Evolutionary Economic Geography and Policy

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Abstract

The literature of Evolutionary Economic Geography (EEG) has received little attention in Evolutionary Economics, despite overwhelming evidence that time-space dimensions are crucial to understand economic evolution. This chapter will focus on the relationship between EEG and regional policy. We will discuss how evolutionary principles like proximity, relatedness and path dependency have been used to construct regional innovation policy in the European Union.

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Introduction

In a recent overview on Evolutionary Economics by its leading proponents (Nelson et al. 2018), the geographical dimension of economic evolution was almost completely overlooked. However, economic evolution can only be understood when not only time but also the dimension of space is fully incorporated. Economic evolution is fundamentally uneven in space, showing persistent inequalities at multiple spatial scales. This neglect of the geographical dimension in Evolutionary Economics is remarkable given the fact that a large body of literature on Evolutionary Economic Geography has developed since the 1990s.

The theoretical foundations of EEG have been laid down in many publications (e.g. Boschma and Lambooy 1999; Boschma and Frenken 2006; Martin and Sunley 2006; Boschma and Martin 2010), and these foundations continue to be explored and discussed (see e.g. MacKinnon et al. 2009; Boschma et al. 2017; Henning 2019). In the vanguard of this, a massive body of empirical studies has been published on the geographies of firms, technologies, science, innovations, jobs, industries, clusters, networks and their evolution over time (Boschma and Frenken 2018).

Evolutionary Economics has been heavily engaged in debates on public policy (Edler and Fagerberg 2017), the future of industrial policy (Rodrik 2004), the changing role of the state (Mazzucato 2013), the need for mission-oriented policies (Mazzucato 2018), how to promote transformative change (Schot and Steinmuller 2018), and how to tackle societal challenges (Kuhlman and Rip 2018). In these policy accounts, geographical aspects of economic evolution have not been given full consideration. In Evolutionary Economic Geography instead, interest in fundamental policy debates has been rather implicit. This policy interest is growing though,

especially with regard to Smart Specialization policy in the EU (Foray 2015; Balland et al. 2019).

This chapter aims to shed light on what EEG might have to offer in terms of these policy debates, especially with respect to the place-based dimension of innovation policy (Barca 2009). This will be illustrated by taking the example of Smart Specialization policy (S3) which represents a form of place-based innovation policy in the European Union in which evolutionary concepts like directionality and relatedness have been widely adopted since its start in 2014 (Foray et al. 2009; McCann and Ortega-Argilés 2015).

EEG and Smart Specialization policy

Smart Specialization policy reflects a vision on regional innovation that is embedded in place-based capabilities. The core idea is to prioritize new domains of specialization in regions that complement and leverage their local capabilities (Foray et al. 2009). Point of departure is that region-specific capabilities define the set of opportunities for developing new growth trajectories in regions. Regions should refrain from targeting new domains in which they lack relevant capabilities. Instead, they should go for domains that build on local related variety (Frenken et al. 2007) and promote the diffusion of knowledge across domains, because such cross-fertilizations lay the foundations of new growth paths. The policy objective is to identify strong capabilities in regions and use them to move into new activities that exploit local synergies and avoid competition with other regions. This implies a rejection of one-size-fits-all policy, in favour of a place-based policy, that is attuned to the capabilities and demands of regions (Tödtling and Trippl 2005; Barca 2009).

The concept of relatedness has been used as a key principle in the EU guidelines for S3 to select future domains in regions (Foray et al. 2012; McCann and Ortega-Argilés 2015; Iacobucci and Guzzini 2016). It builds on evolutionary concepts such as bounded rationality, local search, proximities, networks and path dependence to understand regional development. Relatedness is a principle that identifies activities that demand similar and complementary capabilities (Teece et al. 1994, 1997; Breschi et al. 2003). It has become a key factor to explain regional diversification processes in which the dimensions of time and space are being combined (Boschma 2017; Hidalgo et al. 2018; He and Zhu 2019). That is, regions tend to diversify into new activities that are closely related to their existing capabilities. Place-specific capabilities condition diversification in which geographical, cognitive, social and institutional proximities enable the transfer of capabilities from existing to new activities. Empirically, there is overwhelming evidence that related diversification is far more common than unrelated diversification in regions, no matter whether it concerns diversification in new industries (Neffke et al. 2011), jobs (Muneepeerakul et al. 2013) or technologies (Rigby 2015).

Balland et al. (2019) developed a framework for Smart Specialization policy along the two dimensions of relatedness and complexity. Relatedness refers to the costs of moving into a new activity. These costs will be lower the higher the overlap between the required capabilities of the new activity on the one hand, and the supply of existing capabilities in the region on the other hand. The more related they are, the less risky and less costly it is to develop this new activity. Complexity refers to the potential economic benefits of diversification. The benefits will be higher the more complex activities are (Hidalgo and Hausmann 2009). As complex activities combine many capabilities, it is harder for other regions to copy and develop them. This makes that complex activities may provide a sustainable source of regional competitiveness (Maskell and Malmberg 1999; Fleming and Sorenson 2001). Low-complex

activities can be mastered and produced by many regions instead, which implies their economic value tends to be lower (Balland and Rigby 2017; Antonelli et al. 2020).

This policy framework enables to identify and map potential activities in which a region does not possess a relative advantage by calculating their degree of relatedness and their complexity relative to the existing knowledge stock of the region. This results in a distinction between different policy strategies that represent different risk-return profiles (Balland et al. 2019).

One policy strategy targets activities that promise above-average returns (high complexity) at relatively low risk (high relatedness), as it builds on existing capabilities in the region. This may be an attractive policy option especially for advanced regions, as their opportunity space allows them to diversify into high-complex activities that can exploit relevant (related) local capabilities (Pinheiro et al. 2022). Rigby et al. (2022) assessed whether European cities that follow the logic of this policy (i.e. developing new technologies that increase the complexity level of their economy and that are closely related to local capabilities) showed higher economic performance in the period 1981-2015. They found that cities diversifying into related and complex technologies (while exiting less related and low-complex technologies), enjoyed higher GDP growth than cities that did not. Davies and Maré (2021) found that relatedness and complexity promoted employment growth in the largest cities in New Zealand.

Peripheral regions find themselves in a very different situation (McCann and Ortega-Argilés 2015; Morgan 2015; Foray 2019). These lagging regions lack potential activities for future development that score high on relatedness and complexity simultaneously (Pinheiro et al. 2022). For them, a more viable policy strategy is to target potential activities that score high on relatedness but low on complexity. This reflects a relatively low-risk strategy: it will provide

new job opportunities that are likely to match relatively well with the local supply of skills, because it builds on related capabilities. However, expected benefits might be relatively modest, because such policy strategy targets low-complex activities that are likely to be exposed to strong competitive pressure from other regions.

To break out of such a low-complexity trap, these regions might consider another type of policy outlined by Balland et al. (2019) that targets activities that are far removed from the existing knowledge base of the region. This involves a high-risky strategy that requires strong and massive policy intervention (Alshamsi et al. 2018; Hartmann et al. 2020). While the chances of success might be low because their focus is on developing something brand new and complex, when successful, the complexity level of the economy of the region will increase, yielding high benefits. This policy strategy is likely to be very difficult and highly risky though. Countries like Brazil and Russia (Hartmann et al. 2020) and regions in the US and the EU (Pinheiro et al. 2022) have shown how difficult it is to escape from such a low-complexity trap.

Design and implementation of Smart Specialization policy

So far, we have focused on directionality and priority-setting of S3 based on local capabilities and complexity. Smart Specialization policy has also attached great importance to the design of the policy process, also known as the entrepreneurial discovery process (Foray et al. 2011). Governance issues and the role of collective agents have been incorporated in Smart Specialization (Aranguren et al. 2019). Still, scholars have raised concerns about the actual implementation of S3, and how this differs across regions (Matti et al. 2017; Fratesi et al. 2019).

Entrepreneurial discovery stands for a bottom-up policy process in which a diversity of local stakeholders are involved to discuss, assess and select promising activities for future

development (Rodrik 2004; Foray et al. 2011; Foray 2015). It has some resemblance with the regional innovation system concept that focuses on wide array of local actors that do, or do not, interact and engage in collective action, depending on governing institutions (Asheim et al. 2019). What S3 adds to this regional innovation system perspective is the explicit role of relevant capabilities and the directionality of priority-setting and policy.

Studies have looked into this process of priority-setting in Smart Specialization strategies in the EU and have assessed the extent to which targets were actually region-specific, as the S3 guidelines prescribe (McCann and Ortega-Argilés 2016; Pagliacci et al. 2020). What they conclude is that S3 strategies do indeed make choices to a greater or lesser extent, but these priorities are often quite broadly defined. Regions also tend to focus on different priorities which reflect their local capabilities at least to some extent (D'Adda et al. 2019; Trippl et al. 2020; Deegan et al. 2021). Other studies are more critical (Iacobucci and Guzzini 2016; Di Cataldo et al. 2021). Marrocu et al. (2020) concluded that S3 strategies in European regions show limited potential to develop new growth paths that leverage local capabilities.

However, this regional specificity of Smart Specialization policy is also important for another reason, besides the need to focus on local capabilities *per se* (Boschma 2022). There is increasing evidence that opportunity spaces of regions look very different, which call for different types of innovation policy (Tödtling and Trippl 2005). Core urban regions tend to have many opportunities to move into complex activities because they can build on relevant (related) capabilities to do so. This still requires strong policy intervention though, despite regular claims that related diversification can do without (Grillitsch et al. 2018). Market and system failures (Hausmann and Rodrik 2003; Frenken 2017) need to be tackled through the public support of entrepreneurship, educational reforms, research capacity-building and

institutional change, to ensure these local opportunities are exploited. There are many factors that can make regions fail to diversify into related activities, such as laws and regulations that discourage the mobility of entrepreneurs and workers from related industries (see e.g. Klepper 2010), a poor entrepreneurial culture (Fritsch and Wyrwich 2014), restrictive social norms (De Vaan et al. 2019), weak university-industry linkages, and a lack of (risk) capital investment (Florida and Kenney 1988), among other factors. It comes as no surprise, therefore, that many diversification potentials in regions are not activated in practice. Empirical studies show indeed that the amount of potential entries in related activities in regions far exceeds the actual number of entries in related activities in regions (Boschma 2017).

At the same time, core urban regions also have the most advanced research infrastructure, a rich supply of human capital, unrelated variety, and international connectivity, to move the technological frontier and to diversify in unrelated activities (Castaldi et al. 2015; Moreno et al. 2017; Zhu et al. 2017; Pinheiro et al. 2021). But above all, unrelated diversification requires the build-up of completely new capabilities, in terms of knowledge, skills and instititions (Neffke et al. 2018). This requires collective action and experimentation in which policy is bound to play a major role, due to fundamental uncertainty (Hausmann and Rodrik 2003) and the presence of transformational failures (Schot and Steinmuller 2018). One example is policy intervention that aims to bridge the cognitive distance inherent in unrelated combinations that would remain unexploited otherwise (Janssen and Frenken 2019).

The case of old industrial regions is very different. These concern a large group of regions in the Rustbelts of the US and Europe that used to belong to the most technologically-advanced regions but now find themselves trapped in mature trajectories (Grabher 1993; Hassink 2005; Evenhuis 2016). Old industrial regions tend to show the highest diversification potentials in

simple activities, not in complex activities (Balland et al. 2019). Their industrial history makes it hard for them to move into more complex activities through related diversification. One way out of such a low-complexity trap is promoting unrelated diversification, but this remains a risky and bumpy road, full of obstacles. One major obstacle mentioned in the context of the middle-income trap is that countries might have a weak ability to pursue effective public policies and induce institutional change (Lee 2013; Doner and Schneider 2016; Aghion and Bircan 2017). Instead, policy focus on related diversification could be a less risky alternative to transform old industrial regions and increase their complexity. There is growing awareness that radical transformations do not necessarily occur through unrelated diversification only. For instance, technological breakthroughs primarily make related combinations, rather than unrelated combinations (Boschma et al. 2022). And there is increasing evidence that green diversification in regions is enhanced by local capabilities from related activities, even from so-called 'dirty' activities (Tanner 2016; Van den Berge et al. 2020). In other words, radical change may rely on relatedness to a considerable degree.

The case of peripheral regions is yet another one. Low-income regions have a greater tendency to diversify in activities related to their own activities than high-income regions (Petralia et al. 2017; Xiao et al. 2018). At the same time, lagging regions run the risk of being trapped in a low-complexity state. Pinheiro et al. (2022) indeed observed that low-income regions have diversification potentials primarily in low-complex activities. To escape from this low complexity trap requires a serious and concerted policy effort. However, there is high risk of policy failure where there is little experience to build on. Duplication of policy efforts is also likely to happen when priorities are not embedded in the regional context, and when 'missions' and 'grand societal challenges' become popular drivers of regional innovation policy (Mazzucato 2018). Such policy is also likely to build cathedrals in the desert. This is a typical

policy failure that happened more often than not when industries were encouraged to locate in peripheral regions where they developed little interaction with their surrounding economy, without any significant positive spillovers, because local firms lacked the absorptive capacity and local institutions were generally weak (Rodríguez-Pose and Wilkie 2015).

According to Foray (2019), the way the entrepreneurial discovery process is organized and implemented will show the ability of regions to diversify successfully. Besides capabilities, this depends on institutional and political leaders (Battilana et al. 2009) that trigger new initiatives, promote collective action, and induce institutional change (Garud et al. 2002). Institutional agents are considered crucial for the emergence of new activities in a region, because they collectively mobilize resources, build legitimacy, create new institutions, or shape existing institutions (Sotarauta and Pulkkinen 2011). Such agents of change operate in institutional contexts that vary widely across regions, such as local governance cultures (Kroll 2015) and quality of government (Rodríguez-Pose and Di Cataldo 2015).

A final note is that policy accounts in EEG also need to accommodate the decline and exits of activities in a region. As EEG is concerned with processes of creative destruction in regions, its prime focus should not be restricted to the creation and upgrading of local activities only (and which ones to prioritize in S3 policy). When regions are confronted with activities in decline (possibly as the result of the same creative process), studies have shown that a local supply of activities skill-related to the declining activities functions as a good shock-absorber, because such supply enhances regional labour matching (Neffke and Henning 2013; Diodato and Weterings 2015; Holm et al. 2017). It also prevents the destruction of local human capital and the outflow of high-skilled people to elsewhere. However, in case of declining activities

that are unrelated to existing local activities, this implies strong policy intervention is needed that focuses on re-education and reintegration of redundant workers in the local labour market.

References

Aghion, P. and Bircan, C. (2017) The middle-income trap from a Schumpeterian perspective, *EBRD Working Paper* no. 205, https://doi.org/10.2139/ssrn.3119146

Alshamsi, A. , Pinheiro, F.L. and Hidalgo, C.A. (2018) Optimal diversification strategies in the networks of related products and of related research areas. *Nature Communications* 9 (1), 1–7.

Antonelli, C., F. Crespi and F. Quatraro (2020) Knowledge complexity and the mechanisms of knowledge generation and exploitation: The European evidence, *Research Policy*, forthcoming, doi: 10.1016/j.respol.2020.104081.

Aranguren, M., Magro, E., Navarro, M. and Wilson J. (2019) Governance of the territorial entrepreneurial development process: looking under the bonnet of RIS3, *Regional Studies* 53, 451-461.

Asheim, B.T., A. Isaksen and M. Trippl (2019), *Advanced introduction to regional innovation systems*, Cheltenham: Edward Elgar.

Balland, P.-A., R. Boschma, J. Crespo and D. Rigby (2019) Smart specialization policy in the EU: Relatedness, knowledge complexity and regional diversification, *Regional Studies* 53 (9), 1252-1268.

Battilana, J, Leca, B and Boxenbaum, E (2009) How actors change institutions: Towards a theory of institutional entrepreneurship, *The Academy of Management Annals*, 3, 65–107.

Barca, F. (2009) An agenda for a reformed Cohesion Policy: A place-based approach to meeting European Union challenges and expectations, report, Brussels: European Commission.

Boschma, R. A. (2017) Relatedness as driver behind regional diversification: A research agenda, *Regional Studies* 51 (3), 351–364.

Boschma, R. (2022) Designing Smart Specialization policy: relatedness, unrelatedness, or what? in: M. Anderson, C. Karlsson and S. Wixe (eds.) *Handbook of Spatial Diversity and Business Economics*, Oxford: Oxford University Press, forthcoming.

Boschma, R., L. Coenen, K. Frenken and B. Truffer (2017) Towards a theory of regional diversification: combining insights from evolutionary economic geography and transition studies, *Regional Studies* 51 (1), 31-45.

Boschma, R.A. and K. Frenken (2006) Why is economic geography not an evolutionary science? Towards an evolutionary economic geography, *Journal of Economic Geography* 6 (3), 273-302.

Boschma, R. and K. Frenken (2018) Evolutionary Economic Geography, in: G. Clarke, M. Feldman, M. Gertler and D. Wojcik (eds.), *New Oxford Handbook of Economic Geography*, Chapter 11, Oxford: Oxford University Press, pp. 213-229.

Boschma, R.A. and Lambooy, J.G. (1999) Evolutionary economics and economic geography, *Journal of Evolutionary Economics* 9, 411– 429.

Boschma, R. and Martin, R. (eds) (2010) *The Handbook of Evolutionary Economic Geography,* Cheltenham: Edward Elgar.

Boschma, R., E. Miguelez, R. Moreno and D.B. Ocampo-Corrales (2022) The role of relatedness and unrelatedness for the geography of technological breakthroughs in Europe, *Economic Geography*, forthcoming.

Breschi, S., Lissoni, F. and Malerba, F. (2003) Knowledge-relatedness in firm technological diversification. *Research Policy* 32 (1), 69–87.

Castaldi, C., Frenken, K. and Los, B. (2015) Related variety, unrelated variety and technological breakthroughs: An analysis of US state-level patenting. *Regional Studies* 49 (5), 767–781.

D'Adda, D., Guzzini, E., Iacobucci, D. and Palloni, R. (2019) Is Smart Specialisation Strategy coherent with regional innovative capabilities?, *Regional Studies* 53 (7), 1004-1016.

Davies, B. and D.C. Maré (2021) Relatedness, complexity and local growth, *Regional Studies* 55 (3), 479-494.

Deegan, J., T. Broekel and R.D. Fitjar (2021) Searching through the Haystack. The relatedness and complexity of priorities in smart specialization strategies, *Economic Geography* 97 (5), 497-520.

De Vaan, M., K. Frenken and R. Boschma (2019) The downside of social capital in new industry creation, *Economic Geography* 95 (4), 315-340.

Di Cataldo, M., Monastiriotis, V., and Rodriguez-Pose, A. (2020) How "Smart" Are Smart Specialization Strategies? *Journal of Common Market Studies*. doi: 10.1111/jcms.13156.

Diodato D. and Weterings A.B.R. (2015) The resilience of regional labour markets to economic shocks: Exploring the role of interactions among firms and workers. *Journal of Economic Geography* 15 (4), 723–742.

Doner, R. F. and Schneider, B. R. (2016) The Middle-Income Trap: More Politics than Economics. *World Politics* 68 (4), 608–644.

Edler, J., and Fagerberg, J. (2017) Innovation policy: what, why, and how. *Oxford Review of Economic Policy* 33 (1), 2-23.

Evenhuis, E. (2016) *The political economy of adaptation and resilience in old industrial regions: a comparative study of South Saarland and Teesside*, PhD thesis, Newcastle University, Newcastle.

Fleming, L. and Sorenson, O. (2001) Technology as a complex adaptive system: Evidence from patent data. *Research Policy* 30, 1019–1039.

Florida, R. L. and Kenney M. (1988) Venture capital, high technology and regional development, *Regional Studies* 22, 33–48

Foray, D. (2015) *Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy*. London: Routledge.

Foray, D. (2019) In response to 'Six critical questions about smart specialisation', *European Planning Studies* 27, 10, 2066-2078.

Foray, D., P.A. David, and B.H. Hall (2009) Smart specialization. The concept (Knowledge Economists Policy Brief No. 9, June). Brussels: European Commission.

Foray, D., P.A. David and B.H. Hall (2011) Smart specialization. From academic idea to political instrument, the surprising career of a concept and the difficulties involved in its implementation (MTEI Working Paper, November). Lausanne: MTEI.

Foray, D., Goddard, J., Beldarrain, X. G., Landabaso, M., McCann, P., Morgan, K., Nauwelaers, C., Ortega-Argilés, R. and Mulatero, F. (2012) *Guide to Research and Innovation Strategies for Smart Specialisations (RIS 3)*, Brussels.

Fratesi U., Gianelle, C. and Guzzo, F (2021) *Assessing Smart Specialisation: Policy Implementation Measures*, EUR 30758 EN, Publications Office of the European Union, Luxembourg.

Frenken, K. (2017) Complexity-Theoretic Perspective on Innovation Policy*, Complexity, Governance & Networks*, 35-47, DOI: http://dx.doi.org/10.20377/cgn-41

Frenken, K., Van Oort, F.G. and Verburg, T. (2007) Related variety, unrelated variety and regional economic growth, *Regional Studies* 41, 685–697.

Fritsch, M. and M. Wyrwich (2014), The long persistence of regional levels of entrepreneurship: Germany 1925 to 2005, *Regional Studies* 48, 955–973.

Garud, R., Jain, S. and Kumaraswamy, A (2002) Institutional entrepreneurship in the sponsorship of common technological standards: The case of Sun Microsystems and Java, *Academy of Management Journal* 45 (1), 196–214.

Grabher, G. (1993) The weakness of strong ties: the lock-in of regional development in the Ruhr area, in Grabher G. (Ed.) *The Embedded Firm*, Routledge, London, pp. 255-277.

Grillitsch, M., B. Asheim and M. Trippl (2018) Unrelated knowledge combinations: the unexplored potential for regional industrial path development, *Cambridge Journal of Regions, Economy and Society*, 11 (2), 257–274.

Hartmann, D., Bezerra, M., Lodolo, B. and Pinheiro, F.L. (2020) International trade, development traps, and the core-periphery structure of income inequality. *EconomiA* 21, 255–278.

Hassink, R. (2005) How to unlock regional economies from path dependency? From learning region to learning cluster, *European Planning Studies* 13, 521–535.

Hausmann, R. and Rodrik, D. (2003) Economic development as self-discovery. *Journal of Development Economics* 72(2), 603–633.

He, C and Zhu, S (2019) *Evolutionary Economic Geography in China*, Springer, Berlin.

Henning, M. (2019) Time should tell (more). Evolutionary economic geography and the challenge of history. *Regional Studies* 53 (4), 602-613.

Hidalgo, C., Balland, P.A., Boschma, R., Delgado, M., Feldman, M., Frenken, K., Glaeser, E., He, C., Kogler, D., Morrison, A., Neffke, F., Rigby, D., Stern, S., Zheng, S., and Zhu, S. (2018) The principle of relatedness, *Springer Proceedings in Complexity,* 451-457.

Hidalgo, C. and Hausmann, R. (2009) The building blocks of economic complexity. *Proceedings of the National Academy of Sciences* 106, 10570–10575.

Holm J.R., Østergaard C.R. and Olesen T.R. (2017) Destruction and reallocation of skills following large company closures. *Journal of Regional Science* 57 (2), 245‐265.

Janssen, M. and K. Frenken (2019) Cross-specialisation policy: rationales and options for linking unrelated industries, *Cambridge Journal of Regions, Economy and Society* 12, 195–212.

Klepper, S. (2010), The origin and growth of industry clusters: the making of Silicon Valley and Detroit, *Journal of Urban Economics* 67, 15–32.

Kroll, H. (2015) Efforts to implement smart specialization in practice – Leading unlike horses to the water. *European Planning Studies* 23 (10), 2079–2098.

Kuhlmann, S. and Rip, A. (2018), Next ~~generation~~ innovation policy and grand challenges, *Science and Public Policy* 45, 4, 448-454.

Lee, K. (2013) *Schumpeterian Analysis of Economic Catch-up: Knowledge, Path-Creation, and the Middle-Income Trap*. Cambridge: Cambridge University Press.

MacKinnon, D., Cumbers, A., Pike, A., Birch, K. and McMaster, R. (2009) Evolution in Economic Geography: Institutions, Political Economy, and Adaptation, *Economic Geography* 85, (2), 129-150.

Marrocu, E., Paci, R., Usai, S., and Rigby, D. (2020) Smart Specialization Strategy: Any Relatedness between Theory and Practice? Working Paper CRENoS 202004, Centre for North South Economic Research, University of Cagliari and Sassari, Sardinia.

Martin, R., and Sunley, P. (2006) Path dependence and regional economic evolution. *Journal of Economic Geography* 6 (4), 395–437.

Maskell, P. and Malmberg, A. (1999) The competitiveness of firms and regions: 'ubiquitification' and the importance of localized learning. *European Urban and Regional Studies* 6 (1), 9–25.

Matti, C., Consoli, D. and Uyarra, E. (2017) Multi-level policy mixes and industry emergence: The case of wind energy in Spain. *Environment and Planning C: Pol. Space,* 35 (4), 661–683.

McCann, P. and Ortega-Argilés, R. (2015) Smart specialization, regional growth and applications to European Union Cohesion Policy. *Regional Studies* 49 (8), 1291–1302.

McCann, P. and Ortega-Argilés, R. (2016) The early experience of Smart Specialisation implementation in EU Cohesion Policy. *European Planning Studies* 24 (8), 1407–1427.

Mazzucato, M. (2013) *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*, London/New York: Anthern Press.

Mazzucato, M. (2018) Mission-oriented innovation policies: challenges and opportunities. *Industrial and Corporate Change* 27 (5), 803-815.

Morgan, K. (2015) Smart specialisation: Opportunities and challenges for regional innovation policy. *Regional Studies*, 49(3), 480–482.

Muneepeerakul, R., Lobo, J., Shutters, S. T., Gomez-Lievano, A., & Qubbaj, M. R. (2013). Urban economies and occupation space: Can they get 'there' from 'here'? PLoS ONE, 8(9), e73676. doi:10.1371/journal.pone.0073676

Neffke F. and Henning M. (2013) Skill relatedness and firm diversification. *Strategic Management Journal* 34 (3), 297–316.

Neffke F., M. Henning and R. Boschma (2011) How do regions diversify over time? Industry relatedness and the development of new growth paths in regions, *Economic Geography* 87 (3), 237–265.

Neffke, F., Hartog, M., Boschma, R. and Henning, M. (2018) Agents of structural change. The role of firms and entrepreneurs in regional diversification. *Economic Geography* 94, 23–48.

Nelson, R.R., G. Dosi, C.E. Helfat, A. Pyka, P.P. Saviotti, K. Lee, K. Dopfer, F. Malerba and S.G. Winter (eds.) (2018), *Modern Evolutionary Economics. An Overview*, Cambridge: Cambridge University Press.

Pagliacci, F., Pavone, P., Russo, M. and Giorgi, A. (2020) Regional structural heterogeneity: evidence and policy implications for RIS3 in macro-regional strategies. *Regional Studies* 54, 765–775.

Petralia, S., Balland, P-A. and Morrison, A. (2017) Climbing the ladder of technological development. *Research Policy* 46, 956–969.

Pinheiro, F.L., D. Hartmann, R. Boschma and C. A. Hidalgo (2021) The time and frequency of unrelated diversification, *Research Policy*, doi: 10.1016/j.respol.2021.104323

Pinheiro, F.L., P.A. Balland, R. Boschma and D. Hartmann (2022) The dark side of the geography of innovation: Relatedness, complexity, and regional inequality in Europe, *Regional Studies*, doi: 10.1080/00343404.2022.2106362

Rigby, D. (2015) Technological relatedness and knowledge space: Entry and exit of US cities from patent classes. *Regional Studies* 49 (11), 1922–1937.

Rigby, D.L., C. Roesler, D. Kogler, R. Boschma and P.A. Balland (2022) Do EU regions benefit from Smart Specialisation principles?. *Regional Studies*, DOI: 10.1080/00343404.2022.2032628.

Rodríguez-Pose, A. and Di Cataldo, M. (2015) Quality of government and innovative performance in the regions of Europe. *Journal of Economic Geography* 15 (4), 673–706.

Rodríguez-Pose, A. and Wilkie, C. (2015) Institutions and the entrepreneurial discovery process for smart specialization (Papers in Evolutionary Economic Geography No. 15.23). Utrecht: Utrecht University.

Rodrik D. (2004) Industrial Policy for the Twenty-First Century. Cambridge MA: Harvard University, *Kennedy School of Management Working paper* n. rwp04-047.

Schot J. and Steinmueller W. E. (2018) Three frames for innovation policy: R&D, systems of innovation and transformative change, *Research Policy* 47 (9), 1554–67.

Sotarauta, M. and Pulkkinen, R. (2011) Institutional entrepreneurship for knowledge regions: In search of a fresh set of questions for regional innovation studies, *Environment and Planning C* 29, 96–112.

Tanner, A. N. (2016) The emergence of new technology-based industries: The case of fuel cells and its technological relatedness to regional knowledge bases. *Journal of Economic Geography* 16 (3), 611–635.

Teece, D. J., Rumelt, R., Dosi, G., & Winter, S. (1994). Understanding corporate coherence. *Journal of Economic Behavior and Organization*, 23, 1–30.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509–533.

Tödtling, F. and Trippl, M. (2005) One size fits all? Towards a differentiated regional innovation policy approach, *Research Policy* 34 (8), 1203–1219.

Trippl, M., E. Zukauskaite and A. Healy (2020) Shaping smart specialization: the role of place-specific factors in advanced, intermediate and less-developed European regions, *Regional Studies* 54 (10), 1328-1340.

Van den Berge, M., Weterings, A. and Alkemade, F. (2020) Do existing regional specialisations stimulate or hinder diversification into cleantech? *Environmental Innovation and Societal Transitions* 35, 185-201.

Xiao, J, Boschma, RA and Andersson, M (2018), Industrial diversification in Europe: The differentiated role of relatedness, *Economic Geography* 94 (5), 514–49.

Zhu, S, He, C and Zhou, Y (2017), How to jump further and catch up? Path-breaking in an uneven industry space, *Journal of Economic Geography* 17(3), 521–45.