2016), and which factors (at the regional scale and beyond) facilitate diversification of a more related or a more unrelated type. For instance, is more unrelated diversification more likely to be induced in regions by the inflow of non-local actors like migrants and non-local linkages, and which formal and informal institutions are more likely to generate a more unrelated type of diversification?; (2) a crucial question is which type of diversification secures long-term economic development of regions. Can regions keep relying on more related diversification, or do regions need to diversify in unrelated activities to avoid lock-in in the long run?; (3) we criticized the treatment of relatedness as a global and universal phenomenon that connects the same activities irrespective of their location worldwide, and called for comparative studies between territories (countries, regions) to determine the geography-specific nature of relatedness instead; (4) while the literature has focused primarily on local capabilities driving regional diversification, we need more evidence of how non-local capabilities systematically influence regional diversification, and at what spatial scale. This requires a multi-scalar perspective to investigate the importance of local versus non-local capabilities (Binz et al. 2014).

Finally, we argued that the main focus on local capabilities may have obscured our view who actually is driving regional diversification, as local actors make regions diversify, not regions. This requires a micro-perspective that aims to identify the key agents that drive the process of regional diversification. In particular, there is a need to determine the role of different types of individuals, firms and institutional players including policy makers, to assess who are the key drivers of which type of (more or less related) diversification in regions, and to identify which



are the regional factors that make local actors in some regions (as compared to other regions) more successful in inducing institutional change and diversifying in new activities.

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