

Quality of government and social capital as drivers of regional diversification in Europe

Nicola Cortinovis^{*†}, Jing Xiao^{**}, Ron Boschma^{***} and Frank G. van Oort^{****}

^{*}Erasmus School of Economics, Erasmus University Rotterdam, P.O. Box 1738, 3000 DR, Rotterdam, The Netherlands

^{**}Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE), Sölvegatan 16, 223 62 Lund, Sweden

^{***}Section Economic Geography, Faculty of Geosciences, Utrecht University, P.O. Box 80.115 - 3508 TC Utrecht, The Netherlands and Innovation Studies, Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE), Lund University, Sweden

^{****}Erasmus School of Economics and Institute for Housing and Urban Development Studies (IHS), Erasmus University Rotterdam, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands

[†]Corresponding author: Nicola Cortinovis. *email* <cortinovis@ese.eur.nl>

Abstract

Industrial diversification is crucial for economies to prosper. Recent studies have shown that regional economies tend to diversify into sectors that are related to those already present in the region. However, no study yet has investigated the impact of regional institutions. The objective of the article is to analyze how formal and informal institutions influence regional diversification. Studying 118 European regions in the period 2004–2012, we find evidence that institutions, and especially bridging social capital, matter for regions to diversify into new industries. Our results suggest that regional institutions relevant for diversification in regions are predominantly informal in character rather than formal, and bridging rather than bonding.

Keywords: Regional diversification, social capital, quality of government, institutions

JEL classifications: R11, O14

Date submitted: 28 April 2016 **Date editorial decision:** 10 January 2017

Date accepted: 12 January 2017

1. Introduction

Institutions are increasingly recognized as important drivers of economic development. Scholars have highlighted how a well-functioning set of institutions fosters knowledge creation, innovation and economic growth (Acemoglu and Robinson, 2012; Crescenzi and Rodríguez-Pose, 2013; Rodríguez-Pose and Di Cataldo, 2014, in press). Some scholars consider the quality of institutions even more important than factors such as geography and trade integration, or the endowment of economic resources (Rodrik et al., 2004).

Limited attention has yet been paid to the effects of institutions on the process of diversification and structural change in regions. Technological diversification is among the most important drivers for regional economic growth (McCann, 2013, Frenken et al., 2007), recently emphasized by a burgeoning literature on diversity and relatedness interactions (Boschma and Frenken, 2017). We believe that the role of

both formal and informal institutions¹ is particularly relevant with respect to diversification, as institutions can help properly nudging these processes, with significant payoffs in terms of growth and development (McMillan and Rodrik, 2011). There is no study till date that has investigated systematically the impact of both formal and informal institutions on regional diversification. Rather, studies on industrial diversification focused almost entirely on the importance of relatedness in driving changes in the industrial composition of an economy, both at the national (Hausmann and Klinger, 2007) and regional scale (Neffke et al., 2011). Boschma and Capone (2015)'s has been the only study so far that has assessed whether the probability of countries to develop a comparative advantage in new export products depends on their national formal institutions (as embodied in regulations that govern labor relations, corporate governance relations, product markets and inter-firm collaborations). However, it remains unclear what the exact role of regional institutions is for regional diversification.

The objective of the article is to fill this gap in the literature by presenting a study on industrial diversification of 118 European regions in the period 2004–2012. First, we test whether European regions are more likely to develop new specializations in industries that are strongly related to other industries in the region. Our study finds strong support for this thesis, confirming the results of other studies that investigated regional diversification within one country (Neffke et al., 2011; Boschma et al., 2013). Second, we test whether regional diversification is influenced by formal and informal institutions, as these show significant differences across European regions (Rodríguez-Pose, 2013). Formal institutions at the regional scale are measured by means of quality of government (Charron et al., 2014). Informal regional institutions will be proxied by social capital, accounting for both the bright and dark sight of social capital by making a distinction between bridging and bonding social capital (Knack and Keefer, 1997; Putnam, 2001). We find that bridging social capital increases the probability of developing new specializations in European regions, though quality of government and bonding social capital show no effect. Moreover, we test the claim that informal institutions have a greater impact in regions where formal institutions are weak (Woodruff, 2006; Parker and Kirkpatrick, 2012). We find indeed that the positive effect of bridging social capital on acquiring new industry specializations is stronger in regions with a poor quality of government, while bonding social capital has a negative effect when the quality of government in a region is low.

The article is organized as follows. Section 2 introduces the theoretical framework, in which regional diversification is presented as a path-dependent evolutionary process, and which explains how formal and informal institutions can be linked to regional diversification. Section 3 presents the data and methodology employed. Section 4 presents the main results, and Section 5 concludes.

1 The concept of institutions is divided into formal (also called hard) institutions and informal (soft) institutions. The former refers to rules and bodies hinging upon codified arrangements, such as government policy or competition regulations, while the latter includes more loosely defined sets of incentives and constraints associated with social values, culture and religion.

2. Regional diversification, relatedness and institutions

2.1. Relatedness and regional branching

Theoretical contributions in economics have given a central role to knowledge in relation to growth. From endogenous growth theory (Romer, 1994), to the agglomeration literature (Marshall, 1920) and evolutionary economics (Nelson and Winter, 1982), the performance of national and regional economies has been proven to critically hinge upon the ability to create, absorb, adapt and make use of knowledge. Research underlines that knowledge is neither equally accessible nor equally relevant for economic actors (Nooteboom, 2000). Scholars have focused on the importance of cognitive proximity, among other forms of proximity (Boschma, 2005), for the transmission of knowledge across an economy. In this sense, the more related the knowledge and skill bases of different actors are, the easier it is for ideas, capabilities and knowledge to be profitably exchanged and applied. In contrast, when the cognitive distance is significant and actors do not ‘speak the same language’, knowledge spillovers are less likely to take place (Breschi et al., 2003).

This idea of relatedness between local actors has been tested in studies on agglomeration economies (Frenken et al., 2007; Bishop and Gripaos, 2010; Boschma et al., 2012; Cainelli et al., 2015; Cortinovis and Van Oort, 2015). Moreover, there is an emerging body of literature that focuses on the implications of relatedness for the process of regional diversification (Boschma, 2017). Incumbent firms are more likely to enter industries that are relatively close to the one they are already operating in (Teece et al., 1994). Similarly, new firms are more likely to start off and be successful in a sector that is closely related to other sectors in the region, as they can benefit from relevant local capabilities (like related knowledge and skills), or what has been referred to as ‘local related externalities’ (Neffke et al., 2015; Boschma and Frenken, 2017). Jumping into a completely unrelated sector, though still possible, would increase fundamental uncertainty and make firms face higher costs and higher risks of failure, due to the lack of required capabilities both at the firm and the regional level.

The consequences of these dynamics at the micro-level are that regions tend to diversify into new industries that are closely related to their existing industrial base. This implies that regional diversification can be considered a path-dependent process, in which the industrial history of regions provides opportunities as well as sets limits to diversification. This process of relatedness-driven diversification has been referred to as regional branching, since new activities draw upon and combine capabilities from existing local activities (Boschma and Frenken, 2011). Empirical studies have confirmed the predominance of this process of related diversification both at the national (Hausmann and Klinger, 2007) and regional scale (Neffke et al., 2011; Boschma et al., 2013). Based on these theoretical considerations, we formulate the following hypothesis:

Hypothesis 1: the probability that a region specializes in a new industry is positively affected by the degree of relatedness with existing industries in the region

2.2. Formal institutions and regional diversification

While the theoretical arguments and empirical evidence supporting the thesis of related diversification are solid, the insights they offer with respect to the heterogeneity in

diversification trajectories of economies are still limited. This may be attributed to the fact that the national and regional institutions may matter for diversification but are still relatively unexplored in the diversification literature (Boschma and Capone, 2015).

Institutions are recognized as playing an important role in shaping economic performance (Rodrik et al., 2004; North, 2005). As discussed by Acemoglu and Robinson (2012), the type of political and economic institutions, and more generally whether institutions are inclusive or exclusive, opens up or reduces opportunities for growth and development. Institutions like property rights, rule of law, competition monitoring and contractual agreements are essential for economic growth (Acemoglu and Johnson, 2005) and innovation (Crescenzi and Rodríguez-Pose, 2013). The mechanisms explaining the link between the quality of formal institutions and better economic performance mostly refer to the coordination and uncertainty reduction effects of formal institutions. When political authorities set clear rules, institutions are prevented from taking advantage of their positions (like unduly extracting benefits from economic activities), and provide incentives stimulating the activity of economic actors; they can contribute to the growth and dynamism of an economy (Acemoglu and Robinson, 2012).

Against this background, it can be argued that, besides growth and innovation, good governance can also facilitate the development of new specializations in a region. Within a set of clear and inclusive rights and rules, individuals are able to pursue their economic interests. In such an environment of lower risks and uncertainties, local actors are expected to be more entrepreneurial, more innovative and in a better position to invest in new activities. While this holds for indigenous actors, it is also relevant for foreign ones. In particular, the capacity of an economy to attract and benefit from foreign investment critically hinges upon its institutional settings (Alguacil et al., 2011; Cipollina et al., 2012;). Besides, well-functioning governments may implement policies making local actors better able to take advantage of the inflow of ideas, products and knowledge (Sterlacchini, 2008; Charron et al., 2014). This implies that formal institutions can provide critical resources for an economy to diversify and enlarge its industrial portfolio.

While research on formal institutions is conducted primarily at the country level (Acemoglu and Robinson, 2012), similar arguments apply to the regional level (Rodríguez-Pose, 2013). Significant within-country variations in the quality of formal institutions exist in Europe, as measured by quality of governance, impartiality and level of corruption (Charron et al., 2014). There is much debate regarding what quality of government actually means: Rothstein and Teorell (2008) refer to it as the impartiality of institutions that exercise government authority which also encompasses rule of law. Regions characterized by quality government institutions are found to perform better in terms of socioeconomic development (Charron et al., 2014), growth and convergence (Ederveen et al., 2006; Arbia et al., 2010) and innovation (Crescenzi and Rodríguez-Pose, 2013; Rodríguez-Pose and Di Cataldo, 2014, in press). Besides, European regions strongly differ in terms of the history of their institutional systems, as most of regions that entered in the European Union (EU) after 2004 are former centrally planned economies. As noted by Hall and Soskice (2001), the extent to which economies rely on market coordination as opposed to strategic coordination provides different comparative advantages with respect to innovation and diversification. Empirical studies (Boschma and Capone, 2015) have convincingly shown that related diversification is more common in economies favoring nonmarket coordination,

whereas relatedness plays a less strong role in countries relying on market-based mechanisms of coordination. By contrast, no quantitative study has yet assessed the impact of quality of regional government on diversification. Furthermore, the process of legal integration and alignment of regulations in EU new Member States with the *acquis communautaire* has to some extent leveled out the historical differences existing between East and West Europe, although significant differences in quality of government between the core and periphery of Europe still exist (Charron et al., 2014). Therefore, we test the following hypothesis:

Hypothesis 2: the probability that a region specializes in a new industry is positively related to the quality of the government in the region

2.3. Informal institutions and regional diversification

Like formal institutions, the incentives and constraints set by culture, religion and social norms—that is, informal institutions—impact on human actions in an economy (North, 1990, 2005). In economic geography, a lot of emphasis has been laid on the role of informal institutions for regional development (Rodríguez-Pose, 2013). Storper (1995) referred to ‘untraded interdependencies’ as intangible assets in territories like rules, customs, values and norms. The regional innovation system literature (Cooke, 2001; Asheim and Isaksen, 2002) focused on the importance of interaction and coordination between agents for the innovation process. According to this influential body of literature, the way these relations are governed are embedded in territory-specific institutions, which impact on the intensity of interaction and the level of interactive learning and innovation in regions. Some have argued that a culture of shared trust is a crucial capability that supports learning and innovation (Cooke and Morgan, 1998). Other scholars focused on institutional lock-in (Grabher, 1993; Hassink, 2005) that erodes the ability of regions to develop new growth paths. However, despite many important contributions, few empirical studies in economic geography have systematically investigated the relationship between informal regional institutions and diversification in regions.

While there are many types of informal institutions (Nahapiet and Ghoshal, 1998), social capital has attracted most attention. Putnam et al. (1993) defines social capital as ‘those features of social organizations, such as trust, norms and networks that can improve the efficiency of society by facilitating coordinated actions’ (167). In this definition, social capital is regarded as a beneficial social feature that enhances economic performance. First, trust among actors reduces information and transaction costs (Fukuyama, 1995). Second, trust and involvement in the social community enable the achievement of collective action through cooperation, solidarity and public-spiritedness (Putnam et al., 1993). Third, the social infrastructure and network relations associated with high levels of social capital make it easier to mobilize local resources. This is particularly true for knowledge that circulates more easily when actors are embedded in a system of social relations (Echebarria and Barrutia, 2013).

However, the literature has long acknowledged that social capital can also have detrimental effects (Coleman, 1988; Portes and Landolt, 1996). First, there is the conformity bias that pressure from close social relations may induce. Homogeneous and tightly knitted communities are considered to be less exposed to new information,

and less prone to create innovations and accept new ideas (Uzzi, 1996; North, 2005; De Vaan et al., 2011). Second, tight networks of established groups may lead to opportunistic behavior. Olson (1982) referred to ‘distributional coalitions’ that hinder economic growth by engaging in rent-seeking activities and fighting over the distribution of existing output rather than the production of new wealth. Examples of such distributional coalitions are lobbies, interest groups, professional associations, and other groups and organizations which impose costs to society as a whole (Knack and Keefer, 1997; Coates and Heckelman, 2003; Yamamura, 2011). A review by Westlund and Adam (2010) showed that the empirical literature on social capital and regional development is inconclusive. Some studies found a positive effect (Beugelsdijk and van Schaik, 2005; Dincer and Uslaner, 2007; Akçomak and ter Weel, 2009; Tabellini, 2010; Crescenzi et al., 2013), while other studies found no effect or a negative effect (Casey and Christ, 2003; Miguel et al., 2005).

To distinguish the positive effects from the negative effects of social capital, the literature has proposed a distinction between bonding and bridging dimensions of social capital (Knack and Keefer, 1997; Putnam, 2001). Bonding social capital refers to dense social structures characterized by strong links between like-minded people. It helps mobilizing support and solidarity, but only to the benefit of those who belong to such close groups, like nuclear families (Banfield, 1958) and distributional coalitions (Olson, 1982). On the other hand, bridging social capital refers to associations that are more inclusive and consist of individuals with different socioeconomic characteristics. Because of their inclusiveness and cross-cutting nature, bridging-type of relations facilitate diffusion of nonredundant knowledge and trust-building between heterogeneous groups. Movements for civil rights, youth associations or ecumenical religious groups are considered typical examples of bridging social capital (Putnam, 2001).

Following this line of argumentation, we propose that trust and bridging social capital are crucial for regional diversification because they function as a bridge between disconnected activities. By making the local economy more interconnected and better able to coordinate actions and mobilize resources, higher levels of trust, and especially the presence of bridging-type of social relations, are expected to facilitate the circulation of nonredundant knowledge and other resources among different activities as well as to enable the creation of new combinations of different strands of knowledge and capabilities. These dynamics, in turn, boost regional diversification. A mirroring reasoning applies in the case of bonding social capital. We consider strong bonding relations as potentially detrimental for the ability of regions to adapt and introduce new products. When inward-looking groups are strongly embedded in a local economy, local activities will have a harder time to make crossovers and mobilize and combine the different sorts of skills and knowledge necessary to diversify. Based on these theoretical considerations, we derive the following hypotheses:

Hypothesis 3a: the probability that a region specializes in a new industry is positively related to the level of trust and bridging social capital in the region

Hypothesis 3b: the probability that a region specializes in a new industry is negatively related to the level of bonding social capital in the region

We also test whether the role of relatedness changes according to the regional endowment of institutions. We have no *a priori* expectations concerning the question

whether a higher quality of local government will strengthen or weaken the effect of relatedness on regional diversification. The same applies to the interaction effect between relatedness and bonding social capital, given the fact that we expected a negative relationship between bonding social capital and regional diversification in hypothesis 3b. However, what we do expect is that high levels of trust and bridging social capital may relax the effect of relatedness, in the sense that such social capital may facilitate regions to move into more unrelated activities. Due to their combinatory potential, these two types of informal institutions enable regions to make a jump in their industrial evolution, allowing regions to stay less close to their existing activities when diversifying in new industries, following Boschma and Capone (2015). This idea is tested in the following hypothesis:

Hypothesis 4: relatedness has a weaker effect on the probability that a region specializes in a new industry when the levels of trust and bridging social capital are high

Finally, some scholars have argued that, once a good regulatory framework is in place, the economic need for informal institutions is strongly reduced (Rodríguez-Pose, 2013). As quality of government and social capital perform similar functions and once uncertainty is reduced and cooperation is achieved via formal institutions, informal institutions become less relevant. On the other hand, when red tape and inefficiencies in the local governance system make them costly to use or ineffective, informal relations and rules within the community provide a more efficient way to coordinate actions and curb uncertainty. On these bases, scholars have theorized a substitution effect between formal and informal institutions, with social capital being relevant only when formal institutions are weak (Ahlerup et al., 2009). However, we expect this only to be the case with bridging social capital: when the quality of government is low, we expect that bridging social capital in a region has a stronger positive effect on regional diversification. By contrast, we expect the combination of low quality of government and bonding social capital in a region to be the worst case scenario for a region. In other words, we expect a stronger negative effect of bonding social capital on regional diversification when the local governance system is weak.

Hypothesis 5a: bridging social capital has a stronger positive effect on the probability that a region specializes in a new industry when quality of government is low

Hypothesis 5b: bonding social capital has a stronger negative effect on the probability that a region specializes in a new industry when quality of government is low

3. Methodology and data

3.1. Relatedness

Following Boschma et al. (2013) among others, we employ the proximity index developed by Hidalgo et al. (2007) to measure industry relatedness. In their approach, relatedness between two industries is reflected by the likelihood that countries have revealed comparative advantage in the two industries simultaneously, given the assumption that industries are more likely to be jointly present if they share similar productive inputs or capabilities, such as factor inputs, infrastructure or institutions.

This means that capabilities are not directly observed, but derived from the frequent co-occurrence of the same combinations of industries in the same location (Boschma, 2017). This is regarded as a reflection of two industries demanding similar capabilities. This principle of similar resource requirements has been applied widely at the level of organizations to identify relatedness between industries (Teece et al., 1994). Hidalgo et al. (2007) use the definition of revealed comparative advantage by Balassa (1965), considering country c to have a comparative advantage in product i if the share of product i in the total export of country c is larger than the share of product i in the total export of all countries. Due to data availability at the EU regional level, we base our analysis on employment instead of trade data. We employ the location quotient (LQ) as a measure of the level of specialization of industry i in region c relative to the overall specialization of that industry in all regions in our sample. In more formal terms:

$$LQ_{ic} = \left(\frac{E_{ic}/E_{*c}}{E_{i*}/E_{**}} \right) \quad (1)$$

where i and c denote industry i and region c respectively; E_{ic} refers to employment of industry i in region c ; E_{*c} is total employment of all industries in region c ; E_{i*} is total employment of industry i in all regions; E_{**} represents total employment of all industries in all regions.

A higher value of LQ indicates a higher level of specialization of industry i in region c relative to the overall specialization of that industry in all regions. However, a main criticism in terms of the application of the LQ is that there is no widely accepted cutoff value that can explicitly delimit the specialization of an industry in a region (O'Donoghue and Gleave, 2004). Tian (2013) developed a bootstrap method to obtain an objective cutoff value of standardized location quotient (SLQ). The advantage of this method is that it does not impose any assumptions in terms of the distribution of LQ. Following Tian (2013)'s bootstrap method, we identify the cutoff value of SLQ by estimating the critical value at a 5% significance level based on the actual distribution of SLQ. The purpose of bootstrap resampling is to obtain the actual distribution of SLQ. The use of a 5% significance level is because we need an objective way to identify the outliers (regions) with exceptionally high level of agglomeration activities. First, we calculate the SLQ as in Equation (2)

$$SLQ_{ic} = \frac{LQ_{ic} - \overline{LQ}_i}{\text{std}(LQ_i)} \quad (2)$$

where \overline{LQ}_i is the mean value of the LQ for industry i , and $\text{std}(LQ_i)$ is the standard deviation of the LQ for industry i . Second, we divide the SLQ into samples for each industry. Third, we carry out the procedure of resampling with 1000 times replacement for each industry to obtain 1000 bootstrap samples, each having exactly the same length as the original sample of each industry. Fourth, we calculate the 95th percentile of each bootstrap sample. By calculating the mean value of the 95th percentile of 1000 bootstrap samples, we get the estimate of the critical value of SLQ at the 5% level² for

- 2 The legitimacy of a 5% level has been validated with empirical data, see O'Donoghue and Gleave (2004) for regions in South East England and Tian (2013) for regions in the USA. In our case, at the 5% level, the average number of newly specialized industries is around 2 for European regions from 2004 to 2009. By contrast, the corresponding number is around 0.88 at the 1% level and 3.5 at the 10% level.

each industry. If the SLQ for industry i at region c is higher than the cutoff value in that industry at year t , we define that region c specializes in industry i at year t .

After obtaining the cutoff values of SLQ for each industry, we calculate the proximity index between each pair of industries. Following Hidalgo et al. (2007), we assume co-occurrence of specialization in industry i and j in region c , if the SLQs of the two industries in that region are both higher than their respective cutoff values. After that, we calculate the conditional probability of a region specializing in one industry given it specializes in another. We compute the proximity index between industry i and j by taking the minimum between the conditional probability of a region specializing in industry i given it specializes in industry j , and the conditional probability of a region specializing in industry j given it specializes in industry i , as follows:

$$\phi_{i,j,t} = \min\{P(x_{i,t}|x_{j,t}), P(x_{j,t}|x_{i,t})\} \quad (3)$$

As we have 323 industries in total in our dataset, we obtain a 323×323 matrix of proximities, which is common to all regions included in the analysis. In order to test the first hypothesis on the positive relationship between industrial diversification and the current industrial structure of a region, we follow Hausmann and Klinger (2007) to construct a density indicator, as shown in Equation (4):

$$d_{i,c,t} = \left(\frac{\sum_k \phi_{i,k,t} x_{k,c,t}}{\sum_k \phi_{i,k,t}} \right) \quad (4)$$

where k refers to industry k and t refers to year t ; $\phi_{i,k,t}$ refers to the proximity between industry k and i at year t ; $x_{k,c,t}$ is a dummy variable and takes the value of 1 if region c specializes in industry k at year t . In this way, $d_{i,c,t}$ measures the density around industry i in region c at year t , equaling the sum of proximities between industry i to all industries that region c is specialized in at year t , divided by the sum of proximities between industry i to all industries. The density indicator ranges from 0 to 1: a value of 0 means region c has no specialization in any industry related to industry i at year t ; when $d_{i,c,t}$ is equal to 1, region c is specialized in all industries that are related to industry i at year t .

3.2. Modeling framework

As our focus is on diversification, we opt for an entry model, that is, we look at what factors can be statistically associated with a region becoming specialized in a sector it was previously not. To this end, we include only industries that each region was not specialized in at the beginning of each time interval and observe over time whether regions have acquired new specializations at the end of each period. The dependent variable is $x_{i,c,t+5}$, a dummy variable taking value 1 if region c specializes in industry i at year $t+5$.³ So, following other empirical studies (e.g. Hidalgo et al., 2007; Boschma et al., 2013), we measure whether a region is successful in building up a specialization in

Comparatively, we think that around 2 newly specialized industries averagely across European regions from 2004 to 2009 is a reasonable magnitude. Nonetheless, we still conduct a robustness check based on the cutoff value estimated at the 10% level. The results, displayed in Table A1 further confirms our main findings.

3 We considered 5-year intervals as the minimum length in order to properly capture diversification dynamics. This is in line with the average business cycle length in advanced economies (NBER, 2012).

an industry (as proxied by a location quotient) that is new to the region. This means we identify only new activities that have acquired a substantial size in a region, but our measure does not account for the relative importance of a new specialization in the total economy of a region. Nor does it account for the type of firms (like new firms, diversifiers, branch plants) that induce diversification in the region, because these cannot be identified with our data at hand (see Neffke et al., 2015).

With respect to the independent variables, $d_{i,c,t}$ refers to the density around industry i in region c at year t , accounting for the relatedness of the industry with respect to the others; Ins_c is a vector gathering the scores of our institutional variables in region c (these scores are time invariant due to data constraints); $d_{i,c,t} \times Ins_c$ captures the effect of the interaction between density and the level of formal and informal institutions on developing a new industry specialization; and $C_{c,t}$ is a vector of control variables in region c at year t . In addition, we include $\mu_{i,t}$ to control for fixed effects of each industry for each 5-year interval, while $\epsilon_{i,c,t}$ is the error term. More specifically, our baseline model (Model 1: Equation 5) is:

$$x_{i,c,t+5} = \alpha + \beta * d_{i,c,t} + \theta * C_{c,t} + \mu_{i,t} + \epsilon_{i,c,t}. \quad (5)$$

We extend this specification in order to account for the direct effects of institutions (Model 2: Equation 6) and the interaction effects (Model 3: Equation 7) on diversification.

$$x_{i,c,t+5} = \alpha + \beta * d_{i,c,t} + \gamma * Ins_c + \theta * C_{c,t} + \mu_{i,t} + \epsilon_{i,c,t} \quad (6)$$

$$x_{i,c,t+5} = \alpha + \beta * d_{i,c,t} + \gamma * Ins_c + \delta * d_{i,c,t} * Ins_c + \theta * C_{c,t} + \mu_{i,t} + \epsilon_{i,c,t} \quad (7)$$

The models are estimated by ordinary least squares (OLS) with heteroskedasticity-robust standard errors.⁴ It should be noticed that besides a linear probability OLS model, a logit or probit specification can be used for a binary outcome regression. However, the large number of dummy variables included in our regressions may lead to biased and inconsistent results for logit or probit models (Greene, 2012).⁵ For facilitating interpretation and ensuring numerical precision, we standardize the independent variables of main interest (not including control variables) before estimating our models.

3.3. Variables and data sources

The data for constructing the dependent variable and the density indicator were obtained from the Orbis database by Bureau Van Dijk. This database offers unique information at firm level for a significant number of countries. For our analyses, we

4 We decided not to include clustered errors at regional level, as including these would significantly reduce the number of independent observations in our sample. This would in turn make it impossible to include industry-year fixed effects in the regressions.

5 Alternatively, the nested character of our variables can be used to study the relations between institutions, density and diversification following a multilevel modeling approach (Van Oort et al., 2012). To test whether such an approach is useful, we estimated the null version of our linear probability model with two levels: industries nested within regions. The intra-class correlation score of this null model is less than 1% (0.008), suggesting that a two-level approach does not add explanatory power to our single-level model.

aggregated firm-level employment weighted data into region–industry combinations at NUTS2-level (and sometimes NUTS-1), proportionally fitted into more aggregated region–sector data stemming from Cambridge Econometrics (Cortinovis and Van Oort, 2015). Selecting firms in EU countries in Orbis, we were able to retrieve data for about 10 million firms. For each of these entries, we had information on the location, the 4-digit NACE sector and the number of employees. Data on sales and turnover were also available but not used due to too many missing values. Of the 615 NACE sectors, we only considered 323 tradable industries⁶ given our focus on diversification. The choice of the period is based on data availability. Such a limited time span of 9 years only represents a significant limitation compared to previous studies on regional diversification. To maximize the number of observations, we analyze regional diversification for four overlapping 5-year intervals: 2004–2009, 2005–2010, 2006–2011 and 2007–2012.⁷

While the data are unique in Europe in terms of geographical and industry breakdown, they are not without difficulties (Kalemli-Ozcan et al., 2015). First, small firms are underrepresented in the data. Weighing by employment in broader sectors mitigates this, but the lack of small firms influences the degree of new firm formation and branching into related specializations. Therefore, our observed diversification is conservative by definition. Second, missing values at firm level were present in all countries, but their amount was particularly high and constant over the years in some areas. For this reason, we excluded Austria, Czech Republic, Hungary, Slovenia, Slovakia, Ireland and the UK. For some areas, most notably Sweden, regulations prevented full disclosure of the data, further, reducing the sample. Third, small countries for which NUTS0 and NUTS2 levels coincide were also left out from our sample, such as the Baltic states, Cyprus, Malta and Luxembourg.⁸ Finally, to avoid variability in employment levels within sectors due to missing values, we interpolated data at firm level using the nearest available year.

The list of sectors used in the analysis is reported in the Appendix. Based on the computation described previously, we define the sectors in which each region is specialized. Figures 1 and 2 show the geographical distribution of industrial specializations across the regions in the sample, in 2004 and 2012. Figure 1 refers to the number of specializations in knowledge-intensive and advanced industries (Eurostat, 2016), whereas Figure 2 represents the number of specializations in nonadvanced sectors.

The spatial distribution of specializations across European regions appears rather clearly. Core regions, located between the Netherlands and Northern Italy tend to be specialized in more advanced industries. Over time, only minor changes are detected, most notably, some French regions around Paris partially lost their competitive edge in advanced industries, while Gdansk region in Poland and Sud-Vest Oltenia in Romania entered into more advanced industries. A mirroring pattern is depicted in Figure 2: Mediterranean and Eastern European regions are more frequently specialized in

6 Tradable industries are defined according to the third version of Standard International Trade Classification (SITC3). In other words, we matched our NACE classes with SITC3 ones, in order to include in the analysis only sectors listed in SITC3.

7 As a robustness check, we also used a single 9-year time interval, as reported in Table A2. The results confirm our main findings.

8 We excluded 72 regions (6 small countries and 8 Swedish regions) due to missing values. Due to the integration with other datasets, we also had to re-aggregate the data for some countries (Poland, France, Greece and Germany) at the NUTS1 level.

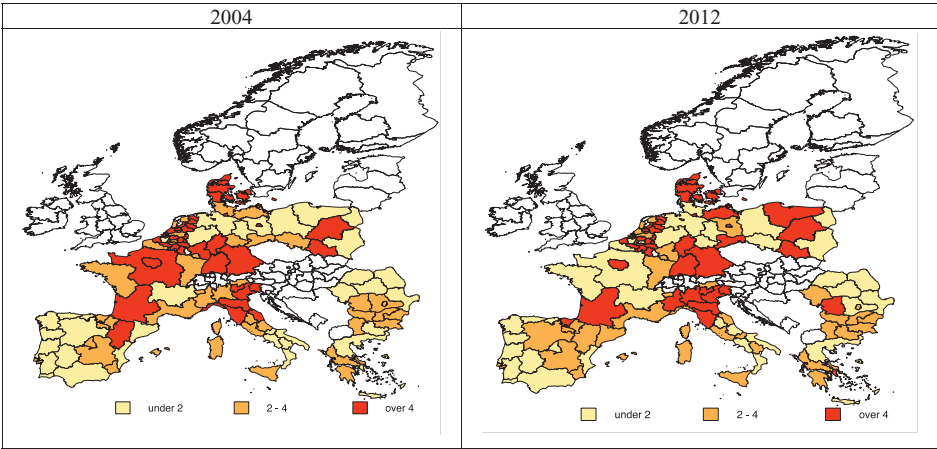


Figure 1. Number of specializations in advanced industries.

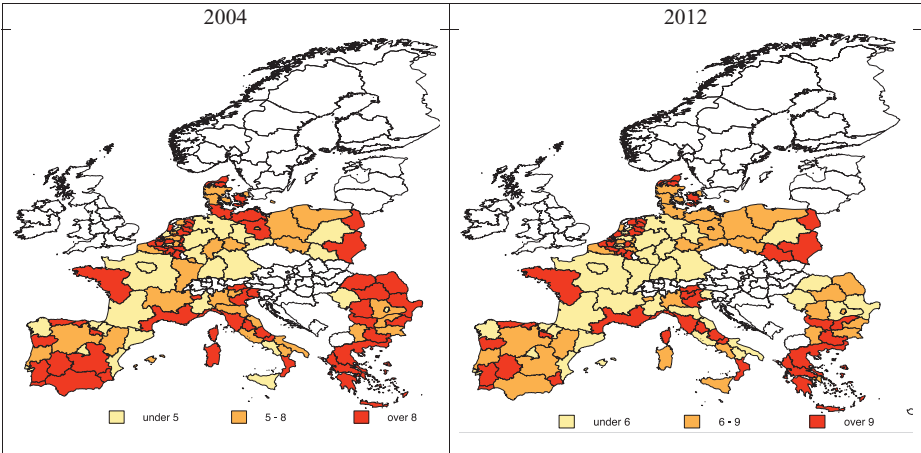


Figure 2. Number of specializations in nonadvanced industries.

industries which are relatively less advanced. It is interesting to notice, however, how specializations in advanced and less-advanced industries coexist in some areas, in particular, in the North East of Italy, Belgium and the Netherlands. Finally, as for knowledge-intensive and high-tech sectors, changes in the number of specializations over time involve relatively few regions.

To measure formal institutions, we use the European Quality of Government Index (*EQI*) by Charron et al. (2014). This index includes 16 indicators derived from respondents that had to rate public services (education, healthcare and law enforcement) with respect to three dimensions of government performance: quality of governance, impartiality and level of corruption. As the index was firstly computed in 2010, we can only include it as time-invariant variable, under the assumption that its score did not change significantly between 2004 and 2012 (see Rodríguez-Pose and Di Cataldo, 2014, in press). While the Quality of Government dataset offers data on a finer

geographical level (NUTS2) than other sources like the European Value Study, for some countries we estimated the value of *EQI* at the broader NUTS1 level, as the NUTS2 average weighted by the population weight included in the Quality of Government dataset.⁹

With respect to social capital, a variety of measures has been proposed, ranging from political participation to blood donation (Ahlerup et al., 2009). In order to include as many regions as possible in our analysis, we follow Knack and Keefer (1997) and Beugelsdijk and van Schaik (2005) among others, and compute common indicators like level of trust and the active involvement of people in associational life. Similar to the latter study, we resort to the European Values Study 1999 database that contains survey data on the social attitude and values of people at regional level. As we only use data from the 1999 survey, our social capital variables are time invariant. Trust is computed by the share of respondents affirming that most people can be trusted over total number of respondents.¹⁰

Clearly, capturing the bridging and bonding dimension of social capital is far from easy and straightforward (Beugelsdijk and Smulders, 2009; Geys and Murdoch, 2010; Crescenzi et al., 2013). We follow the seminal contribution of Knack and Keefer (1997) and look at group membership in different types of associations that are divided according to their potential rent-seeking behavior. Groups with inclusive and heterogeneous membership (referred to as ‘Putnam groups’) are supposed to act as cooperation- and trust-enhancers rather than reflecting rent-seeking conduct. Organizations being exclusive and homogeneous in terms of membership (named ‘Olson-groups’) are instead considered more likely to act as distributional coalitions. Following Knack and Keefer (1997), we link the bridging dimension of social capital to associations like cultural activities (e.g. art, music, education), youth work (like scouting groups) and ecumenical religions, while professional associations, political parties/groups and trade unions represent the bonding-type of social capital. Rather than simply looking at group membership, we consider whether respondents are directly involved in voluntary work. We argue, in line with Beugelsdijk and van Schaik (2005), that this is a more accurate way to assess the participation of people in associational life. We calculated for each type of association the share of people that work as volunteer in at least one organization belonging to each set of associations, over the total respondents in a region.

In order to control for regional characteristics, we include other variables in our regressions. When investigating the role of density only, we include region-year fixed effects in our model. When including the time-invariant institutional variables, we can rely on some control variables. To control for economic conditions in each region, we use the log of gross domestic product (*GDP*), the log of gross capital formation on real gross value added (*Physical K*), the share of employee having attained upper secondary (*HK Sec*) and tertiary education (*HK Tert*) in log scale, and the average rate of economic growth for each 5-year period (*Growth Rate*)¹¹. Additionally, we computed

9 As a robustness check, we also used the scores for each of the three dimensions in order to test whether it is through one or more specific dimensions that formal institutions affect regional diversification. The role of formal institutions remains mostly insignificant.

10 The question that was asked in the survey is ‘Generally speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?’

11 As we do not have data for *GDP* in 2012, in the last period the growth rate is computed over 4 years.

Table 1. Descriptive statistics

Variables	Level of obs. ^a	N	Mean	S.D.	Min	Max
<i>Dummy_{x_{t+5}}</i>	Sector	99,037	0.00993	0.0991	0	1
<i>Density</i>	Sector	99,037	0.0287	0.0318	0	0.629
<i>EQI</i>	Region	99,037	−0.148	0.986	−2.735	1.753
<i>Trust</i>	Region	97,768	−0.144	0.906	−1.646	2.919
<i>Bonding SK</i>	Region	97,768	−0.106	0.887	−1.224	4.358
<i>Bridging SK</i>	Region	97,768	−0.180	0.780	−1.382	4.527
<i>Growth rate</i>	Region	99,037	0.00318	0.0180	−0.0604	0.0723
<i>Pop. Density</i>	Region	99,037	−1.803	1.020	−4.254	1.863
<i>GDP</i>	Region	99,037	3.745	1.227	0.745	6.255
<i>Physical K</i>	Region	99,037	−1.39428	0.234	−2.241	−0.542
<i>HK Sec (log)</i>	Region	99,026	−0.916	0.426	−2.265	−0.307
<i>HK Ter (log)</i>	Region	99,026	−1.54	0.410	−2.516	−0.545

^aSector indicates variables measured at the fourth-digit level of NACE classification. Region indicates variables measured at NUTS1/NUTS2 level.

the log of population density (*Pop. Density*) to control for the level of urbanization of European regions. All these variables have been taken from the Cambridge Econometrics regional database,¹² while part from our human capital measures was obtained from Eurostat.

A potential issue with our modeling strategy is the existence of endogeneity. While the inclusion of control variables can be considered sufficient for reducing the potential omitted variable bias, the issue of reverse causality requires attention. It might be the case that diversifying into a growing sector triggers changes in the amount and type of social capital in a region (e.g. due to firms in new successful sectors sponsoring local associations or events). However, the computation of the social capital indicators from data gathered in 1999 should normally prevent any bias emerging from reverse causality. The *EQI* variable—measured for the first time at regional level in 2010—could theoretically be affected by diversification dynamics in previous years. However, the use of instrumental variable techniques to partial out endogenous effects is not less problematic, given the complexity of the variable to be instrumented, the regional dimension of the data, and the multi-country setting of the study. Moreover, the *EQI* variable is unlikely to change significantly in a short time span, as institutions tend to be inherently stable (Tabellini, 2010; Rodríguez-Pose, 2013). Therefore, it is safe to assume that diversification hardly has any important short-term effects on the quality of government in European regions.

Tables 1 and 2 report descriptive statistics and the correlation matrix for variables. The acquisition of a new specialization by a region occurs in roughly 1% of the cases (Table 1, *dummy_{x_{t+5}}*). The short time interval at stake and the severe recession

- 12 To recap: *Dummy_{x_{t+5}}*, *Density*, *Growth Rate*, *Pop. Density*, *GDP* and *Capital Formation* are measured in every year between 2004 and 2012. *EQI* is measured in 2010, while the three social capital variables are measured in 1999. In our models, we look at NACE4 sector level dynamics: the number of observations is determined by sectors times regions for each period. As we exclude sectors in which regions have already a comparative advantage at time t (*Dummy_{x_t}* = 1), the number of sectors included changes from year to year.

Table 2. Correlation matrix

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)
<i>Dummy_{xt+5}</i> (I)	1											
<i>Density</i> (II)	0.12	1										
<i>EQI</i> (III)	0.01	0.09	1									
<i>Trust</i> (IV)	0.02	0.05	0.53	1								
<i>Bonding SK</i> (V)	0.02	0.11	0.29	0.37	1							
<i>Bridging SK</i> (VI)	0.01	0.06	-0.23	0.03	0.37	1						
<i>Growth rate</i> (VII)	0.01	-0.06	-0.02	-0.12	-0.26	-0.08	1					
<i>Pop. Density</i> (VIII)	0.01	0.00	0.21	0.25	0.29	-0.08	0.05	1				
<i>GDP</i> (IX)	-0.02	-0.07	0.38	0.24	0.26	-0.31	-0.16	0.42	1			
<i>Physical K</i> (X)	0.00	-0.04	-0.17	0.01	-0.17	0.07	-0.16	-0.33	-0.3	1		
<i>HK Sec</i> (XI)	0.02	0.05	-0.11	-0.06	-0.03	0.08	0.43	0.00	-0.04	-0.45	1	
<i>HK Ter</i> (XII)	0.00	-0.01	0.46	0.42	0.11	-0.12	0.13	0.22	0.26	0.09	-0.13	1

Table 3. The effects of density

Variables	Model 1	Model 1 (Control var.)	Model 1 (FE)
<i>Density</i>	0.0208*** (0.00127)	0.0208*** (0.00129)	0.0219*** (0.00137)
<i>Growth rate</i>		0.0425* (0.0247)	
<i>Pop. Density</i>		0.00118*** (0.000367)	
<i>GDP</i>		-0.000533 (0.000325)	
<i>HK Sec</i>		0.00261*** (0.000921)	
<i>HK Ter</i>		0.000400 (0.000822)	
<i>Physical K</i>		0.00545*** (0.00194)	
<i>Constant</i>	0.0126*** (0.000418)	0.0272*** (0.00382)	0.0221*** (0.00422)
<i>Observations</i>	99,037	99,026	99,037
<i>R²</i>	0.025	0.025	0.033
<i>Industry_{year} FE</i>	Yes	Yes	Yes
<i>Region_{year} FE</i>	No	No	Yes

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

affecting some areas of Europe may explain such a relatively low level. None of the correlation scores of the variables shown in Table 2 are worryingly high. Quality of government is generally positively related to trust, bridging social capital and tertiary educational attainment, but negatively related to bonding social capital. Trust is also correlated with bridging social capital, but basically uncorrelated with bonding social capital. The signs and correlations among these variables are as expected (Charron et al., 2014).

Table 4. The direct effects of institutions

Variables	Model 2 EQI	Model 2 Trust	Model 2 Associational groups	Model 2 EQI—Trust	Model 2 EQI—Associational groups
<i>Density</i>	0.0207*** (0.00130)	0.0205*** (0.00130)	0.0203*** (0.00130)	0.0205*** (0.00130)	0.0203*** (0.00131)
<i>EQI</i>	0.000445 (0.000430)			−0.000233 (0.000465)	−0.000201 (0.000454)
<i>Trust</i>		0.00117*** (0.000446)		0.00126*** (0.000474)	
<i>Brid. SK</i>			0.00238*** (0.000663)		0.00245*** (0.000680)
<i>Bond. SK</i>			−0.000553 (0.000459)		−0.000602 (0.000475)
<i>Growth rate</i>	0.0423* (0.0247)	0.0623** (0.0253)	0.0769*** (0.0254)	0.0638** (0.0257)	0.0776*** (0.0255)
<i>Pop. Density</i>	0.00120*** (0.000370)	0.000969*** (0.000367)	0.000793** (0.000373)	0.000942** (0.000372)	0.000774** (0.000378)
<i>GDP</i>	−0.000617* (0.000341)	−0.000575* (0.000327)	−0.000778** (0.000356)	−0.000536 (0.000341)	−0.000756** (0.000361)
<i>HK Sec</i>	0.00277*** (0.000944)	0.00194** (0.000930)	0.00208** (0.000929)	0.00181* (0.000978)	0.00201** (0.000949)
<i>HK Ter</i>	−3.99e-05 (0.000908)	−0.000542 (0.000912)	2.18e-05 (0.000831)	−0.000379 (0.000957)	0.000225 (0.000921)
<i>Physical K</i>	0.00585*** (0.00199)	0.00441** (0.00197)	0.00553*** (0.00198)	0.00413** (0.00207)	0.00535*** (0.00202)
<i>Constant</i>	0.0276*** (0.00388)	0.0234*** (0.00394)	0.0266*** (0.00391)	0.0229*** (0.00412)	0.0264*** (0.00394)
<i>Observations</i>	99,026	97,757	97,757	97,757	97,757
<i>R²</i>	0.025	0.026	0.026	0.026	0.026
<i>Industry_year FE</i>	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4. Results

We first focus on the effect of density. As shown in Table 3, we find that a high density around an industry i at year t significantly increases the probability of a region to acquire a new specialization in industry i 5 years later. This confirms our hypothesis 1 on the importance of related diversification, and replicates other studies. Of the control variables, we find that the average annual growth rate of GDP per capita within each 5-year interval has a positive and significant effect on regional diversification at year $t + 5$. As expected, high regional growth is associated with the acquisition of new industry specializations. Similarly, highly urbanized areas and regions with higher investment rates are more likely to diversify into new sectors, as shown by the positive significant coefficient of *Pop. Density* and *Physical K*. Remarkably, the positive effect of human capital is mostly captured by *HK Sec*, rather than *HK Tert*.

Table 4 reports the results on the direct effects of different types of institutions. Quality of government does not show any effect on regional diversification: hypothesis 2 is therefore rejected. However, trust and bridging social capital are positively and significantly related to diversification: regions with higher trust levels and a higher participation level in bridging-type of associations have a higher probability of

Table 5. The interaction effects between density and institutions

Variables	Model 3 EQI	Model 3 Trust	Model 3 Associational groups	Model 3 EQI—Trust	Model 3 EQI—Associational groups
<i>Density</i>	0.0209*** (0.00132)	0.0204*** (0.00134)	0.0204*** (0.00133)	0.0205*** (0.00136)	0.0206*** (0.00136)
<i>EQI</i>	0.000703 (0.000501)			0.000282 (0.000586)	5.03e-06 (0.000530)
<i>Trust</i>		0.00116** (0.000478)		0.000962* (0.000546)	
<i>Brid. SK</i>			0.00241*** (0.000659)		0.00243*** (0.000680)
<i>Bond. SK</i>			−0.000683 (0.000506)		−0.000707 (0.000519)
<i>Density × EQI</i>	0.00229* (0.00139)			0.00303** (0.00140)	0.00160 (0.00151)
<i>Density × Trust</i>		−0.000247 (0.00163)		−0.00193 (0.00169)	
<i>Density × Brid. SK</i>			0.00238 (0.00172)		0.00170 (0.00178)
<i>Density × Bond. SK</i>			−0.00155 (0.00141)		−0.000858 (0.00151)
<i>Growth rate</i>	0.0399 (0.0247)	0.0626** (0.0254)	0.0721*** (0.0254)	0.0603** (0.0256)	0.0720*** (0.0256)
<i>Pop. Density</i>	0.00105*** (0.000380)	0.000973*** (0.000368)	0.000800** (0.000375)	0.000810** (0.000381)	0.000690* (0.000387)
<i>GDP</i>	−0.000581* (0.000341)	−0.000583* (0.000328)	−0.000760** (0.000356)	−0.000566* (0.000344)	−0.000732** (0.000361)
<i>HK Sec</i>	0.00255*** (0.000959)	0.00194** (0.000931)	0.00193** (0.000943)	0.00168* (0.000989)	0.00178* (0.000965)
<i>HK Ter</i>	0.000151 (0.000911)	−0.000571 (0.000931)	0.000197 (0.000834)	−0.000351 (0.000987)	0.000440 (0.000923)
<i>Physical K</i>	0.00509** (0.00207)	0.00439** (0.00196)	0.00505** (0.00200)	0.00325 (0.00212)	0.00451** (0.00209)
<i>Constant</i>	0.0262*** (0.00401)	0.0234*** (0.00394)	0.0259*** (0.00392)	0.0215*** (0.00421)	0.0250*** (0.00403)
<i>Observations</i>	99,026	97,757	97,757	97,757	97,757
<i>R²</i>	0.025	0.026	0.026	0.026	0.026
<i>Industry_year FE</i>	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

acquiring new industry specializations. These results confirm hypothesis 3a. Bonding social capital has a negative coefficient, as expected, but it is not significant. Also note that the density effect remains strong and positive after including the institutional variables.

In Table 5, we add interaction terms to capture the effects of density on developing new industries, depending on the type of institutions in a region. We find that only the coefficient *Density × EQI* is positive and moderately significant. This suggests that the effect of density on diversification increases with the quality of government in a region. We found no confirmation of hypothesis 4 that high levels of trust and bridging social capital weaken the effect of density on regional diversification: bridging social capital does not enhance the ability of regions to diversify in more unrelated activities. Note that the inclusion of the interaction terms does not produce changes in the significance

Table 6. The substitution effect between quality of government and social capital

Variables	Model 2	Model 2
	Low EQI—Associational groups	High EQI—Associational groups
<i>Density</i>	0.0207*** (0.00256)	0.0273*** (0.00388)
<i>EQI</i>	0.000153 (0.00107)	−0.00636 (0.00667)
<i>Brid. SK</i>	0.00560*** (0.00145)	0.00269** (0.00123)
<i>Bond. SK</i>	−0.00207** (0.000835)	0.00284 (0.00234)
<i>Growth rate</i>	0.0263 (0.0481)	0.158 (0.181)
<i>Pop. Density</i>	0.000275 (0.000986)	0.00396** (0.00160)
<i>GDP</i>	−0.000541 (0.000766)	0.000222 (0.00187)
<i>HK Sec</i>	0.00410 (0.00349)	0.0169* (0.00993)
<i>HK Ter</i>	0.00430** (0.00208)	0.00276 (0.00669)
<i>Physical K</i>	0.00798** (0.00332)	0.0130 (0.00800)
<i>Constant</i>	0.0409*** (0.00936)	0.0599*** (0.0207)
<i>Observations</i>	28,419	15,944
<i>R²</i>	0.068	0.09
<i>Industry_year FE</i>	Yes	Yes

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

of other variables, with trust and bridging social capital still being positive and significant.

To test our hypotheses on substitution effects between formal and informal institutions, we divided the full sample into a sub-sample of low EQI and a sub-sample of high EQI. The former contains industries located in regions below the 25th percentile of EQI variable, while the latter includes industries in regions above the 75th percentile of same variable.¹³ As shown in Table 6, trust does not show any direct relation to diversification, neither in the low nor in the high EQI sub-samples. Differently, bridging social capital is positive and significant in the sub-sample of low EQI and with a larger coefficient in terms of magnitude that in the full sample. In the sub-sample of high EQI, instead, the coefficient of bridging social capital is only marginally significant. This confirms hypothesis 5a: the positive effect of bridging social

13 To test the robustness of the substitution effect we calculate the marginal effect of social capital variables when EQI is held constant at high and low levels of values based on the full sample. Please see the section “Robustness check for the substitution effect” in the Appendix for detailed process of analysis. The results, reported in Table A3, confirm the substitution effect between formal institution and social capital variables.

capital is stronger in regions with a low quality of government. We find that the coefficient of bonding social capital is significantly negative in the sub-sample of low EQI, while it is not significant in the high counterpart. This confirms hypothesis 5b: bonding social capital has a negative effect on diversification, but only in regions with a lower quality of government. So, poor institutions will be less able to properly function when facing strong vested interests and cohesive distributional coalitions. Once the quality of government increases, the negative effect of bonding social capital disappears. In sum, these findings suggest the existence of a substitution effect between informal and formal institutions on regional diversification.

5. Conclusions

An institutional framework of good quality is considered crucial for regions to achieve and sustain high levels of growth and innovation. However, the influence of various types of formal and informal institutions on the process of regional diversification is still rather unexplored in the literature. This article contributes to this field by looking at the relation between quality of government and social capital on the one hand, and the development of new sector specializations in European regions on the other hand.

Our study shows that regional institutions matter for future industry specialization, both directly and through the mediation of density. Trust and active participation in bridging-type of groups increase the probability of regions to diversify into new sectors. By contrast, participation in bonding-type of associations has an insignificant impact on regional diversification in general. The direct effects of quality of government on developing new industrial specializations in European regions turn out to be negligible. However, bridging and bonding social capital have different effects for different levels of quality of government: bridging social capital has a stronger positive effect on acquiring new specializations when the quality of regional government is low, while bonding social capital has a negative effect in regions with weaker government institutions.

Our study also shows that industry relatedness is a key and persistent determinant of acquiring specializations in new industries in European regions. This confirms the predominance of related diversification found in other studies in other countries and regions. Regional institutions do not tend to enhance or weaken the effect of relatedness on regional diversification. Having said that, bridging social capital reinforces the positive effect of density on diversification in regions with low quality of government, while high involvement in groups of the bonding-type of social capital increases the negative effect of density in regions with lower quality of government. These effects become insignificant for regions characterized by high quality of government.

These results suggest some policy implications. First, as relatedness is one of the main drivers for regional diversification, taking advantage of the density around stronger sectors could be a point of departure for policy to enlarge the industrial portfolio of regions (Boschma and Gianelle, 2013). Second, with respect to institutions, we argue that formal institutions and social capital play a somewhat different role in the process of diversification. An important contribution of our work is the recognition given to informal institutions—in the form of bridging social capital—which are shown to have a positive impact on diversification. Since this impact is stronger where formal institutions are poor and it reduces when the quality of government increases, our

results suggest that regions with lower formal institutional capabilities but high levels of bridging social capital might still be able to successfully diversify into new industries. At the same time, a word of caution is in order, as soft institutions are unlikely to represent a perfect substitute for a well-functioning government.

From our results, some potential venues for further research also emerge. First, our results suggest that micro- and sector-level dynamics might be strongly affected by informal institutions. However, more solid confirmation in additional research is needed. In particular, the use of hierarchical modeling would represent an important step forward in the literature on diversification and institutions, as it would allow the researcher to fully exploit data from different levels of observation (sector and region, in our case) and investigate more thoroughly the interactions between them. Second, this also requires a full treatment of the concepts, interactions and mechanisms related to informal institutions. Defining a clear conceptual toolbox for studying informal institutions represents an important next step for unveiling the complex dynamics behind regional diversification. Third, the institutional literature has focused almost entirely on the structure of institutions at the national and regional level as enabling or constraining factors of regional diversification. This has led to new insights, but it also takes the role of institutions as given, as if institutions do not change, and it ignores the role of agents at the micro-level (Boschma, 2017). This violates insights from the evolutionary literature that points to the need of institutional change to enable the emergence and growth of new industries (Nelson, 1994), and the need to take a micro-perspective to see how local agents engage in collective action to mobilize knowledge, resources and public opinion to create new or adapt existing institutions to enable new industry formation (Battilana et al., 2009; Strambach, 2010; Sotarauta and Pulkkinen, 2011). There is still little understanding of which institutional actors make a difference, what types of institutional change can be identified and work best under what conditions, and which regions are better capable of making the required institutional transformation. Fourth, and related to previous point, a truly evolutionary perspective on diversification requires to study a longer time period than the one used in this analysis. Considering a longer time span would allow the research to better evaluate radical changes in the economic structure, which are unlikely to be observed in just a few years. Fifth, a more detailed analysis on the role of relatedness across different types of regions might provide some key insights. In particular, we suppose that the effect of relatedness for regional diversification, besides changing across different institutional settings, may differ between sectors (e.g. high-tech vs. low-tech), the degree of regional openness (trade networks, presence of multinational corporations) or the level of absorptive capacity (Trippel et al., 2015). Relevant new insights could be obtained by future research focusing on these issues.

Appendix

List of regions (NUTS 2010 classification)

BE10	DEE	FR7	NL21
BE21	DEF	FR8	NL22
BE22	DEG	EL1	NL23
BE23	DK01	EL2	NL31
BE24	DK02	EL3	NL32
BE25	DK03	EL4	NL33
BE31	DK04	ITC1	NL34
BE32	DK05	ITC2	NL41
BE33	ES11	ITC3	NL42
BE34	ES12	ITC4	PL1
BE35	ES13	ITF1	PL2
BG31	ES21	ITF2	PL3
BG32	ES22	ITF3	PL4
BG33	ES23	ITF4	PL5
BG34	ES24	ITF5	PL6
BG41	ES30	ITF6	PT11
BG42	ES41	ITG1	PT15
DE1	ES42	ITG2	PT16
DE2	ES43	ITH1	PT17
DE3	ES51	ITH2	PT18
DE4	ES52	ITH3	RO11
DE5	ES53	ITH4	RO12
DE6	ES61	ITH5	RO21
DE7	ES62	ITI1	RO22
DE8	FR1	ITI2	RO31
DE9	FR2	ITI3	RO32
DEA	FR3	ITI4	RO41
DEB	FR4	NL11	RO42
DEC	FR5	NL12	
DED	FR6	NL13	

List of sectors (NACE Rev. 2 classification)

0111	0520	1086	1623	2219	2441	2731	3040	3822	9003
0112	0610	1089	1624	2221	2442	2732	3091	3831	9004
0113	0620	1091	1629	2222	2443	2733	3092	3832	9512
0114	0710	1092	1711	2223	2444	2740	3099	4120	9522
0115	0721	1101	1712	2229	2445	2751	3101	4322	9524
0116	0729	1102	1721	2311	2446	2752	3102	4329	9529
0119	0811	1103	1722	2312	2451	2790	3103	4332	9602
0121	0812	1104	1723	2313	2511	2811	3109	4391	9609
0122	0891	1105	1724	2314	2512	2812	3211	5221	
0123	0892	1106	1729	2319	2521	2813	3212	5222	
0124	0893	1107	1811	2320	2529	2814	3213	5811	
0125	0899	1200	1812	2331	2530	2815	3220	5812	
0126	0910	1310	1813	2332	2540	2821	3230	5813	
0127	0990	1320	1814	2341	2561	2822	3240	5814	
0128	1011	1391	1910	2342	2571	2823	3250	5819	
0129	1012	1392	1920	2343	2572	2825	3291	5911	
0130	1013	1393	2011	2344	2573	2829	3299	5912	
0141	1020	1394	2012	2349	2591	2830	3311	5913	
0142	1031	1395	2013	2351	2592	2841	3312	5920	
0143	1032	1396	2014	2352	2593	2849	3313	6209	
0145	1039	1399	2015	2361	2594	2891	3314	6399	
0146	1041	1411	2016	2362	2599	2892	3315	7022	
0147	1042	1412	2017	2363	2611	2893	3316	7111	
0149	1051	1413	2020	2364	2612	2894	3317	7112	
0163	1052	1414	2030	2365	2620	2895	3319	7410	
0164	1061	1419	2041	2369	2630	2896	3320	7420	
0210	1062	1420	2042	2370	2640	2899	3511	7490	
0220	1071	1431	2051	2391	2651	2910	3512	7740	
0230	1072	1439	2052	2399	2652	2920	3513	7990	
0240	1073	1511	2053	2410	2660	2931	3514	8230	
0311	1081	1512	2059	2420	2670	2932	3521	8291	
0312	1082	1520	2060	2431	2680	3011	3522	8299	
0321	1083	1610	2110	2432	2711	3012	3523	8551	
0322	1084	1621	2120	2433	2712	3020	3812	9001	
0510	1085	1622	2211	2434	2720	3030	3821	9002	

Sectors in bold are considered as high-tech or knowledge-intensive industries according to Eurostat.

A. Robustness check for the substitution effect

It is always a tricky issue to interpret the coefficients of interaction terms of two continuous variables. The reason that we did not include interaction terms over the full sample in Table 6 is because it is difficult to give an intuitive interpretation for the signs of the effects of the interaction terms. Suppose that we add the interaction terms between social capital variables and EQI to Model 2, and term the new model Model 4, see Equation (A.1).

$$x_{i,c,t+5} = \alpha + \beta * d_{i,c,t} + \gamma_1 \times EQI + \gamma_2 \times SK + \rho \times SK \times EQI + \theta \times C_{c,t} + \mu_{i,t} + \epsilon_{i,c,t}$$

(A.1)

Where the marginal effect of social capital is $\Delta^X / \Delta_{SK} = \gamma_2 + \rho \times EQI$.

Table A1. Robustness check: the cutoff value at the 10% significance level

Variables	Model 2 EQI— Trust	Model 2 EQI— Associational groups	Model 2 Low EQI— Associational groups	Model 2 High EQI— Associational groups	Model 3 EQI—Trust	Model 3 EQI— Associational groups
<i>Density</i>	0.0112*** (0.000860)	0.0110*** (0.000859)	0.0155*** (0.00183)	0.00621* (0.00318)	0.0106*** (0.000894)	0.0110*** (0.000960)
<i>EQI</i>	0.00254*** (0.000632)	0.00285*** (0.000642)	0.00229 (0.00158)	0.0188 (0.0132)	0.00223*** (0.000742)	0.00241*** (0.000741)
<i>Trust</i>	0.00231*** (0.000660)				0.00221*** (0.000710)	
<i>Brid. SK</i>		0.00351*** (0.000947)	0.00590*** (0.00193)	-0.000811 (0.00244)		0.00378*** (0.000990)
<i>Bond. SK</i>		0.00111 (0.000678)	-0.00243** (-0.00115)	0.0101*** (0.00317)		0.000947 (0.000769)
<i>Density × EQI</i>					-0.00131 (0.00103)	-0.00227** (0.00112)
<i>Density × Trust</i>					-0.00104 (0.00109)	
<i>Density × Brid. SK</i>						0.00308** (0.00139)
<i>Density × Bond. SK</i>						-0.000632 (0.00119)
<i>Growth rate</i>	-0.0649** (0.0325)	-0.0189 (0.0333)	-0.0229 (0.0624)	0.412 (0.323)	-0.0618* (0.0324)	-0.0131 (0.0331)
<i>Pop. Density</i>	0.00134*** (0.000491)	0.000966* (0.000504)	-2.47e-05 (0.00129)	0.00373 (0.00273)	0.00143*** (0.000494)	0.00107** (0.000508)
<i>GDP</i>	-0.00439*** (0.000464)	-0.00421*** (0.000483)	-0.00261** (0.00114)	0.000531 (0.00250)	-0.00441*** (0.000464)	-0.00431*** (0.000485)
<i>HK Sec</i>	0.00655*** (0.00129)	0.00574*** (0.00128)	0.0127*** (0.00441)	0.0190 (0.0194)	0.00661*** (0.00129)	0.00569*** (0.00128)
<i>HK Ter</i>	0.000252 (0.00134)	0.00107 (0.00129)	0.00321 (0.00321)	0.00483 (0.0101)	-1.31e-05 (0.00135)	0.00110 (0.00129)
<i>Physical K</i>	-0.000365 (0.00269)	0.000956 (0.00264)	0.00265 (0.00433)	0.0106 (0.0104)	3.33e-05 (0.00271)	0.000934 (0.00266)
<i>Constant</i>	0.0455*** (0.00558)	0.0467*** (0.00538)	0.0565*** (0.0125)	0.0489 (0.0328)	0.0458*** (0.00563)	0.0472*** (0.00542)
<i>Observations</i>	88,420	88,420	27,098	12,707	88,420	88,420
<i>R²</i>	0.017	0.017	0.06	0.091	0.017	0.017
<i>Industry_year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

From Model 4, it is difficult to give an intuitive interpretation for the signs of the marginal effects of social capital variables as they depend on the value of EQI. However, in order to demonstrate that the substitution effect between social capital and EQI is not sensitive to our choice of sub-samples, we use a common approach¹⁴ to detect the marginal effects of independent variables when the moderator is held

14 Please see the web resources from UCLA: Statistical Consulting Group for more details.

Table A2. Robustness check: measuring diversification for the whole period 2004–2012

Variables	Model 2 EQI— Trust	Model 2 EQI— Associational groups	Model 2 Low EQI— Associational groups	Model 2 High EQI— Associational groups	Model 3 EQI— Trust	Model 3 EQI— Associational groups
<i>Density</i>	0.0213*** (0.00267)	0.0211*** (0.00268)	0.0303*** (0.00589)	0.0229*** (0.00602)	0.0203*** (0.00255)	0.0204*** (0.00271)
<i>EQI</i>	−0.000275 (0.00104)	−0.000416 (0.00108)	−0.00172 (0.00250)	0.0160 (0.0196)	−0.000300 (0.00143)	−0.000968 (0.00139)
<i>Trust</i>	0.00124 (0.00111)				0.00102 (0.00127)	
<i>Brid. SK</i>		0.00297* (0.00158)	0.00547* (0.00316)	0.000987 (0.00409)		0.00322** (0.00162)
<i>Bond. SK</i>		−1.74e-05 (0.00115)	−0.00421** (0.00187)	0.0101* (0.00573)		−0.000234 (0.00127)
<i>Density × EQI</i>					−0.000960 (0.00320)	−0.00360 (0.00324)
<i>Density × Trust</i>					−0.00332 (0.00303)	
<i>Density × Brid. SK</i>						0.00189 (0.00357)
<i>Density × Bond. SK</i>						−0.00274 (0.00314)
<i>Growth rate</i>	−0.0862 (0.0627)	−0.0412 (0.0640)	−0.0195 (0.128)	1.032 (0.991)	−0.0771 (0.0626)	−0.0371 (0.0639)
<i>Pop. Density</i>	0.00192** (0.000835)	0.00154* (0.000884)	0.000353 (0.00246)	0.00722 (0.00527)	0.00207** (0.000849)	0.00174* (0.000893)
<i>GDP</i>	−0.00222*** (0.000762)	−0.00224*** (0.000785)	−0.00171 (0.00195)	0.00624 (0.00555)	−0.00236*** (0.000755)	−0.00225*** (0.000785)
<i>HK Sec</i>	0.00598*** (0.00226)	0.00518** (0.00222)	0.00270 (0.00792)	0.000199 (0.0302)	0.00601*** (0.00228)	0.00516** (0.00224)
<i>HK Ter</i>	0.000460 (0.00214)	0.000806 (0.00200)	0.00777* (0.00445)	−0.0232 (0.0198)	−5.98e-05 (0.00213)	0.000719 (0.00198)
<i>Physical K</i>	0.00698* (0.00422)	0.00751* (0.00411)	0.0109 (0.00696)	0.0404* (0.0219)	0.00687 (0.00440)	0.00808* (0.00423)
<i>Constant</i>	0.0442*** (0.0103)	0.0440*** (0.00975)	0.0585** (0.0251)	0.00487 (0.0591)	0.0440*** (0.0106)	0.0450*** (0.00997)
<i>Observations</i>	23,293	23,293	7105	3344	23,293	23,293
<i>R²</i>	0.025	0.026	0.087	0.106	0.026	0.026
<i>Industry_year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

constant at high and low levels of values. Following the approach, we define that a high level of EQI is one standard deviation above the mean and a low level of EQI is one standard deviation below the mean. We recenter EQI by subtracting (mean + 1 S.D.) or (mean − 1 S.D.) from all values in EQI. After this, when EQI equals (mean + 1 S.D.) or (mean − 1 S.D.), the recentered EQI equals zero. In this situation, the marginal effects of social capital variables equal their respective coefficients. That is to say, the coefficients γ_2 is interpreted as the marginal effect of bridging/bonding social capital

Table A3. The substitution effect between quality of government and social capital: when EQI is held constant at a low/high level of value

Variables	Model 4 EQI constant at a low level	Model 4 EQI constant at a high level
<i>Density</i>	0.0203*** (0.00131)	0.0203*** (0.00131)
<i>EQI_low</i>	-0.000420 (0.000484)	
<i>EQI_high</i>		-0.000420 (0.000484)
<i>Brid. SK</i>	0.00270*** (0.000973)	0.00204** (0.000806)
<i>Bond. SK</i>	-0.00168** (0.000705)	0.000289 (0.000758)
<i>Brid. SK × EQI_low</i>	-0.000333 (0.000591)	
<i>Bond. SK × EQI_low</i>	0.000997* (0.000571)	
<i>Brid. SK × EQI_high</i>		-0.000333 (0.000591)
<i>Bond. SK × EQI_high</i>		0.000997* (0.000571)
<i>Growth rate</i>	0.0837*** (0.0257)	0.0837*** (0.0257)
<i>Pop. Density</i>	0.000882** (0.000385)	0.000882** (0.000385)
<i>GDP</i>	-0.000834** (0.000375)	-0.000834** (0.000375)
<i>HK Sec</i>	0.00233** (0.000998)	0.00233** (0.000998)
<i>HK Ter</i>	0.000206 (0.000922)	0.000206 (0.000922)
<i>Physical K</i>	0.00554*** (0.00205)	0.00554*** (0.00205)
<i>Constant</i>	0.0281*** (0.00427)	0.0273*** (0.00425)
<i>Observations</i>	97,757	97,757
<i>R²</i>	0.026	0.026
<i>Industry_year FE</i>	YES	YES

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

when EQI is held constant at (mean + 1 S.D.) or (mean - 1 S.D.). The results are shown in Table A3.

From Table A3, we notice that bridging social capital has a stronger positive marginal effect when EQI is held constant at a low level than when EQI is held constant at a high level. In terms of bonding social capital, we find that it shows a significantly negative effect when EQI is held at a low level. But when EQI is held constant at a high level, its effect is not statistically significant. The results from Table A3 further confirms our hypothesis 5a/5b.

Table A4. Robustness check: distinguishing between established market economies and former planned economies

Variables	Model 2 EQI— Trust	Model 2 EQI— Associational groups	Model 2 Low EQI— Associational groups	Model 2 High EQI— Associational groups	Model 3 EQI— Trust	Model 3 EQI— Associational groups
<i>Density</i>	0.0205*** (0.00130)	0.0203*** (0.00131)	0.0207*** (0.00256)	0.0273*** (0.00388)	0.0205*** (0.00135)	0.0206*** (0.00136)
<i>EQI</i>	0.000422 (0.000498)	0.000434 (0.000493)	8.78e-05 (0.00107)	-0.00636 (0.00667)	0.00102 (0.000624)	0.000713 (0.000574)
<i>Trust</i>	0.00168*** (0.000486)				0.00140** (0.000552)	
<i>Brid. SK</i>		0.00257*** (0.000682)	0.00531*** (0.00145)	0.00269** (0.00123)		0.00255*** (0.000679)
<i>Bond. SK</i>		-0.000826* (0.000481)	-0.00231*** (0.000870)	0.00284 (0.00234)		-0.000956* (0.000522)
<i>Density × EQI</i>					0.00322** (0.00140)	0.00177 (0.00152)
<i>Density × Trust</i>					-0.00202 (0.00169)	
<i>Density × Brid. SK</i>						0.00162 (0.00178)
<i>Density × Bond. SK</i>						-0.000891 (0.00150)
<i>Growth rate</i>	0.0320 (0.0277)	0.0461 (0.0282)	0.0254 (0.0482)	0.158 (0.181)	0.0256 (0.0274)	0.0376 (0.0278)
<i>Pop. Density</i>	0.000933** (0.000372)	0.000826** (0.000376)	0.000329 (0.000986)	0.00396** (0.00160)	0.000792** (0.000381)	0.000734* (0.000386)
<i>GDP</i>	-1.91e-05 (0.000399)	-0.000397 (0.000405)	-9.89e-05 (0.000901)	0.000222 (0.00187)	-6.46e-06 (0.000398)	-0.000339 (0.000403)
<i>HK Sec</i>	0.000257 (0.00107)	0.000957 (0.00102)	0.00242 (0.00387)	0.0169* (0.00993)	-1.30e-05 (0.00108)	0.000629 (0.00103)
<i>HK Ter</i>	-0.000446 (0.000957)	0.000360 (0.000922)	0.00358 (0.00219)	0.00276 (0.00669)	-0.000418 (0.000988)	0.000601 (0.000923)
<i>Physical K</i>	0.00347* (0.00207)	0.00512** (0.00202)	0.00742** (0.00329)	0.0130 (0.00800)	0.00249 (0.00212)	0.00423** (0.00209)
<i>Market</i>	-0.00491*** (0.00155)	-0.00403*** (0.00153)	-0.00222 (0.00240)	- (0.00154)	-0.00532*** (0.00154)	-0.00438*** (0.00150)
<i>Constant</i>	0.0225*** (0.00412)	0.0273*** (0.00396)	0.0370*** (0.00976)	0.0599*** (0.0207)	0.0209*** (0.00421)	0.0259*** (0.00403)
<i>Observations</i>	97,757	97,757	28,419	15,944	97,757	97,757
<i>R²</i>	0.026	0.026	0.068	0.090	0.026	0.026
<i>Industry_year FE</i>	YES	YES	YES	YES	YES	YES

In the sub-sample of high EQI regions, there are only regions belonging to established market economies. Robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

B. Robustness check by distinguishing between established market economies and former planned economies

Our data cover 118 regions in 12 European countries, including Belgium, Bulgaria, Germany, Denmark, Spain, France, Greece, Italy, the Netherlands, Poland, Portugal

and Romania. Among them, some countries are former planned economies (such as Bulgaria, Poland and Romania), whereas some others belong to established market economies (the remaining nine countries). In order to test whether our main findings are sensitive to the distinction between the two types of economies, we did a robustness check by adding a dummy variable which is coded 1 when countries belong to established market economies and 0 otherwise. The results, displayed in Table A4, confirm that our main findings still hold.

Funding

Funding support by JPI Urban Europe project ‘Resilient Cities: Industrial Network and Institutional perspectives on Economic Growth and Well-Being (grant 438-13-406)’ is acknowledged by Ron Boschma, Frank van Oort and Jing Xiao.

References

- Acemoglu, D., Johnson, S. (2005) Unbundling institutions. *Journal of Political Economy*, 113: 949–995.
- Acemoglu, D., Robinson, J. A. (2012) *Why Nations Fail: The Origins of Power, Prosperity and Poverty*. New York: Random House.
- Ahlerup, P., Olsson, J., Yanagizawa, D. (2009) Social capital vs institutions in the growth process. *European Journal of Political Economy*, 25: 1–14.
- Akçomak, S. and ter Weel, B. (2009) Social capital, innovation and growth: evidence from Europe. *European Economic Review*, 53: 544–567.
- Alguacil, M. T., Cuadros, A., Orts, V. (2011) Inward FDI and growth: the role of macroeconomic and institutional environment. *Journal of Policy Modeling*, 33: 481–496.
- Arbia, G., Battisti, M., Di Vaio, G. (2010) Institutions and geography: empirical test of spatial growth models for European regions. *Economic Modelling*, 27: 12–21.
- Asheim, B. T., Isaksen, A. (2002) Regional innovation systems. *The integration of local ‘sticky’ and global ‘ubiquitous’ knowledge*. *Journal of Technology Transfer*, 27: 77–86.
- Balassa, B. (1965) Trade liberalisation and revealed comparative advantage. *The Manchester School*, 33: 99–123.
- Banfield, E. (1958) *The Moral Basis of a Backward Society*. Chicago: The Free Press.
- Battilana, J., Leca, B., Boxenbaum, E. (2009) How actors change institutions: towards a theory of institutional entrepreneurship. *The Academy of Management Annals*, 3: 65–107.
- Beugelsdijk, S., van Schaik, T. (2005) Social capital and growth in European regions: an empirical test. *European Journal of Political Economy*, 21: 301–324.
- Beugelsdijk, S., Smulders, J. (2009) *Bonding and bridging social capital and economic growth*. CentER Working Paper No. 2009-27, Tilburg University.
- Bishop, P., Gripiaios, P. (2010) Spatial externalities, relatedness and sector employment growth in Great Britain. *Regional Studies*, 44: 443–454.
- Boschma, R. (2005) Proximity and innovation: a critical assessment. *Regional Studies*, 39: 61–74.
- Boschma, R. (2017) Relatedness as driver behind regional diversification: a research agenda. *Regional Studies*, doi:10.1080/00343404.2016.1254767.
- Boschma, R., Capone, G. (2015) Institutions and diversification: related versus unrelated diversification in a varieties of capitalism framework. *Research Policy*, 44: 1902–1914.
- Boschma, R., Frenken, J. K. (2011) Technological relatedness and regional branching. In H. Bathelt, M. P. Feldman and D. F. Kogler (eds) *Beyond Territory. Dynamic Geographies of Knowledge Creation, Diffusion and Innovation*, pp. 64–81. London and New York: Routledge.

- Boschma, R., Frenken, K. (2017) Evolutionary economic geography. In G. Clarke, M. Gertler, M. Feldman and D. Wojcik (eds) *New Oxford Handbook of Economic Geography*. Oxford: Oxford University Press.
- Boschma, R., Gianelle, C. (2013) Regional branching and smart specialization policy, Policy Note IPTS, Seville, November 2013, 35 pp.
- Boschma, R., Minondo, A., Navarro, M. (2013) The emergence of new industries at the regional level in Spain: a proximity approach based on product relatedness. *Economic Geography*, 89: 29–51.
- Breschi, S., Lissoni, F., Malerba, F. (2003) Knowledge-relatedness in firm technological diversification. *Research Policy*, 32: 69–87.
- Cainelli, G., Fracasso, A., Vitucci Marzetti, G. (2015). Spatial agglomeration and productivity in Italy: a panel smooth transition regression approach. *Papers in Regional Science*, 94: S39–S67.
- Casey, T. and Christ, K. (2003) Social capital and economic performance in the United States. Department of Humanities and Social Sciences, Rose-Hulman Institute of Technology. Available at [http://www.rose-hulman.edu/~casey1/US%20Social%20Capital%20\(Casey-Christ\).pdf](http://www.rose-hulman.edu/~casey1/US%20Social%20Capital%20(Casey-Christ).pdf).
- Charron, N., Dijkstra L., Lapuente V. (2014) Regional governance matters: quality of government within European Union member states. *Regional Studies*, 48: 68–90.
- Cipollina, M., Giovannetti, G., Pietrovito, F., Pozzolo, A. F. (2012) FDI and growth: what cross-country industry data say. *The World Economy*, 35: 1599–1629.
- Coates, C., Heckelman, J. (2003) Interest groups and investment: a further test of the Olson hypothesis. *Public Choice*, 117: 333–340.
- Coleman, J. (1988) Social capital in the creation of human capital. *American Journal of Sociology*, 94: S95–S120.
- Cooke, P. (2001) Regional innovation systems, clusters, and the knowledge economy. *Industrial and Corporate Change*, 10: 945–974.
- Cooke, P. H., Morgan K. (1998) *The Associational Economy. Firms, Regions, and Innovation*. Oxford: Oxford University Press.
- Cortinovis N., Van Oort F. (2015) Variety, economic growth and knowledge-intensity of European regions: a spatial panel analysis. *Annals of Regional Science*, 55: 7–32.
- Crescenzi R., Gagliardi L., Percoco, M. (2013) Social capital and the innovative performance of Italian provinces. *Environment and Planning*, 45: 908–929.
- Crescenzi, R., Rodriguez-Pose, A. (2013) R&D, socio-economic conditions and regional innovation in the U.S. *Growth and Change*, 44: 287–320.
- De Vaan, M., Frenken, K. and Boschma, R. (2011) The downside of social capital in new industry creation. In M. De Vaan (ed.) *The Connected Firm*, PhD dissertation. Utrecht University.
- Dincer, O., Uslaner, E. (2007) Trust and growth. Fondazione Eni Enrico Mattei, Nota di Lavoro 73.2007. Available at <http://ssrn.com/abstract=999922>.
- Echebarria, C., Barrutia J. (2013) Limits of social capital as a driver of innovation: an empirical analysis in the contest of European regions. *Regional Studies*, 47: 1001–1017.
- Ederveen S., de Groot H., Nahuis R. (2006) Fertile soil for structural funds? A panel data analysis of the conditional effectiveness of European Cohesion policy. *Kyklos*, 59: 17–42.
- Frenken, K., van Oort, F. G., Verburg, T. (2007) Related variety, unrelated variety and regional economic growth. *Regional Studies*, 41: 685–697.
- Fukuyama, F. (1995) Social capital and the global economy. *Foreign Affairs*, 74: 89–103.
- Geys, B., Murdoch, Z. (2010) Measuring the ‘Bridging’ versus ‘Bonding’ nature of social networks: a proposal for integrating existing measures. *Sociology*, 44: 523–540.
- Grabher, G. (1993) The weakness of strong ties: the lock-in of regional development in the Ruhr area. In G. Grabher (ed.) *The Embedded Firm*, pp. 255–277. London: Routledge
- Greene, W. H. (2012) *Econometric Analysis*. 7th edn. Harlow, England: Pearson Education Limited.
- Hall, P., Soskice, D. (2001) *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. Oxford: Oxford University Press.
- 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., Klinger, B. (2007) The structure of the product space and the evolution of comparative advantage. Working Paper No. 146. Cambridge, MA: Center for International Development, Harvard University.
- Hidalgo, C. A., Klinger, B., Barabási A. -L., Hausmann R. (2007) The product space conditions the development of nations. *Science* 317: 482–487.
- Kalemli-Ozcan, S., Sørensen, B., Villegas-Sanchez C., Volosovych, V., Yesiltas, S. (2015) How to construct nationally representative firm level data from the ORBIS Global Database. Tinbergen Institute Discussion Paper 15-110/IV, Erasmus University Rotterdam.
- Knack, S., Keefer P. (1997) Does social capital have an economic pay-off? A cross country investigation. *Quarterly Journal of Economics*, 112: 1251–1288.
- McCann, P. (2013) *Modern Urban and Regional Economics*. Oxford: Oxford University Press.
- McMillan, M., Rodrik, D. (2011) Globalization, structural change and productivity growth. NBER Working Papers 17143, National Bureau of Economic Research, Inc.
- Marshall, A. (1920) *Principles of Economics: An Introductory Volume*. London: Macmillan.
- Miguel, E., Gertler, P., Levine, D. I. (2005) Does social capital promote industrialization? Evidence from a rapid industrializer. *The Review of Economics and Statistics*, 87: 754–762.
- Nahapiet, J., Ghoshal, S. (1998) Social capital, intellectual capital and the organization advantage. *Academy of Management Review*, 23: 242–266.
- NBER, 2012. US Business Cycle Expansions and Contractions. Available at: <http://www.nber.org/cycles/cyclesmain.html>.
- Neffke, F., Henning, M., Boschma, R. (2011) How do regions diversify over time? Industry relatedness and the development of new growth paths in regions. *Economic Geography*, 87: 237–265.
- Neffke, F., Hartog, M., Boschma, R., Henning, M. (2015) Agents of structural change. The role of firms and entrepreneurs in regional diversification. Papers in Evolutionary Economic Geography, Utrecht University.
- Nelson, R., Winter, S. (1982) *An Evolutionary Theory of Economic Change*. Cambridge, MA and London: The Belknap Press.
- Nelson, R. R. (1994) The co-evolution of technology, industrial structure and supporting institutions. *Industrial and Corporate Change*, 3: 47–63.
- Nooteboom, B. (2000) *Learning and Innovation in Organizations and Economies*. Oxford: Oxford University Press.
- North, D. (2005) *Understanding the Process of Economic Change*. Princeton: Princeton University Press.
- North, D. C. (1990) *Institutions, Institutional Change, and Economic Performance*. New York: Cambridge University Press.
- O'Donoghue, D., Gleave, B. (2004) A note on methods for measuring industrial agglomeration. *Regional Studies*, 38: 419–427.
- Olson, M. (1982) *The Rise and Decline of Nations*. New Haven: Yale University Press.
- Parker D., Kirkpatrick, C. (2012) The economic impact of regulatory policy: a literature review of quantitative evidence. OECD Expert Paper No. 3.
- Portes, A., Landolt, P. (1996). The downside of social capital. *The American Prospect*, 26: 18–22.
- Putnam, R., Leonardi, R., Nanetti, R. (1993) *Making Democracy Work*. Princeton: Princeton University Press.
- Putnam R. (2001) *Bowling Alone*. New York: Touchstone Books by Simon & Schuster.
- Rodríguez-Pose, A. (2013) Do institutions matter for regional development? *Regional Studies*, 47: 1034–1047.
- Rodríguez-Pose, A., Di Cataldo, M. (2014) Quality of government and innovative performance in the regions of Europe. *Journal of Economic Geography* 15: 673–706.
- Rodrik D., Subramanian A., Trebbi, F. (2004) Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9: 131–165.
- Romer P. (1994) The origins of endogenous growth. *Journal of Economic Perspectives*, 8: 3–22.
- Rothstein, B., Teorell, J. (2008) What is quality of government? A theory of impartial government institutions. *Governance*, 21: 165–190.
- Sotarauta, M., 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.

- Sterlacchini, A. (2008) R&D, higher education and regional growth: uneven linkages among European regions. *Research Policy*, 37: 1096–1107.
- Storper, M. (1995) The resurgence of regional economies, ten years later: the region as a nexus of untraded interdependencies. *European Urban and Regional Studies*, 2: 191–221.
- Strambach, S. (2010) Path dependency and path plasticity. The co-evolution of institutions and innovation - the German customized business software industry. In R. A. Boschma and R. Martin (eds) *Handbook of Evolutionary Economic Geography*, pp. 406–431. Cheltenham: Edward Elgar.
- Tabellini, G. (2010) Culture and institutions: economic development in the regions of Europe. *Journal of the European Economic Association*, 8: 677–716.
- Teece, DJ, Rumelt, 2R, Dosi, 2G, Winter, 2S. (1994) Understanding corporate coherence. Theory and evidence. *Journal of Economic Behavior and Organization*, 23: 1–30.
- Tian, Z. (2013) Measuring agglomeration using the standardized location quotient with a bootstrap method. *Journal of Regional Analysis & Policy*, 43: 186–197.
- Trippl, M., Grillitsch, M., Isaksen, A. (2015) External ‘energy’ for regional industrial change: attraction and absorption of non-local knowledge for new path development. Papers in Innovation Studies No. 2015/47, CIRCLE, Lund University, Lund.
- UCLA: Statistical Consulting Group (No date). Stata FAQ: How can I explain a continuous by continuous interaction? (Stata 10 and earlier). [Online]. Los Angeles, CA, UCLA: Statistical Consulting Group. Available from <http://www.ats.ucla.edu/stat/stata/faq/conconb.htm>. (Accessed 29 August 2016).
- Uzzi, B. (1996) The sources and consequences of embeddedness for the economic performance of organizations: the network effect. *American Sociological Review*, 61: 674–698.
- Van Oort, F. G., Burger, M., Knoben, J., Raspe, O. (2012) Multilevel approaches and the firm-agglomeration ambiguity in economic growth studies. *Journal of Economic Surveys*, 26: 468–491.
- Westlund, H., Adam, F. (2010) Social capital and economic performance: a meta-analysis of 65 studies. *European Planning Studies*, 18: 893–919.
- Woodruff, D. M. (2006) Understanding rules and institutions: possibilities and limits of game theory *Qualitative Methods Newsletter*, 4: 13–17.
- Yamamura, E. (2011) Groups and information disclosure: Olson and Putnam hypotheses. MPRA Paper No. 34628. LMU Munchen.