Towards an entrepreneurial ecosystem typology for regional economic development: the role of creative class and entrepreneurship

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Introducing Entrepreneurial Ecosystem Typology for Regional Economic Development: the Role of Creative Class and Entrepreneurship

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Abstract

Who drives regional economic development in entrepreneurial ecosystems (EEs) of different types? Using longitudinal data on 267 NUTS3 European regions during 2008-2016, we apply the entrepreneurial ecosystem theoretical framework to study how EE type moderates the relationship between a variety of entrepreneurship and regional economic development. We found that regional economic development proxied by gross value added per resident responds differently to changes in entrepreneurship type as well as changes in a share of productive high-growth entrepreneurship across different EEs. Findings have implications for regional and national policymakers and scholars who study geography of entrepreneurship.

1. INTRODUCTION

Entrepreneurship is a fundamental process of economic geography (Stam, 2007) which takes place in localities or regions, drawing on local resources, institutions, and networks (Malecki, 2018). Cities and regions do not act as firms but must rely on entrepreneurs (Malecki 1997; Davidsson et al. 2006) to introduce new activities, innovation and contribute to regional economic development (Fritsch et al. 2019a, 2019b). Along with knowledge and innovation (Stam & Nooteboom, 2011) and a number of location based factors, such as regional institutions, industry structure and culture (Stuetzer et al., 2016) determine

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entrepreneurship persistence and economic growth in a region (Fritsch & Wyrwich 2014, 2017, 2019).

Although entrepreneurship and regional scholars have stopped questioning if local context matters (Autio et al., 2014; Fritsch & Wyrwich, 2019) it continues to appear in journal publications as an important facilitator of regional entrepreneurship and growth (Autio & Levie, 2017; Malecki, 2018), and in particular in European regions (Bosma et al. 2009; Charron et al., 2014; Falck et al., 2011; Stam, 2015). It is an ability of local context to create productive entrepreneurs, who facilitate regional economic development has become a key condition of entrepreneurial ecosystem to exist (Stam, 2015, 2018).

In this study we define entrepreneurial ecosystem following Stam (2015), Stam & Spigel (2018) as a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory.

Historically, entrepreneurship research has paid scant attention to a variety of entrepreneurship in its impact on economic development (Parker, 2009; Desai, 2011; Stem & Van Stel, 2011; Bögenhold, 2019). This may have resulted from widely used definitions of entrepreneurship, sometimes limited to self-employment rates (Fotopoulos & Storey, 2017). From Stam et al. (2011, 2012) and Colombelli et al. (2016) the focus has gradually shifted towards ambitious entrepreneurship, job creation entrepreneurship (Dvouletý, 2018, 2019) and on high-growth innovative start-ups (Colombelli & Quatraro, 2018; Belitski, 2019).

Although, a variety of entrepreneurs is needed to facilitate regional economic development, their relationship to local context is largely unexplored (Autio & Levie, 2017). In addressing this issue our study draws on Stam (2015, 2018) as well as Stam &

Van de Ven (2020) in unpacking the variety of EE types which moderates the ability of entrepreneurial activity to contribute to regional economic development.

In doing so this study moves away from validating the effectiveness of EEs configurations (Boutillier et al., 2016; Szerb et al. 2019) and demonstrates how these configurations (EE typology) are operationalized by different entrepreneurship types to create regional value.

Important studies are Content et. al (2019) who demonstrate how EEs enable the effect of entrepreneurial activity on growth in European Union regions, Szerb et al. (2019) who study how the EE and different types of entrepreneurship impact employment growth and regional economic development in Europe as well as Stam (2018) reveals how the fundamental causes of new value creation (framework and systemic conditions) can be mediated by productive entrepreneurs (as EE output) to achieve higher regional development (EE outcome). Other important studies include Bögenhold (2019) and Dvouletý (2018, 2019) who differentiated between a variety of entrepreneurship and Florida (2002) who highlighted the role of creative class as a driving force in regional economy.

While inflow of creative class, including artists and scientists enhances entrepreneurial culture and diversity of ideas for innovation and entrepreneurship (Donegan et al., 2008; Boschma & Fritsch, 2009; Glaeser et. al., 2010, 2015), yet little is known whether productive entrepreneurship can become a better conduit for regional economic development in regions with high concentration of knowledge and creative class?

This study makes two contributions to regional entrepreneurship and EE literature. First, it introduces EE typology and empirically tests how different types of entrepreneurship (Parker, 2009; Desai, 2011; Fritsch & Storey, 2017), in a variety of EEs (Kuckertz, 2019) can create value for a region. Second, it explains the role of creative class and creative industries in facilitating productive entrepreneurship for regional economic development (Frenken &

Boschma 2007; Piergiovanni et al. 2012; Fritsch & Wyrwich, 2019). In doing so, this study advances our knowledge on the role played by solo self-employed, firms with one to nine full time employees (FTEs), firms with 10 and more FTEs (Dvouletý, 2018, 2019) as well as high-growth firms operating across regional, specialized creative, specialized manufacturing and global EEs for regional value creation.

The geographical focus of this study is on 267 NUTS3 European regions during 2008-2016 (Eurostat, 2020). European regions exhibit one of the highest levels of regional entrepreneurial diversity and institutional heterogeneity in the world (Charron et al. 2014; Leendertse et al. 2020) and embracing it in our analysis will address Fritsch et al. (2019a) call for more comprehensive data to lead to a better description of historical entrepreneurship and related issues, which can be used to identify the antecedents of regional entrepreneurship ecosystems.

Our findings demonstrate that regional economic development is location-based and context specific (Szerb et al., 2013, 2019; Stuetzer et al., 2016; Fritsch et al., 2019a) as a variety of entrepreneurial activities create different economic outcomes across four distinctive types of EE. We also found that productive entrepreneurship can contribute to regional economic development in regions with higher proportion of creative class and creative industries. Additional factors that contribute to regional value creation are number of international highways connecting region with other regions, presence of opera house, share of residents with tertiary education, population age, wages, and industry mix.

The remainder of this paper is as follows. Section 2 outlines three theoretical framework. Section 3 presents data, method. Section 4 reports empirical analysis with robustness checks. Section 5 discusses major findings and concludes.

2. THEORETICAL BACKGROUND

2.1. Entrepreneurship and regional economic development

Local and national policymakers worldwide are looking for insights into how to channel entrepreneurship to regional economic developments (Fritsch, 2013) and improve people's lives. This study builds on the following four premises.

First, understanding the relationship between creative class, entrepreneurship, and regional economic development (Falck et. al., 2011). Regions and cities compete for attracting more individuals with knowledge and creativity by subsidizing cultural services, facilitating infrastructure development, cultivating talent and tolerance and growing creative class (Audretsch et al., 2019a).

Second, unpacking the way EEs facilitate interactions between economic agents in their impact on regional economy, in addition to regional location and knowledge endowments (Audretsch et al. 2019b). This is because a pool of innovative ideas is available to all entrepreneurs in the region and possibly country, co-location in a region rich in knowledge and resources (Minniti & Levesque, 2010), entrepreneurial culture (Fritsch & Wyrwich, 2014, 2017) may ensure competitive advantage over entrepreneurs outside the region. As EEs are spatially bounded (Stam, 2015; Malecki, 2018) entrepreneurs use EEs to increase their exposure to potential knowledge spillovers (Agarwal et.al., 2010).

Third, recent empirical studies have demonstrated that it is important to distinguish between variety of entrepreneurial activities, because they may in a different way affect regional economic development (Parker, 2009; Stam & Van Stel, 2011; Hessels et al., 2018). We argue that entrepreneurship activity changes with the region (Stam, 2007, 2010), because regions are different (Saxenian, 1994; Markusen, 1996) and the framework and systemic conditions of EE are different (Stam, 2018).

Differences in local contexts including framework and systemic conditions of EE (Stam, 2015) attract different types of entrepreneurs (e.g. solo-self-employed, job creators,

high-growth firms, who have different motivations and objectives to grow. Within the same EEs one may find productive and unproductive entrepreneurs (Baumol, 1993; Chowdhury et al. 2019), own-account workers and freelancers (solo self-employed), necessity entrepreneurs and social entrepreneurs (Fritsch & Storey, 2017; Dvouletý, 2017).

Finally, the application of Dvouletý's (2018, 2019) and Stam (2018) approach to smaller geographical units (NUTS3) enabled us to better explore the heterogeneity in entrepreneurial activity at the smallest spatial scale possible for European regions.

2.2. Entrepreneurship ecosystem typology, entrepreneurship types and regional development

Location decisions are central to entrepreneurial activity (Bosma & Sternberg, 2014; Glaeser et al. 2015), which suggests that entrepreneurs of different types may start their business and grow if their need in access new technologies, skills and knowledge is satisfied. Prior theoretical and empirical studies aimed to understand the set of drivers of entrepreneurial activity and interdependencies between entrepreneurial actors (Stam, 2015; Mason & Brown, 2014). In this attempt, factors driving productive entrepreneurship and innovation at regional (Szerb et al. 2013; Stam & Spigel, 2018), city (Audretsch & Belitski, 2017; Spigel, 2017) and national levels (Autio et al. 2014) were considered.

Brown & Mason (2017) related EE to a set of interdependent pillars such as stakeholders, financial resources, connectors and entrepreneurial orientation. Kuckertz (2019) developed five principles for the management of EEs unpacking its diversity, that might advance theorizing on them and future empirical analysis. Stam (2015, 2018) studies offer a framework and systemic conditions that are relevant for regional

economic development and economic policy. While the focus of entrepreneurship ecosystem is at the degree to which it produces productive outputs (Stam, 2018), the ability to transfer entrepreneurial activity into regional economic development depends on the quality of entrepreneurship activity (Bosma et al. 2012; Chowdhury et al. 2019), local context and economic structure of a region (Franken et al. 2007; Bosma & Schutjens, 2011). Local context includes formal and informal institutions, resource structure, skills availability and diversity (Malecki, 1997; Fritsch et al. 2019a).

Studying the changing nature of ecosystem is important to understand its ability to transfer regional entrepreneurial activity into regional economic outcomes such as gross value added, well-being and productivity.

Entrepreneurial ecosystems in Europe often fail to achieve objectives stated on prior research (Bosma et al. 2009; Stam, 2010; Spigel & Harrison, 2018). This is because the factors which constitute the foundations of the ecosystems (framework conditions), mechanisms of its regulation and self-regulation (systemic conditions) as well as resource availability are not homogeneous across different regions (Charron et al. 2014), but regional policies and government support programs for entrepreneurship are universal. Using the typology of EEs can become an important tool to diagnose why similar type of entrepreneurial activity (e.g. solo self-employed or job creator) (Bögenhold, 2019; Dvouletý, 2018, 2019) produce different economic outcomes within EE of the same type and between EEs of different types?

Entrepreneurial ecosystems are spatially bounded (Stam, 2018) and hence their ability to connect entrepreneurial stakeholders, generate knowledge within specific cognitive, geographical, organizational and social proximities (Boschma, 2005) is different. Interdependences between various pillars of ecosystems (Brown & Mason, 2017) may explain the need of different entrepreneurs for differentiating resources, matching innovative

ideas (Minniti & Levesque, 2010) and coming up with different combination of resources. Examples of different EEs include Spigel (2017), who distinguished between entrepreneurial ecosystems in Waterloo and Calgary, Canada and confirms that ecosystems can have different structures and origins, while their unique success factor lies in the ability to supports the creation and growth of entrepreneurs.

Diversity of EEs limits or enhances the knowledge spillover of entrepreneurship (Acs et al. 2009) by making available different combinations of knowledge to different entrepreneurs.

In addition to persistence of regional entrepreneurship and culture (Fritsch et al. 2019b; Audretsch et al. 2017), the type of EEs creates a unique set of factors resulting in different returns to entrepreneurship opportunities, that spurs diverse economic incentives and outcomes (Fotopoulos & Storey, 2017; Dvouletý, 2018, 2019). It is how entrepreneurs of different types use key EE resources to a large extent determines economic outcomes of entrepreneurial activity (Stam, 2015). We thus hypothesize

H1: The relationship between different entrepreneurship types and regional economic development is moderated by entrepreneurial ecosystem type.

2.3. The role of creative class in regional economic development

Several works have studied regional determinants and the effects of the presence of creative industries and the 'creative class' on regional economic development (Marlet & Van Woerkens, 2007; Donegan et al. 2008). In addition, Saxenian (1994) underlines the value of entrepreneurs and network-based industrial systems for regional growth of high-tech firms and creative industries. Florida's (2002) defines 'creative class' is a much broader formation than even Bourdieu's new petite bourgeoisie,

making up a high proportion of the population in the developed countries, such as the USA of up to 30 percent of the workforce (McGuigan, 2009).

Based on this premises, entrepreneurial activity is a channel through which new ideas transfer into economic growth, stressing the role of creative industries, where ideas are created and commercialized. Mueller (2006) demonstrated that it is crucial to increase startup activity in innovative industries to realize stronger growth rates of gross value added.

Regional environments rich in creativity are characterized by a higher degree of 'embeddedness' (Florida et al. 2008), with ongoing social relations affecting both economic behavior and institutions. If one combines the concept of EEs introduced by Stam (2015, 2018) and ambitions entrepreneurship (Stam et al. 2011, 2012), with the ideas put forward by Florida (2002), one may reasonably argue that high growth productive entrepreneurs will be more active in EEs rich in knowledge and creativity than in EEs with the paucity of knowledge and creativity.

This is equivalent to saying that certain EEs, concentrate knowledge within spatial boundaries such as clusters of knowledge, make some regions and industries intrinsically more dynamic and entrepreneurial (Morrison, 2008). Building EEs that are attractive to the creative class offers regions the opportunity to capitalize on diversity and creativity (Audretsch et al. 2010; Piergiovanni et al. 2012). Regions with a sizeable creative industry where creative class works are more likely to display openness to diversity and new ideas generation that spillover into new marketable products leading to high-growth firms (Audretsch et al. 2019b).

Regions with high concentration of creative industries may feature particularly attractive for the creative class to work and live as well as to create business to make an impact – such as job creation and high growth-orientation. The rationale behind this is that spatial concentration of ideas and knowledge within creative industries increases intra- and

inter-industry knowledge spillovers, making it easier for new ideas to be commercialized (Audretsch & Keilbach, 2007; Acs et al. 2009; Audretsch & Belitski, 2013). More educated, talented, and creative workers who are highly concentrated in knowledge intense and creative sectors are expected to contribute significantly to EE outputs and outcomes that are productive and economically viable. The persistence of entrepreneurship culture and growth -orientation in such regions, related to cultivation of different entrepreneurship types may be an additional factor to further exploit entrepreneurial opportunities for regional growth. We hypothesize:

H2: Productive high-growth entrepreneurship contributes to regional economic development to a greater extent in entrepreneurial ecosystems with high presence of creative and knowledge-based industries.

3. METHOD

3.1. Sample

We used European Regional NUTS3 and NUTS2 data during 2008-2016 to test our hypotheses (Eurostat, 2020). Our sample consists of 267 European NUTS3 regions from nine countries in the Central, West and East Europe (see Table A1).

The structure of our data is characterized as 11.28% of total observations are Bulgarian NUTS3 regions, Croatian regions (8.46%), Czech Republic regions (4.23%), Danish regions (3.52%), Hungarian regions (6.34%), Italian regions (40.08%), Portuguese regions (8.46%), Romanian regions (14.80%) and Slovak regions (2.82%). The distribution by time periods varies between 9.71% of observations in 2009 to 13.44% in 2012 and 2013.

Given the local dimension of entrepreneurial activity, NUTS 3 regions represent a sufficiently large geographic area to statistically represent an entrepreneurial ecosystem within a region. Gross value added of all industries can be regionalized at the NUTS 3

level based on the firms' addresses. An advantage of using NUTS3 level is also related to using the industry characteristics of the wider boundaries than a city.

Dependent variable

Although some regional studies use employment growth, population growth, and income to measure regional economic development (Van Stel et al. 2004; Fritsch and Mueller 2008; Glaeser et al. 2010), we consider gross value added (GVA) in constant 2010 prices in thousand euro per resident to be more appropriate (Mueller, 2007; Agarwal et al. 2010; Content et al. 2019). Using GVA per capita as opposed to income growth (Florida et al. 2008) and employment growth (Fritsch and Noseleit, 2013) has two main advantages: (1) It is place-dependent, and (2) it demonstrates value added as a measure of economic efficiency and financial viability of a region.

Other variables were available to be used as a proxy at NUTS3 such as GDP euro per resident in PPS (0.98), GDP at constant 2010 prices euro per resident (0.97), GDP per inhabitant euro in % of the EU average (0.95). Although the overall GVA does not differentiate between resource-based and knowledge-intensive businesses, data by industry is available from Eurostat (2020) regional statistics for further robustness checks.

Explanatory variables

Creative class and creative industries

The mechanisms through which creativity links to regional economic development remains the subject of debate (Florida, 2002; Boschma and Fritsch, 2009; Falck et al. 2011; Nathan, 2015; Kemeny et al. 2019). One clear problem is that, in order to link creative activity and economic development empirically, researchers require reliable ways of defining and measuring creative industries across cities and regions. Due to a limitation in the longitudinal data for occupations over 2008-2016 for European NUTS3 regions, we combined Florida's (2002) definition of the creative class as occupation based with the

'Creative Trident' method developed by Higgs et al. (2008) and recently applied by applied Kemeny et al. (2019) in Regional Studies. The Trident improves on prior creative industries definitions by using occupations as the base unit, identifying 'creatively intense' sectors as those with a critical mass of creative occupations in the workforce. The implication of this approach is that it overlooks creativity in industries that are not 'creatively intense'. The advantage of this approach is that it enables greater flexibility in analyzing the workforce. This also allows to identify the degree to which regions specialize within creative work and uses the shares of employment in creative sectors to further typify EEs.

Similarly, many creative industries scholars (Bakhshi, Freeman, & Higgs, 2012; Qian, 2013) have shifted definitional work towards the practices and activities within occupations, with specific occupations defined as 'creative'. We use shares of employment in creative industries such as arts, culture, entertainment, science, professional and knowledge services and ICT to control for the contribution of creative industries in regional economic development[2] as well as to further classify EEs using creativity and R&D intensity.

Entrepreneurial activity

An increasing research interest has emerged to understand the diversity of entrepreneurial activity between productive and unproductive entrepreneurs (Stam, 2018), and within the self-employed population (Bögenhold, 2019, Dvouletý, 2018).

[2] One of the limitation highlighted by readers is that most of Bohemians are self-employed and therefore the method will include interaction of solo-self-employment rates in a region with a proxy for a high concentration of creative industries. This is not the case for European cities. The correlation coefficient between the share of solo-self -employed and specialized clusters in creative industries in this study is negative (-0.15) and statistically significant.

Bögenhold (2019) demonstrated significant differences between part-time and full-time entrepreneurs, while Dvouletý (2018) studied solo self-employed and job creators which includes both highly skilled freelancers and lower-skilled self-employed.

Eurostat (2020) enables three segmentation criteria for business registrations with the number of employees - zero, 1-9 and 10 plus full-time employees (FTEs). Building on Dvouletý (2018, 2019) as well as Stam and Van Stel (2011) and Van Stel et al. (2014) we distinguished the following proxies for entrepreneurship types: share of solo self-employed; share of firms with one to nine full time employees (FTEs); share of firms with 10 and more FTEs. In measuring productive entrepreneurship (Baumol, 1993), we used a share of high-growth firms in a region (Stam et al. 2011, 2012; Stam, 2018) (see Table 1).

The four types of entrepreneurial activity are particularly important at the smaller units of analysis (Bosma & Sternberg, 2014) due to an increasing proportion of freelancers and solo self-employed who work in coworking centers in cities and in digital "gig-jobs" (Todolí-Signes, 2017). In addition, solo self-employed are often perform subcontractor jobs as an alternative to formal employment (Belitski and Korosteleva, 2010).

Combining four types of entrepreneurship activity is a novelty of this study as it has not been part of prior research on ecosystems (Stam, 2018; Stam & Spigel, 2018) or variety of entrepreneurship (Parker, 2009; Glaeser et. al., 2010; Fritsch & Storey, 2014; Hessels et al. 2018).

Entrepreneurship ecosystem typology.

We typify regional entrepreneurship ecosystems in order to provide a better insight into regional pillars of EEs and the role that innovation, knowledge and creative industries in cities can play in regional economic development. These criteria are based on available socioeconomic and institutional data from Eurostat (region and cities) statistics (Eurostat,

2020) and State of European cities report (2007). Recent research in regional typology of EEs suggests that the precise composition and 'mix' of these drivers differs considerably between regions in Europe (Szerb et al. 2013; Charron et al. 2014; Fritsch et al. 2019b). We combine two approaches in typifying EEs in European cities.

First, we start by investigating the criteria developed by the European Commission Urban Audit Project which focuses on the fundamental differences between the city types in the strength of the drivers of competitiveness and entrepreneurship. Major criteria of typifying a city applied were city size, industrial structure, economic outcomes and competitiveness. Additional criteria were innovation, talent and connectivity between entrepreneurial actors (State of European cities report, 2007: VII-X).

Regions with international centers of knowledge, transport, radical innovation, concentration of creative class with across European or global exposure were defined as "global EEs".

Second, in differentiating specialized ecosystems we drew on Creative Trident approach and Kemeny et al (2019) work who contrasted creative intensities in the United States and the United Kingdom. Authors used creative intensities threshold of 0.3 to designate 'creative industries' (Kemeny et al 2019). In this study we used this approach to understand regional specialization. Regions with a share of employment in one of creative industries (arts, entertainment and recreation, professional, scientific and knowledge activities, ICT) greater than 30 percent of total employment were classified as "specialized creative EEs". In addition to this threshold, R&D intensity measure was used distinguishing between high knowledge-based industries (R&D intensity >0.02) and other industries (R&D intensity<0.02). It was confirmed that creative industries also had R&D intensity >0.02.

Using the same approach, regions with a share of employment in one of the industries (trade and transportation, construction, manufacturing and agriculture) greater than 0.3 of

total employment and R&D intensity <0.02 were defined as "specialized manufacturing EEs". All cities that were not classified as specialized EEs and global EEs were treated as regional EEs. "Regional ecosystems" could be heavily industrialized centers in the past but has broken the path dependence and now emerge as large de-industrialized cities and service cities (State of European cities report, 2007: VII). The distribution four types of EEs across 267 NUTS 3 European regions is illustrated in Figure 1 and the list of EEs is provided in Table A1. It is likely that EE types exhibit persistence of entrepreneurship and industry mix (Frenken et al., 2007; Fritsch & Wyrwich, 2014, 2019; Fritsch et al. 2019a) of almost a decade or longer. Variety of institutional, social, cognitive and organizational proximities (Boschma, 2005) may change the pool of resource and EE type over time.

FIGURE 1 ABOUT HERE

Figure 1: A Map of NUTS 3 regions showing the distribution of entrepreneurial ecosystems types

3.2. Control variables

We follow previous studies on EEs and regional economic development to control for relevant socio-economic factors at NUTS2 and NUTS 3 level that could impact the regional economic development. In particular at NUTS 2 level we include tertiary educational attainment age (25-64 years) in percentage (tertiary), wages of households (wages), median age of population (age), household access to internet at home in percentage (digital), intramural R&D expenditure per inhabitant (R&D). Furthermore, at NUTS 3 level we control for population size (in logarithms) (Fritsch and Mueller, 2008) and unemployment rate (Thurik et al. 2008). We control for industry structure of NUTS3 region (Belitski & Desai, 2016) with a share of employment in public services and agriculture is a reference category. Finally, the control for year fixed effects (2008 is a reference year). Table 1 represents the descriptive statistics and Table 2 is a correlation matrix.

Insert Table 1 about here

Insert Table 2 about here

3.3. Method

We test our hypotheses using the following econometric model:

$$Y_{it} = \alpha_i + \beta_{1i} x_{it-1} + \beta_{2i} \dot{z}_{it-1} + d_t + \mu_{it-1} \quad (1)$$

where i = 1, …., N; t = 1, …., T; where Y_{it} our dependent variable indicates GVA per resident in 2010 constant prices (thousands euro) in the i-th NUTS3 region at time t, x_{it-1} is a k×1 set of explanatory and control variables in the i-th region at time t-1, and $\dot{z}_{it-1}$ is a k×1 set of interaction variables which is a product of entrepreneurship type and entrepreneurial ecosystem type in the i-th region at time t-1; α_i is a region-specific intercept, d_t is time fixed effects and μ_{it-1} is the error term. The model (1) assumes a one-way error component model for the disturbances, with

$$\mu_{it-1} = \gamma_{i-1} + \varepsilon_{it-1} \quad (2)$$

$\gamma_{i-1}$is the m×1 vector of the *unobservable* region -specific effects for ith region in time t-1 and ε_{it} is a region-specific error assumed to be identically and independently distributed. Standard errors are clustered by NUTS3 region. Regional EE is a reference category.

Using longitudinal data and one-year lags for explanatory and control variables partly resolved the causality issues, while fixed effect panel data estimation helped us to control for changes in unobserved fixed effects within NUTS3 regions.

4. EMPIRICAL ANALYSIS

The fixed effects regression results are shown in Table 3. Specification (1) reports basic regression with controls. Model 1 in Table 3 (specifications 2-5) illustrates the

effect of each entrepreneurial type on the regional economic development, while Model 2 in Table 3 (specifications 6-9) reports each of the relationship conditional on entrepreneurial ecosystem type. The share of sole self-employed is not directly associated with regional economic development (spec. 2), while specification 5 shows non-significant effect of the share of high-growth firms on economic development. The share of firms 1-9 FTEs ($\beta = 47.9$, $p < 0.01$) as well as the share of firms 10 and more FTEs ($\beta = 64.9$, $p < 0.05$) have significant and positive effect on regional economic development (spec. 3-4). In order to test our H1, we use Model 2 and interact each entrepreneurship type with each of four EE types (specifications 6-9 Table 3).

Insert Table 3 about here

The share of solo-self-employed has a negative effect on regional economic development in global EEs ($\beta = 13.1+(-122.6)=-109.5$, $p < 0.01$) (spec. 6), while the share of firms with 1-9 FTEs ($\beta = 29.6$, $p < 0.05$) is not conditional on EE type for regional economic development (spec. 7). The share of firms with 10 and more FTEs has a positive effect on regional economic development in global EEs ($\beta = 68.4+557.6=626.0$, $p < 0.01$) compared to regional EE (spec. 8). These results taken together support H1 which states that the contribution of entrepreneurship types in regional economic development is conditional of a type of EE in a region. Finally, the share of high-growth firms has a negative effect on regional economic development in global EEs ($\beta = 471.1+(-2290.8)=-1817.7$, $p < 0.01$) and specialized manufacturing EEs ($\beta = 471.1+(-661.7)=-190.6$, $p < 0.01$), while it contributes to GVA in regions with high presence of creative industries (specialized creative EEs) ($\beta = 471.1+3676.2=4147.3$, $p < 0.01$) (spec. 9), supporting H2.

We plot the moderating effects for three EE types (Figures 1-3) (Aiken and West, 1991). Figure 2 illustrates how the relationship between different types of entrepreneurship

and regional economic development (GVA per resident) in global vs. regional EEs. As shown in Fig 2A, when share of solo self-employed is low in global EEs it has a significant positive effect on regional economic development, but this effect dissipates when share of solo-self-employed reaches 30 percent. Similar effect was found for the share of high-growth firms (see Figure 2D). Changes in a share of firms with 1-9 FTEs does not change regional economic development for firms located in regional and global ecosystems (Figure 2B). Finally, Figure 2C shows that the share of firms with 10 and more FTEs has positive and significant effect on GVA in global EEs. These results demonstrate that type of EEs is an important factor in moderating the relationship between entrepreneurship type and regional outcome, supporting H1.

FIGURE 2 ABOUT HERE

Similarly, as shown in Figure 3A, an increase in a share of solo self-employed has a negative effect on regional economic development in specialized creative EEs compared to regional EEs. Figures 3B and 3C illustrate that share of firms with 1-9 FTEs and 10 and more FTEs do not affect regional economic development differently between regional and specialized creative EEs. Finally, Figure 3D shows that an increase in a share of high-growth firms positively effect GVA in specialized creative EEs compared to regional EE, supporting H2.

FIGURE 3 ABOUT HERE

Figure 4 demonstrates that changes in the share of solo self-employed, share of firms between 1-9 FTEs and in share of firms with 10 and more FTEs are not associated with changes in GVA per capita between two EEs types (Figure 4A-4C). An increase in a share of high-growth firms accelerates GVA per resident in regional EEs to a greater extent than it does in specialized manufacturing EEs (Figure 4D), supporting H1.

FIGURE 4 ABOUT HERE

Post-hoc analysis

Several robustness checked were performed. Firstly, we performed the Variance Inflation Factors (VIF) test using the OLS regression on all variables presented in Table 1 and 2.VIF. This test was not possible to do on the fixed-effects regression we use. The results are reported in Table 2 in column 1. Secondly, we mean-centered four entrepreneurship types variables involved in the interaction terms with the type of EE to mitigate the potential multicollinearity threat (Aiken and West, 1991). Our standard errors, signs and significance of the coefficients of interests have not changed with both H1 and H2 supported. What standardizing by mean helped us to do is to reduce the variation of the coefficients[3].

Thirdly, we included a set of additional NUTS3 characteristics which may affect a choice of entrepreneur over a type of entrepreneurial activity (Bosma & Schutjens, 2011; Bosma & Sternberg, 2014) and further explain regional economic development (Fritsch et al. 2006; Fritsch & Falck, 2007; Sternberg & Fritsch, 2011; Fritsch, 2013). We started by including the number of airports and highways as a measure of connectivity with other regions (Audretsch et al. 2015b). We also controlled for entrepreneurship infrastructure such as number of incubators, accelerator programs, science parks, coworking centers (Stam, 2015; Brown & Mason, 2017; Kolympiris & Klein, 2017; Audretsch & Belitski, 2019).

Finally, to analyze the extent to which endogenous cultural amenities may change the spatial equilibrium share of high-human-capital employees (Falck et al. 2011) we add a binary variable equals one if region has an opera house built as a part of competition for prestigious cultural sights between cities in the past. All opera houses were considered along with baroque opera houses used in Falck et al (2011) study.

[3] Results are available from authors upon request

Due to data limitations our sample drops to 449 observations and 61 largest NUTS3 regions during 2008-2016. Data on entrepreneurial infrastructure, which is highly localized in larger cities was not available for smaller NUTS3 regions, possibly due to nonexistence of entrepreneurship support infrastructure. We used Googlemaps (2020), Coworker (2020) engines as well as Amadeus (2019) for data on incubators, accelerators and science parks registered for year 2014. Random panel data estimation is used as data on entrepreneurship infrastructure data does not allow variation over 2008-2016 period. Our results are reported in Model 1 (Table 4) for the direct effect of entrepreneurship type on economic development and Model 2 for the interaction effects.

Insert Table 4 about here

In addition to what we already know from Table 3, our results demonstrate that physical infrastructure (Audretsch et al. 2015b)- number of international highways connecting NUTS3 region with other regions is the predictor for regional economic development ($\beta = 575.8\text{-}672.1$, $p < 0.01$) (Table 4, specifications 2-9). Presence of opera house in a region significantly affects regional economic development ($\beta = 2242.6\text{-}2393.3$, $p < 0.01$) (Table 4, specifications 3-9). Table 4 (specification 9) also shows that an increase in a share of high-growth firms by 1 percent in specialized creative EEs (Stam, 2018) was associated with on average 8050.3 euro greater GVA per resident ($\beta = 446.8+7603.5=8050.3$, $p < 0.01$), providing further support to H2. Results from specifications 2-9 in Table 4 fully support H1 on the heterogeneous effects of EE type on the relationship between entrepreneurial type and regional economic development. Future research should address this limitation with longitudinal data.

5. DISCUSSION AND CONCLUSION

Entrepreneurial activity is seen as an important driver of regional economic growth. The present study provides evidence for the 267 European NUTS3 regions how the impact of various entrepreneurship types on regional economic development is moderated by entrepreneurship ecosystems which represent different economic structures. The EE approach in addressing the relationship between entrepreneurship and regional development and how regional specialization and structure may affect this relationship has a long legacy (Frenken et al. 2007; Bosma & Schutjens, 2011; Stam, 2015). The differences in economic structures may enhance or hinder different types of entrepreneurial activity in its impact on regional economic development (Szerb et al. 2019), with previous studies on regions within the same country (Stam, 2015) and between countries (Content et al. 2019; Leendertse et al., 2020) discussed it in more details. Different economic structures that have evolved in the regions may facilitate one type of entrepreneurship activity versus another based on availability of regional resources and entrepreneurial culture (Brown & Mason, 2017; Fritsch, 2013; Audretsch et al. 2017; Szerb et al. 2019).

We found that the regional economic structure that are dominated by agriculture and manufacturing sectors is not conducive for entrepreneurial activity. At the same time, regions with the higher share of creative industries attracts productive entrepreneurship, which grow faster and influence regional economic development. Creative industries facilitate the culture of ideas (Audretsch et al 2010, 2019a, 2019b) and gradually contributes to accumulation of successful and innovative productive entrepreneurs who can spur creativity and knowledge for growth (Malecki & Spigel, 2017). EE types matters as we found that global EEs favor higher concentration of startups with 10 and more FTEs based on the economies of scope and scale.

Our study demonstrates that regional culture of entrepreneurship (Stam, 2015) and economic structure of a region (Frenken et al. 2007) are two important conditions for regional economic development. Therefore, it is not an exogenous phenomenon that entrepreneurs can contribute to growth independently on who they are and where they are located.

While the most significant contributions to "who they are" for regional economic development were made by Stam and Van Stel (2011), Van Stel et al. (2014), Hessels et al. (2018), not until recently the research demonstrated considerable differences between self-employed workers and employer entrepreneurs (Dvouletý, 2018, 2019), Kirznerian and Schumpeterian entrepreneurs (Szerb et al. 2019), with this study advances on "where they are located" and how heterogeneous EEs affect regional economic development.

Building on the extent literature of creative class (Florida, 2002; Florida et al. 2008) as well as argument on ambitious entrepreneurship (Stam et al. 2011, 2012), we found that EEs with high concentration of creative industries compared to other EE types are springboards for productive entrepreneurship in its impact on regional economic development.

Implications for regional policy makers.

While we argue that one-size-does not fit all, regional EEs and specialized manufacturing EEs are places where start-ups that are solo self-employed, start-ups between 1-9 FTEs and start-ups with 10 and more FTEs are equally effective and capable to contribute to regional economic development. Both regional EEs and specialized creative EEs favor an increase in a share of high-growth firms with the effect stronger for creative EEs.

Based on our findings, policymakers may want to reconsider what type of entrepreneurship activity to be supported in a region in order to increase EE outcomes (well-being, regional growth, productivity, value added). The diversity of regional endowments, including both framework and systemic conditions (Stam, 2018) could be combined in a way to attract a type of entrepreneur, which can contribute most to regional economy. These combinations may depend on already available resource (Brown and Mason, 2017) as well as a combination of resources to be acquired. On the one hand, an EE may change its evolution pattern, changing incentives, motivation, and type of entrepreneurial activity (Bosma et al. 2012; Dvouletý, 2018). On the other hand, EE type can be used as an effective policy tool to create growth incentives for entrepreneurs and develop any specific entrepreneurship type (Minniti & Levesque, 2010; Spigel, 2017). Policy measures may include access to a variety of financial resources, local specialization, quality controls, entrepreneurship support programs and infrastructure. Additional factors to be considered by policymakers aiming for regional economic development are development of physical infrastructure, such as international highways (Audretsch et al. 2015a, 2015b), investing in cultural amenities such as opera houses and cultural venues (Falck et al. 2011), attracting high-skilled labor, increase wages, investing in tertiary education and R&D.

Policy-makers may want to combine these factors with entrepreneurship types that are most conducive to growth, perhaps changing specialization of a region / city in a long-term, moving from manufacture- intense to creativity intense industries and entrepreneurship type that fully benefit society (Desai, 2011).

Limitations and future research

This study has several limitations. First, limitations related to ecosystem type research. Given a significant diversity in regional EEs further research will require to unpack elements

and factors which constitute and drive regional EEs. Second, limitation related to cross-country data. The focus on between-country sample of regions compared to within country sample (Colombelli & Quatraro, 2018) may bring additional issues of heterogeneity as well as institutional setting related to the implementation of specific industrial programs to promote entrepreneurship. Further research may add institutional controls and multi-level models to measure the role of regulation across different types of EEs. Third, limitation related to the use of control variables for regional development and entrepreneurship. We are limited with Eurostat (2020) regional and city data as part of post-hoc analysis. Longitudinal data for entrepreneurship infrastructure which allows cross-regional and cross-country comparisons is still poor and trackable back to 2014. While many indicators over the study period 2008-2016 have not changed (e.g. science parks in NUTS3, opera house, number of highways and airports) other characteristics of business development in a region could have changed (number of accelerators, incubators and science parks). Further research should be undertaken using longitudinal data to measure the effect of "soft" entrepreneurship infrastructure in European regions, which is acknowledged as limitation and a fruitful future direction for empirical research on entrepreneurship. This may include using new search engines such as OpenStreetMap for data collection.

While our study used both NUTS2 and NUTS3 level measures it cannot be called multi-level (Liguori et al., 2019). Further research, when more data will become available to allow variance within NUTS2 levels, may test our hypotheses using multilevel and hierarchical regression approach.

Future research may develop other classifications of EEs, for example using Stam framework (2018) one may be able to build on and measure a spectrum of localized characteristics where entrepreneurs work and live. In addition, future research may

focus on the interdependencies between EE stakeholders and development of indicators to measure quality and quantity of regional EEs.

Future research will facilitate regional and national decision-making on what type of entrepreneurial activity and to what extent should be supported to accelerate regional economic development. We also call for more research for other developing regions outside Europe, as well as adding more countries in European Union, which were not included in this study. This is to adhere and support entrepreneurial activity and regional growth within the primary agenda of the EU Commission communication report on "Strengthening Innovation in Europe's Regions: Strategies for resilient, inclusive and sustainable growth (European Commission, 2017). Understanding the role of EE typology and a variety of entrepreneurs will facilitate better understanding of both supply and demand side of regional economic development.

REFERENCES

Acs, Z.J., Braunerhjelm, P., Audretsch, D.B., & Carlsson, B. (2009). The knowledge spillover theory of entrepreneurship. *Small Business Economics*, 32, 15–30.

Agarwal, R., Audretsch, D.B., & Sarkar, M. (2010). Knowledge Spillovers and Strategic Entrepreneurship, *Strategic Entrepreneurship Journal*, 4, 271–283

Aiken, L. S., & West S. G. (1991). Multiple regression: Testing and interpreting interactions. Sage Press, Newbury Park

Amadeus (2019). *A database of comparable financial information for public and private companies across Europe*. Available at: https://amadeus.bvdinfo.com/version-2019919/home.serv?product=AmadeusNeo.

Audretsch, D.B., & Keilbach, M. C. (2007). The Theory of Knowledge Spillover Entrepreneurship. *Journal of Management Studies*, 44, 1242–1254.

Audretsch, D.B., Dohse, D., & Niebuhr, A. (2010). Cultural diversity and entrepreneurship: a regional analysis for Germany. *The Annals of Regional Science*, 45, 55–85.

Audretsch, D.B., & Belitski, M. (2013). The missing pillar: The creativity theory of knowledge spillover entrepreneurship. *Small Business Economics*, 41(4): 819-836.

Audretsch, D.B., & Belitski, M. (2017). Entrepreneurial ecosystems in cities: establishing the framework conditions. *Journal of Technology Transfer*, *42*(5), 1030–1051.

Audretsch, D.B., Belitski, M., & Desai, S. (2015a). Entrepreneurship and economic development in cities. *The Annals of Regional Science*, 55(1), 33–60.

Audretsch, D. B., Heger, D., & Veith, T. (2015b). Infrastructure and entrepreneurship. *Small Business Economics*, *44*(2), 219-230.

Audretsch, D. B., Obschonka, M., Gosling, S. D., & Potter, J. (2017). A new perspective on entrepreneurial regions: linking cultural identity with latent and manifest entrepreneurship. *Small Business Economics*, *48*(3), 681–697.

Audretsch, D. B., & Belitski, M. (2019). Science Parks and Business Incubation in the United Kingdom: Evidence from University Spin-Offs and Staff Start-Ups. In *Science and Technology Parks and Regional Economic Development* (pp. 99-122). Palgrave Macmillan, Cham.

Audretsch, D.B., Lehmann, E.E., & Seitz, N. (2019a). Cultural amenities, subcultures and entrepreneurship. *Small Business Economics*, 1–19.

Audretsch, D.B., Belitski, M., & Korosteleva, J. (2019b). Cultural diversity and knowledge in explaining entrepreneurship in European cities. *Small Business Economics*, 1-19.

Autio, E., Kenney, M., Mustar, P., Siegel, D., & Wright, M. (2014). Entrepreneurial innovation: The importance of context. *Research Policy*, 43(7), 1097-1108.

Autio, E., & Levie, J. (2017). Management of Entrepreneurial Ecosystems. In The Wiley Handbook of Entrepreneurship (Vol. 43). Chichester, UK: John Wiley & Sons, Ltd. pp. 423–449.

Bakhshi, H., Freeman, A., & Higgs, P. (2012). A dynamic mapping of the UK's creative industries. London: National Endowment for Science Technology and the Arts (NESTA).

Baumol, W. J. (1993). *Entrepreneurship, Management and the Structure of Payoffs*, Cambridge, MA: MIT-Press.

Belitski, M., & Korosteleva, J. A. (2010). Entrepreneurial activity across European cities (interactive paper). *Frontiers of Entrepreneurship Research*, *30*(4), 12.

Belitski, M., & Desai, S. (2016). What drives ICT clustering in European cities?. *The Journal of Technology Transfer*, *41*(3), 430-450.

Belitski, M. (2019). Innovation in Schumpeterian-type Firms: Knowledge Collaboration or Knowledge Spillover?. *Foundations and Trends® in Entrepreneurship*, *15*(3-4), 368-390.

Bögenhold, D. (2019). From Hybrid Entrepreneurs to Entrepreneurial Billionaires: Observations on the Socioeconomic Heterogeneity of Self-employment. American Behavioral Scientist, 63(2), 129-146.

Bosma, N., & Schutjens, V. (2011). Understanding regional variation in entrepreneurial activity and entrepreneurial attitude in Europe. *The Annals of regional science*, *47*(3), 711-742.

Bosma, N., Schutjens, V., & Stam, E. (2009). Entrepreneurship in European regions. In *Public policies for fostering entrepreneurship* (pp. 59-89). Springer, New York, NY.

Bosma, N., Hessels, J., Schutjens, V., Van Praag, M., & Verheul, I. (2012), "Entrepreneurship and role models", Journal of Economic Psychology, 33(2), 410-424

Bosma, N.S., & Sternberg, R. (2014). Entrepreneurship as an urban event? Empirical evidence from European cities. *Regional Studies*, 48(6), 1016-1033.

Boschma, R.A. (2005). Proximity and innovation. A critical assessment. *Regional Studies*, 39, 61–74.

Boschma, R., & Fritsch, M. (2009). Creative class and regional growth: empirical evidence from seven European countries. *Economic Geography*, 85, 391–423.

Boutillier, S., Carré, D., & Levratto, N. (2016). *Entrepreneurial Ecosystems*. Hoboken, NJ: John Wiley & Sons.

Brown, R., & Mason, C. (2017). Looking inside the spiky bits: a critical review and conceptualisation of entrepreneurial ecosystems. *Small Business Economics*, *49*(1), 11-30.

Charron, N., Dijkstra, L., & Lapuente, V. (2014). Regional governance matters: quality of government within European Union member states. *Regional Studies*, 48(1), 68–90.

Chowdhury, F., Audretsch, D. B., & Belitski, M. (2019). Institutions and entrepreneurship quality. *Entrepreneurship Theory and Practice*, *43*(1), 51-81.

Colombelli, A., Krafft, J., & Vivarelli, M. (2016). To be born is not enough: The key role of innovative startups. *Small Business Economics*, 47, 277–291.

Colombelli, A., & Quatraro, F. (2018). New firm formation and regional knowledge production modes: Italian evidence. *Research Policy*, 47(1), 139–157.

Content, J., Bosma, N., Jordaan, J., & Sanders, M. (2019). Entrepreneurial ecosystems, entrepreneurial activity and economic growth: new evidence from European regions. *Regional Studies*, 1-13.

Coworker (2020). Coworker.com [www. Document]. Available at https://www. Coworker.com / (accessed 01.02.2020).

Davidsson, P., Delmar, F., & Wiklund, J. (2006). Entrepreneurship as growth; growth as entrepreneurship. *Entrepreneurship and the Growth of Firms*, *1*(2), 21-38.

Desai, S. (2011). Measuring entrepreneurship in developing countries. In *Entrepreneurship and economic development. London:* Palgrave Macmillan.

Dvouletý, O. & Lukeš, M. (2017). Report on Policies on Business Start-ups and Self-employment, Report commissioned by the European Commission. Retrieved from: https://doi.org/ 10.13140/rg.2.2.20256.89608/1.

Dvouletý, O. (2018). Determinants of Self-employment With and Without Employees: Empirical Findings from Europe. International Review of Entrepreneurship, (16)3, 405-426

Dvouletý, O. (2019). Development of Entrepreneurial Activity in the Czech Republic over the Years 2005–2017. Journal of Open Innovation: Technology, Market, and Complexity, 5(3), 38.

Donegan, M., Drucker, J., Goldstein, H., Lowe, N., & Malizia, E. (2008). Which Indicators Explain Metropolitan Economic Performance Best? Traditional or Creative Class. *Journal of the American Planning Association,* 74, 180–195.

European Commission (2017). Strengthening Innovation in Europe's Regions: Strategies for resilient, inclusive and sustainable growth. SWD (2017). Final. Available at: http://ec.europa.eu/regional_policy/sources/docoffic/2014/com_2017_376_2_en.pdf

Eurostat (2020) Regional statistics by NUTS classification https://ec.europa.eu/eurostat/web/regions/data/database. Accessed 11 January 2020.

Falck, O., Fritsch, M., & Heblich, S. (2011). The phantom of the opera: Cultural amenities, human capital, and regional economic growth. *Labour Economics*, 18(6), 755–766.

Florida, R. (2002). The rise of the creative class: And how it's transforming work, leisure, community and everyday life. New York: Basic Books.

Florida, R.L., Mellander, C., & Stolarick, K. (2008). Inside the black box of regional development: Human capital, the creative class and tolerance. *Journal of Economic Geography*, 8, 615–649

Fotopoulos, G., & Storey, D.J. (2017). Persistence and Change in Interregional Differences in Entrepreneurship: England and Wales 1921-2011. Environment and Planning A, 49, 70–72.

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

Frenken, K., & Boschma, R.A. (2007). A theoretical framework for evolutionary economic geography: industrial dynamics and urban growth as a branching process. *Journal of Economic Geography*, 7, 635–649.

Fritsch M., Brixy U, & Falck, O. (2006) The effect of industry, region and time on new business survival – a multi-dimensional analysis, Review of Industrial Organization 28, 285–306.

Fritsch, M. (2013). Handbook of research on entrepreneurship and regional development: national and regional perspectives. Edward Elgar Publishing.

Fritsch, M., & Storey, D. (2014). Entrepreneurship in a Regional Context – Historical Roots and Recent Developments. *Regional Studies*, *48*, 939–954.

Fritsch, M., & Falck, O. (2007). New business formation by industry over space and time: A multidimensional analysis. *Regional Studies, 41*(2), 157–172.

Fritsch, M., & Mueller, P. (2008). The effect of new business formation on regional development over time: the case of Germany. *Small Business Economics*, 30, 15–29.

Fritsch M., & Noseleit, F. (2013). Investigating the anatomy of the employment effect of new business formation. Camb J Econ 37, 349–377

Fritsch, M. & Wyrwich, M. (2014). The Long Persistence of Regional Levels of Entrepreneurship: Germany, 1925-2005. *Regional Studies, 48*(6), 955–973.

Fritsch, M., & Storey, D.J. (2017). Entrepreneurship in a Regional Context, New York: Routledge.

Fritsch, M. & Wyrwich, M. (2017). Persistence of Regional Entrepreneurship: Causes, Effects, and Directions for Future Research. *International Review of Entrepreneurship, 15*(4), 395–416.

Fritsch, M. & Wyrwich, M. (2019). *Regional Trajectories of Entrepreneurship, Knowledge, and Growth—The Role of History and Culture*. Cham: Springer.

Fritsch, M., Obschonka, M., & Wyrwich, M. (2019a). Historical roots of entrepreneurship-facilitating culture and innovation activity: an analysis for German regions. *Regional Studies*, 1-12.

Fritsch, M., Pylak, K., & Wyrwich, M. (2019b). *Persistence of Entrepreneurship in Different Historical Contexts* (No. 2019-003). Friedrich-Schiller-University Jena.

Glaeser, E. L., Rosenhal, S.S., & Strange, W.C. (2010). Urban economics and entrepreneurship. *Journal of Urban Economics*, 67, 1–14.

Glaeser, E. L., Kerr, S.P., & Kerr, W.R. (2015). Entrepreneurship and Urban Growth: An Empirical Assessment with Historical Mines. *The Review of Economics and Statistics*, 97, 498–520.

Googlemaps (2020). Google.com [www. Document]. Available at https://www.google.com/maps/dir. (accessed 03.02.2020).

Hessels, J., Arampatzi, E., van der Zwan, P., & Burger, M. (2018). Life satisfaction and selfemployment in different types of occupations. Applied Economics Letters, 25(11), 734-740.

Higgs, P. L., Cunningham, S. D., & Bakhshi, H. (2008). Beyond the creative industries: Mapping the creative economy in the United Kingdom.

Kemeny, T., Nathan, M., & O'Brien, D. (2019). Creative differences? Measuring creative economy employment in the United States and the UK. *Regional Studies*, 1-11.

Kolympiris, C., & Klein, P. G. (2017). The effects of academic incubators on university innovation. *Strategic Entrepreneurship Journal*, *11*(2), 145-170.

Kuckertz, A. (2019). Let's take the entrepreneurial ecosystem metaphor seriously! Journal of Business Venturing Insights, 11, 124.

Leendertse, J., Schrijvers, M. T., & Stam, F. C. (2020). Measure twice, cut once: entrepreneurial ecosystem metrics. *USE Working Paper series*, *20*(01).

Liguori, E., Bendickson, J., Solomon, S., & McDowell, W.C. (2019). Development of a multi-dimensional measure for assessing entrepreneurial ecosystems. *Entrepreneurship & Regional Development*, *31*(1-2), 7–21.

Malecki, E. J. (1997). Entrepreneurs, networks, and economic development: A review of recent research. Advances in Entrepreneurship, Firm Emergence and Growth 3:57–118.

Malecki, E. J., & Spigel, B. (2017). Innovation and entrepreneurship. In *The Elgar Companion to Innovation and Knowledge Creation*. Edward Elgar Publishing.

Malecki, E. J. (2018). Entrepreneurship and entrepreneurial ecosystems. Geography Compass, 12(3), e12359.

Markusen, A. (1996) Sticky places in slippery space: A typology of industrial districts. *Economic Geography*, 72, 293–313.

Marlet, G., & Van Woerkens, C. (2007). The Dutch Creative Class and How it Fosters Urban Employment Growth. *Urban Studies*, 44, 2605–2626.

Mason, C., & Brown, R. (2014). Entrepreneurial ecosystems and growth oriented entrepreneurship - Final Report Paris: OECD.

McGuigan, J. (2009). Doing a Florida thing: the creative class thesis and cultural policy. *International journal of cultural policy*, *15*(3), 291-300.

Minniti, M., & Levesque, M. (2010). Entrepreneurial types and economic growth. *Journal of Business Venturing*, 25, 305–314

Morrison, A. (2008). Gatekeepers of knowledge within industrial districts: Who they are, how they interact. Regional Studies, 42, 817–835.

Mueller, P. (2006). Exploring the Knowledge Filter: How Entrepreneurship and University-Industry Relations Drive Economic Growth, Research Policy, 35(10), 1499–1508.

Mueller, P. (2007). Exploiting entrepreneurial opportunities: The impact of entrepreneurship on growth. *Small Business Economics*, *28*(4), 355-362.

Nathan, M. (2015). After Florida: Towards an economics of diversity. *European Urban and Regional Studies, 22*(1), 3–19.

Parker, S.C. (2009). The Economics of Entrepreneurship, Cambridge, MA: Cambridge University Press.

Piergiovanni, R., Carree, M. A., & Santarelli, E. (2012). Creative industries, new business formation, and regional economic growth. *Small Business Economics*, *39*(3), 539-560.

Qian, H. (2013). Diversity versus tolerance: The social drivers of innovation and entrepreneurship in US cities. *Urban Studies*, 50(13), 2718–2735.

Saxenian, A. (1994). Regional advantage: Culture and competition in Silicon Valley and Route 128. Cambridge, MA: Harvard Univ. Press.

Stuetzer, M., Obschonka, M., Audretsch, D. B., Wyrwich, M., Rentfrow, P. J., Coombes, M., ... & Satchell, M. (2016). Industry structure, entrepreneurship, and culture: An empirical analysis using historical coalfields. *European Economic Review*, *86*, 52–72.

Spigel, B. (2017). The relational organization of entrepreneurial ecosystems. *Entrepreneurship Theory and Practice*, *41*(1), 49–72.

Spigel, B., & Harrison, R. (2018). Toward a process theory of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, *12*(1), 151-168.

Stam, E. (2007). Why butterflies don't leave: Locational behavior of entrepreneurial firms. *Economic Geography*, 83, 27– 50.

Stam, E. (2009). *Entrepreneurship, evolution and geography* (No. 0907). Papers on economics and evolution.

Stam, E., & Nooteboom, B. (2011). Entrepreneurship, innovation and institutions. *Handbook of research on innovation and entrepreneurship*, *421*.

Stam, E., & van Stel, A. (2011). Types of entrepreneurship and economic growth. *Entrepreneurship, innovation, and economic development*, 78–95.

Stam, E., Hartog, C., Van Stel, A. & Thurik, R. (2011) Ambitious Entrepreneurship and MacroEconomic growth. In: Minniti, M. (ed.) The Dynamics of Entrepreneurship. Evidence from the Global Entrepreneurship Monitor Data. Oxford: Oxford University Press. pp. 231-249.

Stam, E., Bosma, N., Van Witteloostuijn, A., De Jong, J., Bogaert, S., Edwards, N. & Jaspers, F. (2012) Ambitious Entrepreneurship. A review of the academic literature and new directions for public policy. The Hague: Advisory Council for Science and Technology Policy (AWT).

Stam, E. & Bosma, N.S. (2015) Local policies for high-growth firms. In: Audretsch, D., Link, A. & Walshok, A. (eds) The Oxford Handbook of Local Competitiveness. Oxford: Oxford University Press. pp. 286-305.

Stam, E. (2015). Entrepreneurial ecosystems and regional policy: a sympathetic critique. *European Planning Studies*, *23*(9), 1759–1769.

Stam, E. (2018). Measuring Entrepreneurial Ecosystems. In A. O'Connor, E. Stam, E., F. Sussan & D.B. Audretsch (Ed.)., Entrepreneurial Ecosystems Cham: Springer, pp. 173-197.

Stam, E., & Spigel, B. (2018). Entrepreneurial Ecosystems. In: Blackburn, R., De Clercq, D., Heinonen, J. & Wang, Z. (Eds), Handbook for Entrepreneurship and Small Business. London: SAGE, 407-422.

Stam, E., & Van de Ven, A. (2020). Entrepreneurial Ecosystem Elements. Small Bus. Econ. 1–24.

State of European Cities Report (2007). State of European Cities Report. European Commission. Available at: https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/urban/stateofcities_2007.pdf. Accessed 26 Oct 2019

Sternberg, R., & Fritsch, M. (2011). Regional determinants of entrepreneurial activities–theories and empirical evidence. *Handbook of research on entrepreneurship and regional development. National and regional perspectives*, 33-57.

Szerb, L., Acs, Z.J., Autio, E., Ortega-Argilés, R., & Komlósi, É. (2013). REDI: The Regional Entrepreneurship and Development Index–Measuring regional entrepreneurship Report for the European Commission Directorate-General Regional and Urban Policy under contract number 2012.

Szerb, L., Lafuente, E., Horváth, K., & Páger, B. (2019). The relevance of quantity and quality entrepreneurship for regional performance: the moderating role of the entrepreneurial ecosystem. *Regional Studies*, 53(9), 1308-1320.

Thurik, A.R., Carree, M.A., van Stel, A., & Audretsch, D.B. (2008) Does self-employment reduce unemployment? *Journal of Business Venturing*, 23, 673–686.

Todolí-Signes, A. (2017). The 'gig economy': employee, self-employed or the need for a special employment regulation? *Transfer: European Review of Labour and Research*, *23*(2), 193-205.

van Stel, A. J., Carree, M. A., & Thurik, A. R. (2004). *The effect of entrepreneurship on national economic growth: An analysis using the GEM database* (No. 3404). Papers on Entrepreneurship, Growth and Public Policy.

Van Stel, A., Wennekers, S., & Scholman, G. (2014). Solo self-employed versus employer entrepreneurs: Determinants and macro-economic effects in OECD countries. Eurasian Business Review, 4(1), 107-136.

Table 1: Descriptive statistics

Variables	Description	Mean	St.dev.	Min	Max
GVA	GVA const. 2010 prices NUTS3 000s euro per resident	14072.44	9722.57	2149.01	69115.97
Arts	share employment in arts, entertainment and recreation in total employment, %	6.12	4.08	0.59	24.87
Scientific services	share employment in professional, scientific and technical services in total employment, %	6.61	3.51	0.73	20.19
Real estate	share employment in real estate in total employment, %	0.59	0.44	0.00	2.69
ICT	share employment in ICT in total employment, %	1.28	1.10	0.00	8.21
Trade and transport	share employment in trade and transport in total employment, %	22.62	4.91	7.68	42.90
Construction	share employment in construction in total employment, %	7.25	2.07	1.61	19.55
Manufacturing	share employment in manufacturing in total employment, %	20.75	8.81	2.46	44.88
Tertiary	Tertiary educational attainment (age 25-64) in total population, % (NUTS2)	17.23	5.92	6.80	48.50
Wages	Wages of households million euro (NUTS2)	24210.9	31455.6	864.86	145345.7
Population age	Median age of population (NUTS2)	42.50	2.66	34.10	49.60
Digital	Households with access to internet at home, %	58.60	14.60	17.00	95.00
Unemployment	Unemployment, share of total labor force (NUTS3)	10.13	3.06	2.89	17.29
R&D	Intramural R&D expenditure in Euro per inhabitant (NUTS2)	220.85	357.30	3.00	2847.00
Population size	Population in logarithms (NUTS2)	5.85	0.73	3.69	8.38
Share of solo self-employed	number of self-employed births (enterprisers with zero employees) in the period (t) divided by total number enterprises active in t – percentage	12.28	5.79	5.36	48.88
Share of firms with one to nine FTEs	number of enterprise births with one to nine full time employees (FTEs) in the period (t) divided by a number of enterprises active in t – percentage.	6.86	2.61	1.98	19.91
Share of firms with ten and more FTEs	number of enterprise births with 10 and more FTEs in the period (t) divided by number of enterprises active in t – percentage.	1.57	1.09	0.00	8.69
Share of high-growth firms	proportion of firms that have grown at least 10% in employment over last 3 years (in period t) to a number of enterprises active in t period.	0.41	0.27	0.02	2.00
Global EE	Binary variable =1 if NUTS3 regions is known as global EE, zero otherwise	0.03	0.16	0.00	1.00
Specialized creative EE	Binary variable =1 if NUTS3 regions is known as specialized creative EE, zero otherwise	0.11	0.31	0.00	1.00
Specialized manufacturing EE	Binary variable =1 if NUTS3 regions is known as specialized *manufacturing* EE, zero otherwise	0.36	0.48	0.00	1.00
Regional EE	Binary variable =1 if NUTS3 regions is known as regional EE, zero otherwise	0.52	0.50	0.00	1.00
Additional controls for reduced sample					
Accelerators	Number of business accelerators in a city which is a centre of NUTS3 region 9	0.29	0.87	0.00	5.00
Coworking spaces	Number of co-working spaces in NUTS3 region	6.21	11.27	0.00	60.00
Business incubators	Number of Business incubators in NUTS3 region	0.90	1.47	0.00	7.00
Science parks	Number of Science parks in NUTS3 region	0.70	0.88	0.00	3.00
Airports	Number of international/ domestic airports in NUTS3 region (Googlemaps, 2020)	1.17	0.69	0.00	4.00
Highways	Number of international highways connecting NUTS3 region with other regions (Googlemaps, 2020)	2.96	2.12	0.00	9.00
Opera house	Binary variable =1 if NUTS3 region has an opera house, zero otherwise	0.85	0.36	0.00	1.00

Note: Number of observations for all variables in Table 1 is 1986. Number of NUTS3 regions 267. Number of observations for additional controls used the reduced sample is 449. Number of NUTS3 regions 61
Sources: Eurostat (2020). Data on additional variables for entrepreneurship infrastructure is compiled via various sources and matched by NUTS3 level: Google (2020); Coworker (2020), Amadeus (2019).

Table 2: Correlation matrix

GVA	**VIF**																						
Arts	**5.02**	0.62*	1																				
Scientific services	**5.01**	0.71*	0.68*	1																			
Real estate	**2.07**	0.46*	0.11*	0.48*	1																		
ICT	**3.54**	0.56*	0.24*	0.60*	0.46*	1																	
Trade and transport	**2.35**	0.43*	0.43*	0.58*	0.42*	0.42*	1																
Construction	**1.48**	0.08*	0.22*	0.14*	0.04*	0.02	0.25*	1															
Manufacturing	**1.68**	-0.22*	-0.41*	-0.27*	0.09*	-0.2*	-0.21*	0.03	1														
Tertiary	**3.67**	0.27*	-0.10*	0.15*	0.35*	0.3*	0.25*	-0.30*	-0.06*	1													
Wages	**2.05**	0.61*	0.54*	0.53*	0.19*	0.2*	0.19*	0.08*	-0.02	0.01	1												
Population age	**2.53**	0.39*	0.49*	0.40*	0.09	-0.02	0.23*	-0.12*	-0.15*	0.01	0.27*	1											
Digital	**2.30**	0.56*	0.30*	0.48*	0.39*	0.3*	0.37*	-0.03	-0.02*	0.44*	0.30*	0.22*	1										
Unemployment	**1.51**	0.08*	0.25*	0.16*	-0.22*	-0.01	0.23*	0.07*	-0.14*	-0.06*	0.15*	0.30*	-0.01	1									
R&D	**2.67**	0.61*	0.31*	0.44*	0.36*	0.40*	0.22*	-0.07*	-0.18*	0.58*	0.41*	0.08*	0.49*	-0.06*	1								
Population size	**2.57**	0.30*	0.12*	0.45*	0.39*	0.52*	0.22*	0.15*	0.05*	-0.09*	0.26*	-0.23*	0.13*	-0.23*	0.08*	1							
Share of solo self-employed	**1.80**	-0.35*	-0.47*	-0.38*	-0.12*	-0.05*	-0.24*	-0.15*	-0.02	0.14*	-0.35*	-0.37*	-0.22*	-0.24*	-0.10*	0.01	1						
Share of firms with one to nine FTEs	**3.20**	-0.55*	-0.53*	-0.47*	-0.23*	-0.09*	-0.19*	-0.10*	0.06*	0.06*	-0.45*	-0.51*	-0.23*	-0.08*	-0.31*	-0.02	0.52*	1					
Share of firms with ten and more FTEs	**2.25**	-0.46*	-0.38*	-0.38*	-0.27*	-0.08*	-0.19*	-0.04	0.04	-0.10*	-0.29*	-0.38*	-0.26*	-0.10*	-0.33*	0.05*	0.44*	0.68*	1				
Share of high-growth firms	**2.33**	-0.30*	-0.43*	-0.27*	0.03	0.01	-0.09*	-0.22*	0.26*	0.39*	-0.24*	-0.13*	-0.31*	0.04*	-0.10*	-0.13*	0.18*	0.26*	0.05*	1			
Global EE	**2.36**	0.24*	0.03	0.28*	0.20*	0.50*	0.14*	-0.08*	-0.14*	0.31*	0.10*	-0.08*	0.11*	0.01	0.18*	0.26*	0.09*	0.07*	0.09*	0.11*	1		
Specialized creative EE	**5.13**	0.22*	0.60*	0.27*	0.04	0.10*	0.17*	0.07*	-0.32*	-0.10*	0.24*	0.19*	0.08*	0.08*	0.08*	0.01	-0.21*	-0.22*	-0.15*	-0.20*	0.10*	1	
Specialized manufacturing EE	**4.98**	-0.41*	-0.47*	-0.43*	-0.04	-0.20	-0.21*	-0.15*	0.27*	-0.02	-0.30	-0.20*	-0.23*	-0.20*	-0.26*	-0.09*	0.26*	0.24*	0.25*	0.22*	-0.08*	-0.21*	1
Regional EE	**6.11**	0.24*	0.11*	0.21*	0.01	0.02	0.10*	0.14*	-0.05*	0.01	0.14*	0.13*	0.15*	0.13*	0.16*	0.06*	-0.15*	-0.12*	-0.16*	-0.13*	-0.17*	-0.36*	-0.65*

Note: Number of obs. 1986. Number of NUTS3 regions 267. Variance Inflation Factors (VIF) test was performed using the OLS regression with VIF results in column 1.
Sources: Eurostat (2020). List of variables is limited to NUTS3 level.

Table 3: Regression results, regional (NUTS3) fixed-effect estimation. DV: GVA per resident

Models	Basic	Model 1				Model 2			
Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Arts	91.9 (65.53)	68.5** (33.77)	69.5** (33.59)	67.3** (33.67)	60.6** (32.24)	72.2** (33.47)	68.6** (33.61)	65.2** (33.65)	76.5** (31.90)
Scientific services	121.3*** (38.08)	194.4*** (34.86)	192.6*** (34.72)	194.3*** (34.80)	122.1*** (32.73)	183.5*** (34.52)	191.7*** (34.72)	189.5*** (34.81)	132.2*** (32.24)
Real estate	407.8*** (150.43)	39.0 (136.66)	43.4 (136.03)	48.8 (136.42)	-66.0 (136.34)	63.6 (135.23)	40.4 (136.44)	62.0 (136.38)	-18.5 (134.68)
ICT	434.1*** (76.87)	359.9*** (72.46)	373.1*** (72.18)	362.5*** (72.26)	397.1*** (67.90)	312.9*** (72.07)	367.3*** (72.32)	363.5*** (72.20)	379.7*** (66.95)
Trade and transport	6.6 (28.27)	113.8*** (25.31)	115.0*** (25.21)	115.7*** (25.28)	67.14*** (25.01)	115.9*** (25.06)	113.1*** (25.26)	115.1*** (25.28)	64.46*** (24.60)
Construction	242.7*** (28.44)	160.9*** (27.07)	160.9*** (26.94)	161.0*** (27.00)	108.9*** (25.70)	165.6*** (26.79)	159.5*** (26.96)	160.4*** (26.98)	115.0*** (25.36)
Manufacturing	92.61*** (24.32)	106.6*** (22.03)	107.2*** (21.94)	105.6*** (22.00)	73.8*** (21.24)	110.4*** (21.82)	106.3*** (21.97)	104.6*** (21.98)	82.5*** (20.97)
Tertiary (NUTS2)		62.4*** (18.09)	61.4*** (18.01)	64.0*** (18.06)	62.9*** (17.01)	51.8*** (18.01)	59.3*** (18.14)	63.7*** (18.05)	65.2*** (16.74)
Wages (NUTS2)		0.1*** (0.02)	0.1*** (0.02)	0.1*** (0.02)	0.1*** (0.01)	0.1*** (0.02)	0.1*** (0.02)	0.1*** (0.02)	0.1*** (0.01)
Population age (NUTS2)		113.7** (44.68)	118.9*** (44.46)	114.8** (44.55)	126.8*** (46.26)	136.3*** (44.38)	121.1*** (44.47)	114.2** (44.51)	139.9*** (46.03)
Digital (NUTS2)		-18.2*** (5.38)	-18.7*** (5.36)	-18.2*** (5.37)	3.31 (5.31)	-18.4*** (5.33)	-18.8*** (5.36)	-18.1*** (5.37)	3.6 (5.22)
Unemployment		-73.7*** (12.57)	-77.1*** (12.55)	-73.1*** (12.54)	-73.1*** (12.31)	-76.2*** (12.45)	-77.7*** (12.55)	-73.5*** (12.54)	-64.7*** (12.22)
R&D (NUTS2)		4.5*** (0.73)	4.6*** (0.72)	4.5*** (0.73)	4.5*** (0.75)	3.9*** (0.73)	4.5*** (0.73)	4.4*** (0.72)	4.2*** (0.74)
Population size		-2919.3*** (734.46)	-2909.2*** (730.38)	-2923.8*** (732.12)	-2675.3*** (713.64)	-2489.9*** (729.56)	-2897.2*** (731.30)	-2883.8*** (731.54)	-2339.2*** (704.86)
Share of solo self-employed		1.0 (3.79)				13.1* (7.22)			
Share of firms with one to nine FTEs			47.9*** (12.87)				29.6* (15.82)		
Share of firms with ten and more FTEs				64.9** (26.71)				68.4* (38.05)	
Share of high-growth firms					-28.2 (24.39)				471.1*** (175.83)
Share of solo self-employed x Global EE						-122.6*** (20.15)			
Share of solo self-employed x Specialized creative EE						-141.4* (79.47)			
Share of solo self-employed x Specialized manuf. EE						-10.1 (8.19)			
Share of firms with one to nine FTEs x Global EE							66.0 (45.22)		
Share of firms with one to nine FTEs x Specialized creative EE							73.7 (73.62)		
Share of firms with one to nine FTEs x Specialized manufacturing EE							43.0 (30.68)		
Share of firms with ten and more FTEs x Global EE								557.6** (220.79)	
Share of firms with ten and more FTEs x Specialized creative EE								7.0 (10.17)	
Share of firms with ten and more FTEs x Specialized manuf. EE								-27.0 (55.34)	
Share of high-growth firms x Global EE									-2290.8*** (512.92)
Share of high-growth firms x Specialized creative EE									3676.2*** (784.86)

Share of high-growth firms x Specialized manuf. EE									-661.7*** (190.97)
Constant	8428.1*** (1628.75)	12641.1** (5316.77)	12003.5** (5291.15)	12503.7** (5301.44)	13916.8** (5426.80)	9517.4* (5283.71)	11944.0** (5290.51)	12377.5** (5296.27)	10789.3** (5379.92)
R2 within	.37	.44	.45	.44	.46	.45	.45	.449	.47
R2 overall	.01	.43	.43	.43	.49	.41	.43	.44	.51
R2 between	.06	.45	.44	.45	.49	.43	.44	.45	.52
F stat	78.71	59.28	60.37	59.74	57.31	55.20	53.62	53.20	54.52
F Test ui=0	379.82	191.99	191.08	191.48	198.77	192.94	187.13	190.05	200.57
Sigma (σ_γ)	12132.38	7428.52	7457.22	7437.73	7301.55	7578.49	7475.91	7400.09	7201.81
Sigma (σ_e)	743.8713	602.90	600.45	601.86	538.00	596.24	600.19	601.24	529.18
rho	.98	.98	.98	.98	.98	.98	.98	.98	.97

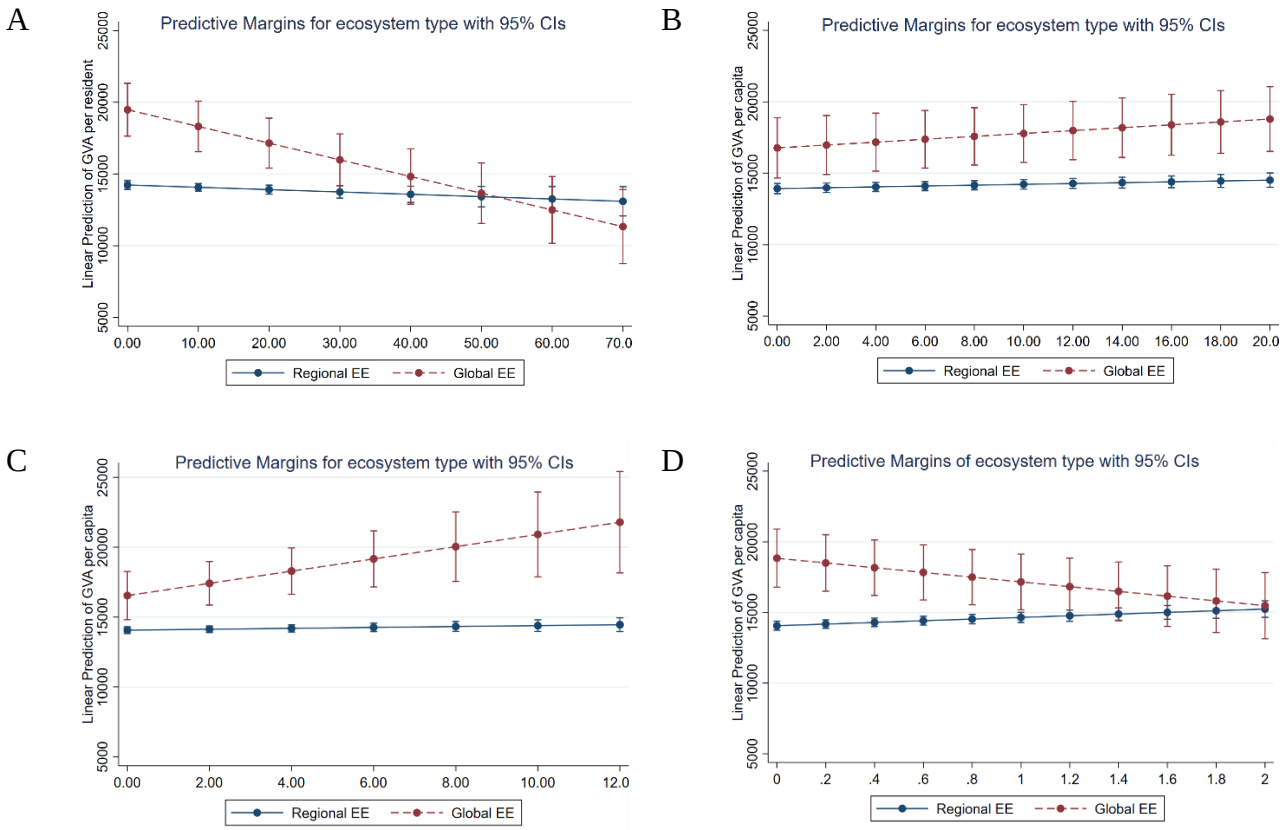
Note: Level of statistical significance is * 0.1%. ** 0.05% and ***, 0.01%. Standard errors clustered by NUTS3 regions in parenthesis.
Number of obs. 1986. Number of NUTS3 regions 267.
Source: Eurostat (2020).

Table 4: Regression results, regional (NUTS3) random-effect estimation. DV: GVA per resident

Models	Basic	Model 1				Model 2			
Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Arts	159.1 (113.40)	27.4 (100.71)	33.7 (100.92)	34.4 (100.82)	27.5 (103.66)	84.6 (103.03)	50.8 (103.39)	55.9 (103.28)	139.1 (106.52)
Scientific services	261.2** (113.57)	419.6*** (103.26)	423.0*** (103.61)	420.4*** (103.56)	362.9*** (105.73)	449.3*** (105.48)	447.5*** (105.30)	422.9*** (107.32)	386.0*** (105.24)
Real estate	-352.0 (367.11)	-1215.4*** (347.65)	-1192.3*** (348.94)	-1202.3*** (348.56)	-1222.7*** (348.29)	-1056.9*** (358.17)	-1167.9*** (362.15)	-1092.0*** (358.64)	-1045.3*** (354.35)
ICT	768.9*** (189.37)	343.0** (170.73)	361.6** (169.87)	367.6** (169.41)	333.3* (170.93)	299.5* (175.87)	384.1** (175.81)	405.6** (175.87)	414.9** (174.29)
Trade and transport	51.0 (79.90)	83.3 (67.64)	79.3 (67.91)	82.1 (67.73)	32.0 (71.75)	108.7 (70.07)	101.9 (70.83)	108.0 (70.90)	57.2 (73.44)
Construction	12.1 (75.58)	-126.3* (69.54)	-127.5* (69.77)	-127.3* (69.64)	-199.7*** (74.57)	-88.0 (71.90)	-108.3 (72.74)	-108.2 (72.55)	-162.6** (75.97)
Manufacturing	-56.3 (67.26)	-98.6* (54.94)	-98.6* (55.00)	-97.7* (55.06)	-126.9** (58.16)	-61.8 (56.60)	-70.5 (57.21)	-72.8 (57.30)	-71.0 (59.42)
Tertiary (NUTS2)		111.0** (43.21)	109.9** (43.54)	110.6** (43.34)	102.8** (43.22)	112.0** (45.05)	105.8** (45.70)	110.5** (45.21)	113.1*** (43.73)
Wages (NUTS2)		0.1*** (0.01)	0.1*** (0.01)	0.1*** (0.01)	0.1*** (0.01)	0.1*** (0.01)	0.1** (0.01)	0.1*** (0.01)	0.1*** (0.01)
Population age (NUTS2)		241.4** (109.18)	227.5** (107.80)	220.8** (107.66)	177.3 (114.35)	282.4** (109.75)	240.1** (108.87)	245.0** (108.82)	230.2** (116.14)
Digital (NUTS2)		11.2 (13.42)	11.4 (13.49)	10.9 (13.44)	34.7** (15.05)	15.2 (13.68)	11.4 (13.86)	14.1 (13.82)	37.7** (15.14)
Unemployment		-103.0*** (32.21)	-102.7*** (32.37)	-102.6*** (32.30)	-99.1*** (32.34)	-91.04*** (33.14)	-104.8*** (33.36)	-103.2*** (33.41)	-78.6** (33.03)
R&D (NUTS2)		12.7*** (1.05)	12.8*** (1.05)	12.8*** (1.05)	12.1*** (1.09)	12.8*** (1.05)	13.0*** (1.07)	13.1*** (1.07)	12.1*** (1.09)
Population size		-168.4 (809.54)	-192.7 (801.62)	-219.4 (808.89)	-322.5 (824.61)	405.4 (746.82)	58.3 (763.46)	1.9 (757.34)	-48.9 (764.48)
Share of solo self-employed		-12.8 (11.85)				22.1 (24.96)			
Share of firms with one to nine FTEs			10.8* (5.60)				52.78** (25.97)		
Share of firms with ten and more FTEs				23.0 (18.61)				172.2** (46.23)	
Share of high-growth firms					633.4 (461.27)				446.8** (206.95)
Global EE						-23.2 (2087.43)	-238.4 (209.72)	-263.3 (210.11)	-793.8 (415.79)

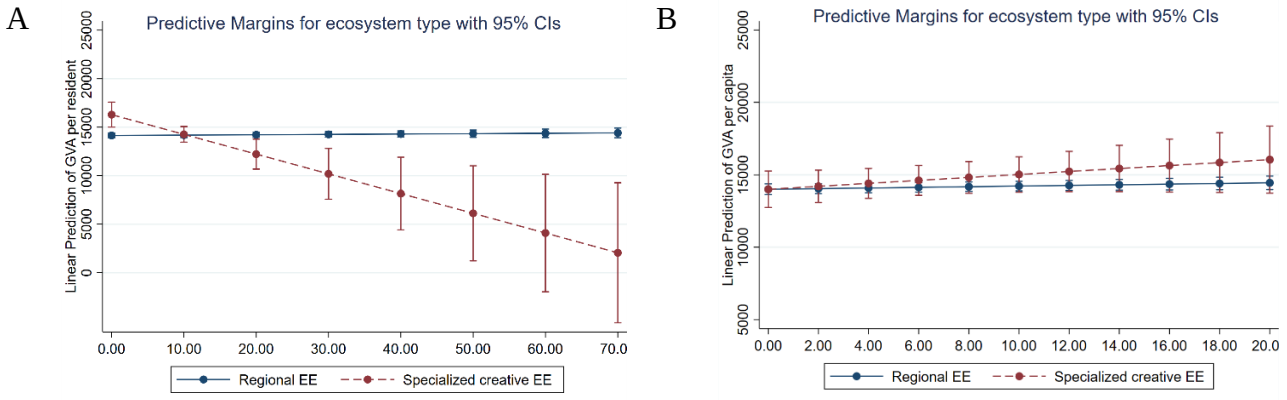
Specialized creative EE						5070.9** (2460.44)	-138.4 (1896.13)	-90.0 (1734.94)	-2340.9 (1811.54)
Specialized manufacturing. EE						-1988.8* (1126.63)	-2715.9** (1342.61)	-2610.1** (1171.20)	-1415.4* (833.00)
Share of solo self-employed x Global EE						-71.8** (30.41)			
Share of solo self-employed x Specialized creative EE						-532.5*** (205.23)			
Share of solo self-employed x Specialized manuf. EE						-26.6 (26.96)			
Share of firms with one to nine FTEs x Global EE							122.7 (77.43)		
Share of firms with one to nine FTEs x Specialized creative EE							73.1 (185.59)		
Share of firms with one to nine FTEs x Specialized manufacturing EE							63.3 (105.26)		
Share of firms with ten and more FTEs x Global EE								552.0* (321.52)	
Share of firms with ten and more FTEs x Specialized creative EE								278.3 (503.27)	
Share of firms with ten and more FTEs x Specialized manuf. EE								200.7 (222.34)	
Share of high-growth firms x Global EE									-1133.5** (601.03)
Share of high-growth firms x Specialized creative EE									7603.5*** (2395.35)
Share of high-growth firms x Specialized manuf. EE									-1552.4*** (577.14)
Additional controls									
Accelerators	514.0 (1272.12)	892.5 (653.00)	891.6 (646.35)	890.8 (653.63)	877.7 (666.93)	776.7 (622.52)	845.0 (642.83)	859.7 (636.06)	798.1 (641.31)
Coworking spaces	267.1** (130.96)	40.4 (68.13)	40.6 (67.43)	41.1 (68.18)	-34.6 (69.55)	36.8 (63.27)	26.6 (65.18)	30.1 (64.55)	27.9 (65.18)
Business incubators	1000.8 (690.10)	173.3 (396.40)	118.2 (390.65)	131.3 (394.85)	67.4 (404.51)	311.8 (390.57)	240.2 (400.00)	192.1 (397.93)	193.1 (402.94)
Science parks	903.6 (1291.94)	328.2 (673.10)	322.2 (666.16)	318.9 (673.67)	305.0 (687.12)	565.0 (607.80)	487.0 (626.42)	426.9 (621.03)	448.9 (626.18)
Airports	1920.4 (1817.87)	-807.1 (1013.75)	-798.7 (1004.04)	-780.7 (1014.46)	-714.4 (1037.20)	-703.2 (977.70)	-802.8 (1004.39)	-790.3 (998.32)	-754.2 (1006.61)
Highways	1477.0*** (488.22)	672.0*** (254.60)	679.7*** (252.22)	677.7*** (254.97)	638.1** (260.15)	601.8*** (231.63)	596.2** (239.04)	580.0** (236.73)	575.8** (238.72)
Opera house	3033.1 (2856.27)	2393.3 (1495.10)	2347.9** (1180.11)	2358.2** (1396.23)	2634.2** (1241.65)	2382.5** (1368.47)	2242.6* (1110.68)	2334.0* (1396.01)	2513.3* (1323.71)
Constant	7521.6 (5522.11)	2246.2 (8328.58)	1660.8 (8275.53)	1216.5 (8290.52)	3914.9 (9007.10)	-9398.8 (8177.34)	3788.4 (8250.84)	4047.9 (8218.01)	3191.9 (8854.12)
R2 within	.40	.52	.52	.52	.50	.53	.52	.52	.52
R2 overall	.34	.83	.82	.82	.82	.85	.84	.84	.84
R2 between	.34	.83	.83	.82	.83	.84	.84	.84	.85
Chi-square	297.56	864.74	871.43	861.85	788.37	1002.17	946.46	958.79	921.62
Sigma (σ_γ)	6255.57	2928.31	2875.01	2928.27	3025.08	2524.12	2612.83	2574.83	2653.70
Sigma (σ_e)	811.06	634.49	633.30	635.04	617.89	627.23	632.69	632.28	605.67
rho	.98	.95	.95	.95	.95	.94	.94	.94	.95

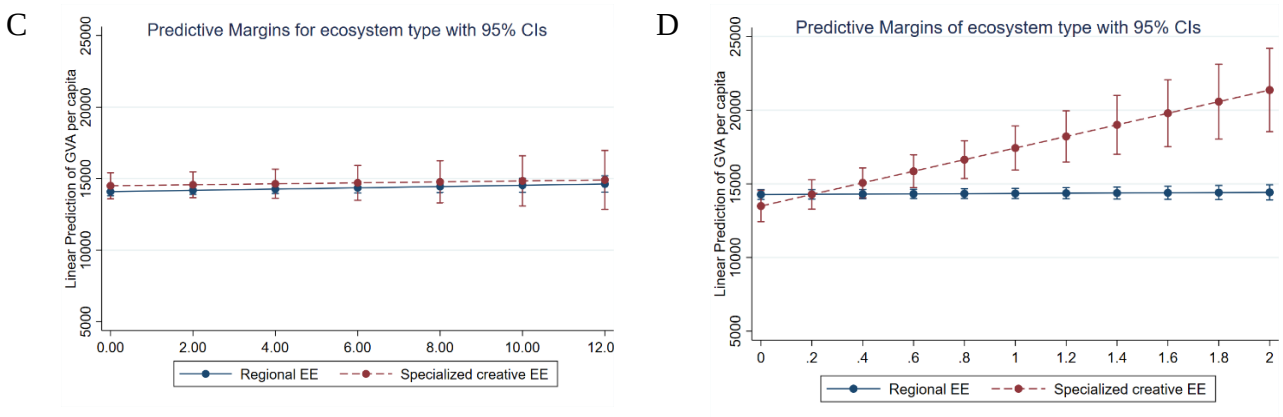
Note: Level of statistical significance is * 0.1%. ** 0.05% and ***, 0.01%. Standard errors clustered by NUTS3 regions in parenthesis.
Number of obs. is 449. Number of NUTS3 regions 61
Reference ecosystem type – regional EE; reference year – 2008.
Source: Eurostat (2020); Google (2020), Amadeus (2019), Coworker.com (2020).



Number of obs. 1986. Number of NUTS3 regions 267. Reference category – regional EE. Source: Authors' calculations based on Eurostat (2020).

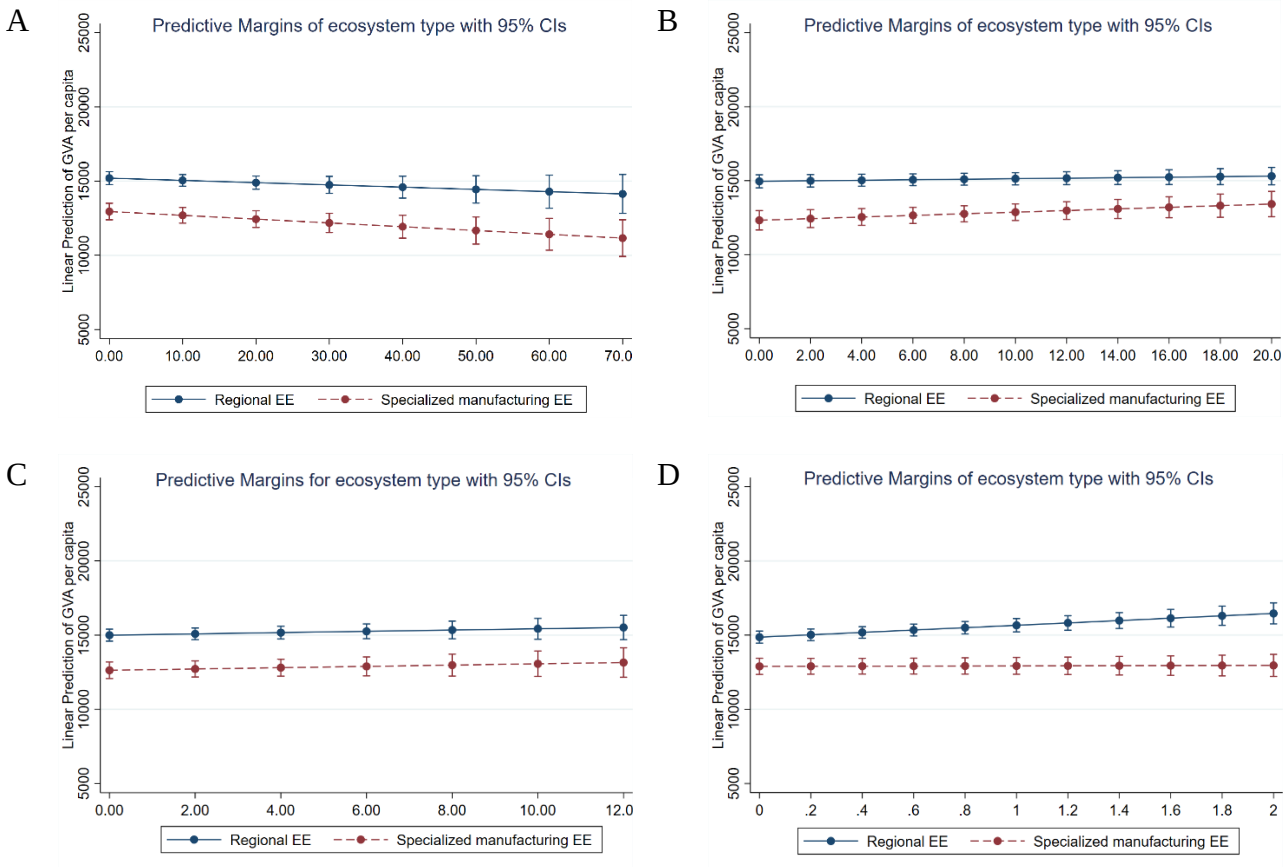
Figure 2 Predictive margins for global entrepreneurial ecosystems and four types of entrepreneurship (A- Share of solo self-employed; B - Share of firms with one to nine FTEs; C - Share of firms with ten and more FTEs; D - Share of high-growth firms)





Number of obs. 1986. Number of NUTS3 regions 267. Reference category – regional EE. Source: Authors' calculations based on Eurostat (2020).

Figure 3: Predictive margins for specialized creative entrepreneurial ecosystems and four types of entrepreneurship (A- Share of solo self-employed; B - Share of firms with one to nine FTEs; C - Share of firms with ten and more FTEs; D - Share of high-growth firms)



Number of obs. 1986. Number of NUTS3 regions 267. Reference category – regional EE. Source: Authors' calculations based on Eurostat (2020).

Figure 4: Predictive margins for specialized manufacturing entrepreneurial ecosystems and

four types of entrepreneurship (A- Share of solo self-employed; B - Share of firms with one to nine FTEs; C - Share of firms with ten and more FTEs; D - Share of high-growth firms)

Table A1: List of NUTS3 regions included in this study by entrepreneurship ecosystem type

Global EE	**Specialized manufacturing EE**	**Specialized manufacturing EE**
Bratislavský kraj, Slovak Rep.	Alba	Napoli
Bucuresti, Romania	Alto Tâmega	Neamt
København, Denmark	Arad	Oeste
City of Zagreb, Croatia	Arges	Olbia-Tempio
Milano, Italy	Ave	Olomoucký kraj
Roma, Italy	Bacau	Olt
Sofia, Bulgaria	Botosani	Pardubický kraj
Prague, Czech Republic	Braila	Pazardzhik
Budapest, Hungary	Burgas	Plzenský kraj
	Buzau	Prato
	Calarasi	Primorsko-goranska zupanija
	Caras-Severin	Razgrad
	Constanta	Reggio nell'Emilia
	Covasna	Região de Aveiro
Specialized creative EE	Dobrich	Rimini
Agrigento	Dolj	Ruse
Avellino	Douro	Salaj
Cagliari	Dubrovacko-neretvanska zup.	Satu Mare
Carbonia-Iglesias	Fejér	Savona
Catania	Fermo	Shumen
Enna	Gabrovo	Sibensko-kninska zupanija
Frosinone	Giurgiu	Sibiu
Grosseto	Gorj	Silistra
Livorno	Gyor-Moson-Sopron	Smolyan
Lodi	Haskovo	Splitsko-dalmatinska zupanija
Medio Campidano	Heves	Stara Zagora
Nuoro	Hunedoara	Suceava
Oristano	Ialomita	Targovishte
Palermo	Iasi	Teleorman
Perugia	Ilfov	Terras de Trás-os-Montes
Piacenza	Imperia	Timis
Rieti	Istarska zupanija	Trenciansky kraj
Sassari	Jihocecký kraj	Tulcea
Savona	Kardzhali	Tâmega e Sousa
Siracusa	Karlovarský kraj	Varazdinska zupanija

Sondrio	Komárom-Esztergom	Varna
Terni	Kraj Vysocina	Vas
Trapani	Krapinsko-zagorska zupanija	Vaslui
Trieste	Královéhradecký kraj	Venezia
Verbano-Cusio-Ossola	Kyustendil	Vicenza
Viterbo	Lecco	Vidin
	Liberecký kraj	Viroviticko-podravska zupanija
	Livorno	Vâlcea
	Lovech	Yambol
	Medimurska zupanija	Zadarska zupanija
	Mehedinti	Zagrebacka zupanija
	Montana	Zlínský kraj
	Moravskoslezský kraj	Ústecký kraj

Table A1: List of NUTS3 regions included in this study by entrepreneurship ecosystem type (continued)

Regional entrepreneurship ecosystem			
Alentejo Central	Caserta	Lucca	Região de Coimbra
Alentejo Litoral	Catanzaro	Macerata	Região de Leiria
Alessandria	Chieti	Mantova	Rovigo
Alto Alentejo	Cluj	Maramures	Salerno
Alto Minho	Como	Massa-Carrara	Siena
Ancona	Cosenza	Matera	Sisacko-moslavacka zup.
Arezzo	Cremona	Messina	Sliven
Ascoli Piceno	Crotone	Modena	Somogy
Asti	Csongrád	Monza e della Brianza	Sydjylland
Baixo Alentejo	Cuneo	Mures	Szabolcs-Szatmár-Bereg
Banskobystrický kraj	Cávado	Médio Tejo	Taranto
Baranya	Dâmbovita	Nitriansky kraj	Teramo
Bari	Ferrara	Nordsjælland	Tolna
Barletta-Andria-Trani	Firenze	Novara	Torino
Beira Baixa	Foggia	Nógrád	Treviso
Beiras e Serra da Estrela	Forlì-Cesena	Ogliastra	Trnavský kraj
Belluno	Fyn	Osjecko-baranjska zupanija	Udine
Benevento	Galati	Padova	Varese
Bergamo	Genova	Parma	Veliko Tarnovo
Biella	Gorizia	Pavia	Vercelli
Bihor	Hajdú-Bihar	Pernik	Verona

Bistrita-Nasaud	Harghita	Pesaro e Urbino	Vest- og Sydsjælland
Bjelovarsko-bilogorska zupanija	Isernia	Pescara	Vestjylland
Blagoevgrad	Jihomoravský kraj	Pisa	Veszprém
Bologna	Jász-Nagykun-Szolnok	Pistoia	Vibo Valentia
Bornholm	Karlovacka zupanija	Pleven	Viseu Dão Lafões
Borsod-Abaúj-Zemplén	Koprivnicko-krizevacka zupanija	Plovdiv	Vrancea
Brasov	Kosický kraj	Pordenone	Vratsa
Brescia	Københavns region	Potenza	Vukovarsko-srijemska zupanija
Brindisi	L'Aquila	Pozesko-slavonska zupanija	Zala
Brodsko-posavska zupanija	La Spezia	Prahova	Zilinský kraj
Bács-Kiskun	Latina	Presovský kraj	Área Metropolitana do Porto
Békés	Lecce	Ragusa	Østjylland
Caltanissetta	Lezíria do Tejo	Ravenna	Østsjælland
Campobasso	Licko-senjska zupanija	Reggio di Calabria	