Smart Finance for Smart Places to foster New Venture creation

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Abstract:

This study examines the role of smart finance within smart regions to generate smart growth. The smart growth idea has been established by the development of the 20-20 agenda of the European Commission as a regional and urban policy-prioritization framework. We follow this framework of smart growth and rely on the efficacy of the role played by entrepreneurship in driving innovation as being central to the issue. In particular, we argue that new venture creation is shaped by the interplay or 'match' between the smartness of a region and the provision of smart finance. Based on metropolitan areas in Germany, our empirical analysis strongly supports the complementary effect of measures of smart finance and the smartness of places in stimulating new venture creation.

Key words: Smart finance, new venture creation, smart places

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1. INTRODUCTION

Smart growth is a key priority issue on the development 20-20 agenda of the European Commission. Within the recent EU regional and urban policy reform, the emergence of smart specialization as a policy-prioritization framework has been established (Cooke & De Propris, 2011; P. McCann & Ortega-Argilés, 2015). The smart growth approach brings entrepreneurship in EU policy-thinking together with regional endowment and smart infrastructure as key development challenges facing European regions (Cooke & De Propris, 2011; Foray, David, & Hall, 2011).

We follow this framework and rely on the efficacy of the role played by entrepreneurship in driving innovation as being central to the issue. Within the smart specialization framework entrepreneurship is understood as being key to fostering not only innovation, but also innovation that could be successfully nurtured, disseminated and taken up within the wider economy (Caragliu, Del Bo, & Nijkamp, 2011; Cooke & De Propris, 2011; P. McCann & Ortega-Argilés, 2013, 2015). A common feature is that entrepreneurial actions and new venture creation contain a sufficient degree of experimentalism, self-discovery and creative destruction (Acs, Audretsch, & Lehmann, 2013; Florida, 2014; Obschonka et al., 2015).

Creativity, self-discovery and entrepreneurial spirit are by far a fundamental condition to generate ideas. To transform ideas into innovations, marketable goods or services, the access to financial resources is a condition *sine qua non.* However, as known from banking theory (Stiglitz & Weiss, 1981), the associated higher risk of such new ventures leads to problems of moral hazard and adverse selection. This makes traditional financial intermediaries like banks reluctant to finance entrepreneurial firms by debt. What is needed is another kind of financial intermediary, which not only bears the downside risks, as is with debt finance, but also benefits from the upside risk. In the past decades, venture capitalists have been established as intermediaries between the demand and supply for such financial resources (Audretsch and

Lehmann, 2004). Venture capitalists not just provide financial resources; they also support and promote new ventures, making financial decisions smarter. Smart growth via entrepreneurial activities thus also needs smart finance (Sørensen, 2007). Or, as Anthony Goldbloom of *Kaggle*, points it out: *"Young companies need more than creative labor, they also need smart money and advice"*, and explained why he moved his company to the SOMA[2] district away from Melbourne, since smart places "*makes serendipity possible, by more face-to-face meetings, more productive than phone calls or e-mails, and a good chance of bumping into someone interesting, such as a venture capitalist.*"

The expression 'smart' today is a catchword and thus lacks of a clear definition and discrimination towards synonyms like 'intelligent', 'sustainable' or 'green'. We use the term 'smart' in the context of a predominance of non-physical assets like knowledge, soft information, and social capital or creativity. Smart regions are those with an above average and dynamic growth which is almost based and shaped by knowledge spillovers, economies of scope, entrepreneurial spirit or, what *Alfred Marshall* pointed out some 100 years ago, "it is in the air". In contrast, unsmart or 'hard' regions are those where economic growth is mainly based on physical assets like plants, mass production, and economies of scale.[3]

As smart money we define the kind of external finance – either kinds of debt or equity – which is not provided mainly on the basis of tangible securities, physical assets, or current cash flows. Whereas hard money is given by banks or creditors based on hard facts and information, smart finance is provided by intermediaries like venture capitalists on the basis of rather soft facts, a promising and convincing story about the future returns and less on hard information, securities and secure cash flows.

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[2] South of Market (SOMA), a cluster within the Silicon Valley. Source: http://www.economist.com/news/special-report/21565001-why-birds-tech-feather-flock-together-something-air, accessed 16th June 2016.

[3] Audretsch and Lehmann (2016b) characterize these regions as *sunrise* and *sunset* regions. Where sunrise regions benefit from skill biased technological change and the globalization, while sunset regions could not benefit in the same way and are more prone to external shocks.

If regions differ in basic conditions and endowment as a critical resource for new venture creation, also financial intermediaries and financial resources should differ for new venture creation. This paper empirically tests this assumption.

In particular, we test the factor conditions that make places either growing smart or hard. To determine whether the availability of smart finance stimulates the formation of new firms in particular in smart ICT-industries, we exploit cross-sectional variation in the supply of venture capital transactions across all 69 large urban districts in Germany. We estimate the local effects of venture capital activity as a proxy for smart finance in terms of transactions made within an urban district on the number of new ventures created within an urban district. A broad and promising stream of research has highlighted the importance of close proximity and spillovers of entrepreneurship and the transformation of regions and districts into smart places and the shift from factor-based to knowledge-driven to entrepreneurial and smart places (Acs et al., 2013; Audretsch, Lehmann, & Paleari, 2015; Florida, 2014; Ghio, Guerini, Lehmann, & Rossi-Lamastra, 2015; Glaeser, 2005; Lehmann & Seitz, 2016b). The smartness of a place or urban district is expressed by different measures of the creative class (Florida, 2005). Knowledge-driven places are included as the control group. Such places are expected to be less driven and shaped by new venture creation and where the industrial dynamic is shaped by large and established companies and their R&D activities.

Our findings confirm that smart finance stimulates new venture creation in ICT; whereas hard places, characterized by high patenting outcomes, are not affected by smart finance supply rather than R&D investments. This result is consistent with the overwhelming empirical evidence that venture capital spurs entrepreneurial activities (Bertoni, Colombo, & Grilli, 2011, 2013; Bertoni, Colombo, & Quas, 2015; Colombo, Cumming, & Vismara, 2014; Lehmann, 2006; Minola, Vismara, & Hahn). In addition, our results imply that the provision of smart finance not only differs but also matters across regions and the smartness of places. This

result contradicts in parts previous evidence on the role and importance of spatial proximity of venture capitalists on new venture creation (Fritsch & Schilder, 2008).

Thus, our study contributes to recent literature that has been attempting to explain cross-regional differences in social, economic and entrepreneurial outcomes (Audretsch, 2015; Scott, 2006), where variation in the availability of smart finance and in measures of the creative class each account for cross-regional differences (Audretsch & Belitski, 2013; Florida, Mellander, & Stolarick, 2008).

Our results have several implications for the management of places as discussed in Section 5. The next section provides a short review of the literature on the smartness of places and finance, in particular venture capital. Section 3 then provides an overview of the included dataset, the variables and offers some descriptive statistics. The results of the econometric part are presented in Section 4. Section 5 concludes.

2. SMART PLACES, SMART FINANCE, AND NEW VENTURE CREATION

2.1 Complementarity of places and finance

New venture creation has recently been suggested as a measure of regional competitiveness in several ways. First, because new ventures have been identified as the driving forces of innovations and ideas, in particular in future oriented and emerging industries (Audretsch et al., 2006). Secondly, because new venture creation is a measure of the future orientation of a society to cope with the challenges raised by technological change and globalization (Audretsch, 2007). And, last but not least, because new venture creation leads to agglomeration and spillover effects and thus improves regional competitiveness. The phenomenon of new venture creation does not fall from heaven like manna, but is accompanied by ingredients: Knowledge spillovers, human capital and an endowment which fosters and stimulates creativity and entrepreneurial spirit. Secondly, the provision of equity as a source of

venture specific financial capital, i.e. venture capital. According to the tacit character of these ingredients, they are geographically bounded and their local coincidence is labelled ‘smart’. Whether and how the interplay of these ingredients spurs new venture creation is in the focus of this study. In particular, we are interested whether smart places and smart finance act as complements. Complementarity involves the interactions among changes in different variables in affecting performance (Roberts, 2004, p. 34). If the smartness of a place and the smartness of capital are complements, then a more of one, like smart finance, increases the returns to doing more of the other, like a driver of the smartness of a place.

This leads us to formulate our main hypothesis:

Hypothesis: Smart places and smart finance as choice variables are complements!

In the following, we will corroborate our hypothesis by briefly summarizing literature on the smartness of places and finance, arguing how and why these variables are complements. Smart places like hard places are each characterized by a set of complementarities as coherent patterns of choices over a large set of variables (see table 1). A move from any one element from the ‘unsmart place’ to the ‘smart place’ is complementary with the corresponding move on each of the other variables.[4] Instead of examining all possible interactions among such a set of variables we will summarize and sketch some of them in table 1, and subsequently discuss them in the next subsection.

- Insert table 1 about here -

2.2 Smart places and hard places

‘Smart’ is recently used as catchphrase for every ICT device that promises a kind of intelligent and user-centered experience. Even the EU policy 20-20 development agenda is

[4] One of the first who highlight the importance of coherent patterns and the complementarity of choice variables are Milgrom and Roberts (1990).

framed around the idea of smartness: Smart specialization, smart transformation or even smart growth by new venture creation are all claims of future development plans (Cooke & De Propris, 2011; Foray et al., 2011; Caragliu et al., 2011; European Commission, 2015; Giffinger et al., 2007; McCann & Ortega-Argilés, 2015). What facilitates new venture creation in the regional context of places has been discussed from various perspectives, like the moderating role of legal incentives and institutions (Acs, Audretsch, Lehmann, & Licht, 2016; Autio & Acs, 2007; E. J. McCann & Acs, 2010), the technological and technical infrastructure (Cattaneo, Meoli, & Vismara, 2015; Glaeser, Kahn, & Rappaport, 2008; Glaeser, Kolko, & Saiz, 2001; Glaeser, Rosenthal, & Strange, 2010), the role of universities and educational attainment (Breznitz & Noonan, 2014; Lehmann, 2015; Leydesdorff & Etzkowitz, 1996), and in particular even the culture and subcultures (Davidsson, 1995; Lehmann & Seitz, 2016a; Lloyd & Clark, 2001; Morgan & Ren, 2012; Tubadji, 2012).

Consequently, scholars have shifted their attention towards 'softer' and intangible assets to explain country specific entrepreneurship-driven growth (Dettori, Marrocu, & Paci, 2012). What makes a place smart is creativity and creative people which are attracted or select themselves, often sprout by chance and then follow path dependencies (Florida, 2004, 2014; Florida et al., 2008; Glaeser, 2005). Smart places are characterized by rather low entry and set up costs and a high industrial dynamic of new entries and exits (Florida, 2004; Florida et al., 2008). The industry structure is rather heterogeneous in size and age but also by the type of services and goods offered for niche and target markets and a flourishing entrepreneurial and start-up scene. In smart places, entrepreneurial activities are a social event relying on co-working, knowledge sharing and creativity spillovers (Altinay, 2008; Bosma & Sternberg, 2014; Cushing et al., 2002), and being 'entrepreneurial' is driven by peers and the socio-cultural context individuals are faced with (Altinay, 2008; Aoyama, 2009; Audretsch & Belitski, 2013; Fritsch & Wyrwich, 2012; Lehmann & Seitz, 2016a; Obschonka et al., 2015). Various studies reveal that weak-bounded, social highly diverse neighborhoods that are open-minded and exalt

social tolerance and individuality gain high entrepreneurship rates (Florida et al., 2008; Hauser, Tappeiner, & Walde, 2007; Huggins & Debies-Carl, 2015; Lehmann & Seitz, 2016b).

In contrast to knowledge-based, industrial-driven places that mainly value 'hard' physical and technological assets, smart locations are framed around infrastructures that foster social diversity, creative capital, and experimentalism and all amenities that motivate startup and creative entrepreneurship. Hard places are characterized by rather homogenous firms, based on high set-up costs and mass production, with a market orientation of global mass markets and a rather homogenous workforce. Such places often reveal a great history in the production of automobiles, metals, machineries and other products for the mass market, are still innovative as depicted by the high number of patents in these sectors. Infrastructure is basic and standardized, like hubs for transportation, on either the road, by train, ships or airplanes, but also an infrastructure to provide the necessary resources like human capital, financial resources, and basic entertainment and leisure activities.

Both, hard and smart places are associated with specific costs and benefits. While sunset places may suffer from industrial dynamic, diversity, and 'smartness', they offer employment for low- and medium skilled people, ensuring stable growth rates and tax incomes (Audretsch and Lehmann, 2016b), smart places with high shares of creative class outperform their less smarter ones; in terms of innovation, new venture creation and productivity (Florida, 2014; Lee, Florida, & Acs, 2004).

2.3 Smart finance and hard finance

An important variable listed in table 1 is the provision of finance. In the past decade researchers have been extensively highlighting the critical role of venture capital supply and places capacity for creativity. Experimentalism and self-discovery in an entrepreneurial context however is risky with high expected returns on the one hand but also high failure rates on the other (Audretsch & Lehmann, 2004; Lehmann, 2006), which makes traditional banks reluctant

to finance entrepreneurial firms (Stiglitz and Weiß, 1981). Financing also consists on coherent patterns of choices over a set of variables (Bertoni et al., 2011; 2013; Audretsch and Lehmann, 2004). The broadest set of complementarities studied so far in the corporate finance literature involves debt and bank loans versus venture capital and equity (Tirole, 2006). Debt and equity represent two coherent patterns of choices over a set of variables, where, like expressed above, a move of any one element from debt to equity is complementary with the corresponding move on each of the other variables (see table 2).[5]

- Insert table 2 about here -

Without securities, a lack of physical assets, and almost no positive returns and revenues, new ventures suffer from credit restraints (Carpenter & Petersen, 2002). Instead of these 'hard' assets and information, venture capital has been established as an alternative financial intermediary, relying more on 'soft' information and intangible assets like ideas, creativity, and human capital. Information asymmetry between the entrepreneur and the investor as well as a high probability of failure accompany these 'soft' assets (Gompers & Lerner, 2001; Manigart, Standaert, & Vanacker, 2015). Venture capitalists try to solve these problems by providing smart finance, like convertible securities, stage financing or the involvement in the start-ups' management. A significant equity stake ensures this kind of governance control and at the same time gives the venture capitalist the role of a consultant (Audretsch & Lehmann, 2013; Sahlman, 1990). His experience and specific knowledge is a fundamental benefit for the entrepreneur, who often needs some assistance concerning managerial challenges. Especially networking and interacting with other stakeholders as well as further fundraising are common tasks (Davila, Foster, & Gupta, 2003).

[5] This also holds for mezzanine finance where the costs and benefits of debt and equity are traded against each other. The small market share of this kind of finance reflects the lack of complementarities in the construction and provision of the product.

The access to venture capital is an essential driver of the success of new entrepreneurial firms (Colombo & Grilli, 2010; Manigart & Wright, 2013), and a strong complement to exit strategies like an IPO (Meoli, Paleari, & Vismara, 2013; Vismara, Paleari, & Ritter, 2012) or M&A (Lehmann & Schwerdtfeger, 2016; Signori &Vismara, 2015).

2.4 Smart places and smart finance

Entrepreneurs are stimulated by a creative and entrepreneurial environment, which includes existing supply of smart finance opportunities (Samila & Sorenson, 2011) and close social networks. Smart places and smart finance both consist of coherent patterns of choice variables, which are assumed to be complementary in the output – new venture creation. Our main hypotheses is thus to test the match of measures of smart places and smart finance in fostering new venture creation.

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3. ANALYSIS

3.1 Dataset

This paper analyzes the role of local venture capital supply in fostering smart regional growth. In this case, 'smart' refers to the extent of knowledge, entrepreneurship and creativity growth across regions. We test our thesis by comparing the 69 largest urban districts (independent cities) in Germany over 100.000 inhabitants. Given the proximity and density of social and physical capital, amenities and necessary infrastructure conditions, scholars advocate large cities to be the most relevant context studying sources of entrepreneurship and creativity-driven growth (Bosma & Sternberg, 2014; Capello & Lenzi, 2015; Florida, 2005; Fritsch & Schilder, 2008; Kourtit, Nijkamp, & Arribas, 2012; Marrocu, Paci, & Usai, 2011). Along, we build on a full and comprehensive sample survey of all large cities in Germany given the Census of 2011; according to the statistical conference of 1887 large cities are defined as dense, urban

communities hosting more than 100.000 inhabitants (Berry, Goheen, & Goldstein, 1969). Entrepreneurship and creativity growth differs in scale and scope across countries, regions and cities due to national and local institutions, cultural and economic development constraints (Autio & Acs, 2007; Scott, 2006). Comparing cites within the same country should promise reduced complexity and biased effects. We rely on cross-city analysis across German cities over 100.000 inhabitants. We hand-collected data from several public data sources and commercial reports to construct our model and deployed measures (for an overview over variables and sources see table 3).

- Insert table 3 about here -

3.2 Measurement and variables

For capturing cities´ capacity for smart growth, we rely on data about entrepreneurship performance. In wake of shorten product life cycles, global competition and the rise of knowledge-based societies, national competitiveness relies within its regions and their 'smartness' to foster and stimulate entrepreneurship and innovation growth. In correspondence, we draw on the number of start-ups listed in 2014 for each city according to *Gründerszene.de*. Start-ups here are referring to firms with high growth rates affiliated to smart industries, thus, startups related to Internet and ICT. Gründerszene.de is a leading online and news magazine for entrepreneurs, start-ups and investors informing about new frontiers and daily news of German and international start-up scene and digital economy.

For testing the framework conditions of hard places, we deploy patent data. Patent statistics, however, are the most common used metrics for innovation outcomes in recent research (Acs, Anselin, & Varga, 2002). Patents constitute a formalized and physically intensive knowledge base, best appropriate to proxy our idea of 'hard places'.

Table 4 and table 5 display the top ten cities of Germany according to their startup versus patenting performance. The tables intuitively support the idea that smart and hard places rely on different socio-economic settings and characteristics. Comparing both rankings only the city of Stuttgart and Munich are listed in both categories; the rest are either startup locations or patent hotspots. Further, it becomes vivid that all locations that feature high patent outcomes are traditional and renown places for physically-driven and technology-intensive engineering, e.g. SIEMENS city of Erlangen, CARL ZEISS city of Jena or the automotive cluster around the city of Stuttgart with PORSCHE or the DAIMLER AG, or the city of Leverkusen that host the BAYER AG. On the other hand, all listed startup hotspots are vivid market places for business and financial services (e.g. Hamburg, Munich, Düsseldorf, Frankfurt) or hosting media production and broadcasting (Berlin, Cologne).

In correspondence with previous studies, we assess the supply of local venture capital (VC) by counting the numbers of VC transactions in each city as a simple average over the years 2006 to 2012 – no matter where these investments are coming from. We justify possible selection biases by arguing that it is not about the 'physical' presence of venture capitalist that foster local entrepreneurship, but technical investments that either directly spur new business venturing or indirectly encourage next entrepreneurs to do so in the future. Besides financing, alternate sources of entrepreneurship growth have been extensively discussed over past decades, ranging from industrial clusters (Porter, 1998, 2000), to the role of education and human capital to personal (Dakhli & De Clercq, 2004; Falck, Fritsch, & Heblich, 2009; Storper & Scott, 2009), economic (Acs et al., 2016; Acs, Desai, & Hessels, 2008; Acs & Szerb, 2007) or socio-cultural constraints (Krueger Jr, 2003; Lehmann & Seitz, 2016a; Obschonka et al., 2015). Regarding the concept of smart growth, notably Florida´s (2004) concept about the creative class gathered great response across scholars and public policy makers. Accordingly, entrepreneurship flourishes in open-minded, social diverse and tolerant local networks that encourage creativity and knowledge spillovers. This setting commonly occurs in places locating

high shares of a so-called ‘creative class’, i.e. people working in new ways to solve problems that encompasses artists as well as academics or business professionals (Florida, 2014; Florida et al., 2008). For taking local creativity as an explanatory power for smart growth into account, we relied on Florida´s (2001) classification scheme and built on occupational data from people affiliated to creative, arts and cultural industries (bohemians), and the free professions, e.g. consulting, attorney etc. (professionals).

Further, local R&D intensity has ever been directly linked to innovation, knowledge-spillovers and entrepreneurship (Audretsch & Keilbach, 2008; Braunerhjelm, Acs, Audretsch, & Carlsson, 2010; Furman, Porter, & Stern, 2002; Nelson & Rosenberg, 1993). Thus, we use the share of employee in R&D to test endogeneity and biased effects. Further, in line with endogenous growth theory (Lucas, 1988; Romer, 1990a, 1990b) human capital is considered to be main power of national innovativeness spurring creativity and entrepreneurship outcomes. In order to control for the supply of high levels of local knowledge and human capital, we deploy on data of the share of employees that have obtained minimum a tertiary level education degree (cf. Cooke et al., 2005; Dakhli & De Clercq, 2004; Knack & Keefer, 1997; Storper & Scott, 2009). Research has highlighted the importance of cluster structures (Lamperti, Mavilia, & Castellini, 2015; Leydesdorff & Etzkowitz, 1996; Martin & Sunley, 2003; Porter, 2000) and in particular the density of population and the spatial proximity of technical and industrial infrastructure (Glaeser et al., 2010; Porter, 2000). Thus we include the variable population density for several reasons. First, density of people is assumed to be a good predictor for both rising entrepreneurial and creative milieus and infrastructure (Florida, 2014; Glaeser, 2005; Marrocu et al., 2011; McGranahan & Wojan, 2007; Möller & Tubadji, 2009). Secondly, literature on venture capital discusses endogeneity problems, when neglecting the role of local market demand (Samila & Sorenson, 2011): venture capital investments spur local entrepreneurship growth, but the supply of venture capital is also shaped by new venture creation. Population density serves even as proxy for a local demand for venture capital.

Finally, we include GDP per capita to control for the macroeconomic surrounding for new venture creation (Furman et al., 2002; Nelson & Rosenberg, 1993), although empirical evidence shows mixed results. For instance, Acs et al. (2008) highlights that measuring entrepreneurship with total new firm registration leads to a negative association with GDP, thus, indicating that people establish business because of lack job-opportunities (necessity-driven entrepreneurship); whereas entrepreneurship rates decrease with rising GDP and opportunity costs for becoming self-employed are increasing. In contrast, ICT start-ups are founded from and in the backdrop of ideas and market chances that are independent from economic situations (opportunity-driven entrepreneurship). This even holds for creative class and its establishments.

3.3.Methodology

For analyzing our data set we rely on cross-section comparison between our sampled cities. Because of its special political history, we have to consider possible biased effects due to the former socialist regions and cities of Eastern Germany: Our complete sample of the 69 largest urban districts (>100,000 inhabitants) comprises eight ex-socialist cities (Dresden, Erfurt, Halle/Saale, Jena, Leipzig, Magdeburg, Potsdam, Rostock); however, controlling for dummy effects shows no evidence that having a socialist heritage makes significant difference to above average startup rates. This is inconsistent to recent findings (Fritsch & Wyrwich, 2012) suggesting that socio-cultural heritages contest a long period of time and even endures institutional shocks, e.g. socialism the broke down of Soviet Union; but nevertheless appears to be reasonable in the backdrop of our small but full data set. This is in line with recent research demonstrating that socio-cultural ideology and psychological constraints contest a long period of time (Obschonka et al., 2015).

Table 3 and 6 summarizes all sampled variables. Most variables correlate very slightly to moderate, however, our explanatory variables, local venture capital transactions and creative

class, both co-correlate high with each other (r>0.79) and with our start up variable (r>0.73; r>0.56).

- Insert table 6 about here –

High levels of GDP reflect high levels of productivity and income, and are usually occurring in labor markets with skilled and high-educated workers. Employees in R&D usually belonging to these high income groups. Correlations even reveal that density of human capital (r>0.59), here measured as share of people with minimum bachelor degree, and members of the creative class co-locate moderately. Since the first publication of the *Rise of the Creative Class*, scholars have criticized Florida´s theory as being too vague in his creative class classification in contrast to traditional work on human capital (Boschma & Fritsch, 2009; Möller & Tubadji, 2009; Morgan & Ren, 2012; Peck, 2005). Most prominent along this line, Glaeser (2005) refers to the great overlap between high qualified and skilled people, traditionally referring to human capital, and some of Florida´s (2001) declared creative "underclasses", e.g. core creatives (researchers, teachers) or professionals (lawyers, consultant etc.). Most of these professions require formal education or training (Glaeser, 2005; Peck, 2005).

Population density is also meant to be strongly correlated with clustering of creative class (Clark, 2004; Clark, Lloyd, Wong, & Jain, 2002; Falck et al., 2011). Members of the creative class prefer open social networks where creativity spillovers and urban landscapes provide sophisticated life-style, cultural attainment and other amenities (Cushing et al., 2002; Florida, 2005). Usually, these infrastructures occur with high levels of urban density (Rappaport, 2008), thus, the moderate correlation between creative class and urban density (r>0.57) in our data sample supports this link.

Our study compares factor conditions of smart vs. hard places. Thus, we contrast startup growth, here as measure of young establishment in ICT industries, with patent data, here reflecting mainly physical, 'hard' technology-driven innovation growth. Correlations support

our arguments whereas the outcome of locations is shaped by their infrastructure and factor conditions, intuitively. Hard places seem to rely on other factor conditions than smart places´ ecosystems. Thus, findings show only slight to negligible correlations between patents and most variables, except from R&D employees ($r>0.43$). The almost non-existent, and negative correlation between ICT startups and the local patents indicate that there is a significant difference between hard and soft places.

Testing for multi-collinearity, however, reveals inconspicuous values of variance inflation factor along all deployed variables ($2.08 \leq VIF \geq 4.7$; Mean VIF = 2.78). We assume that the relationship between outcomes and our main predictors is linear. Testing for non-linearity even shows inconspicuous findings.

The endogenous variables of our study are the location quotient of start-ups and the number of patents per 100.000 employee. Due to their nature, both measures are count variables that ranges only non-negative integer values. Hence the general assumptions of linear regression models are violated and only Poisson or negative binomial regression methods are appropriate for dealing with such data (Cameron & Trivedi, 1986, 2005, 2013; Hausman, Hall, & Griliches, 1984). For the Poisson distribution the variance is restricted to equal the mean. As table 3 shows our outcome variable is highly over-dispersed, thus appropriate to test with negative binominal modelling. We analyze our data stepwise along four core models comparing the influence of venture capital and creative class on startup vis-a-vis innovation growth. First, we predict effects by either of both variables isolated, before we control for a complementary or joint effect of venture and creative capital on innovation and entrepreneurship growth.

4. RESULTS AND DISCUSSION

The scatterplot (figure 1) displays the relationship between our measure of the creative class and the provision of smart finance, notably venture capital transactions. First, the slope is

increasing. In the left and lower sectors are cities representing traditional hard places in Germany. Wolfsburg, named the automotive city, is the headquarter of Volkswagen and its basic production place. Although a place with high GDP per capita and highly innovative when measured by the number of patents per capita, this place reveals the lack of diversity and plurality. The same holds for cities like Leverkusen, Duisburg, Essen, Gelsenkirchen and others from the Ruhr Valley. The interesting fact is that Cologne, also located at the boarder of the Ruhr Valley and in close neighborhood to these cities, is a smart place and a hotspot of the creative class. While the neighboring cities have a long tradition in manufacturing, steel production and mining, Cologne is the called the "Media City" in Germany, with a long historical tradition of publishers and printers. A tradition, which selects creative people since ever. No wonder that Cologne is in close proximity – on the scatterplot – to smart places like Munich, Hamburg and Berlin.

- Insert figure 1 about here -

Table 7 and 8 report the findings of our econometric analysis. Our first model tested the link between smart finance and new venture creation. Results reveal that venture capital has a positive and highly significant impact on local start up rates. With our second model, we aim to test the creativity-entrepreneurship link. Findings support previous studies within this line, whereas the clustering of creative talents is positively associated with a vivid entrepreneurship culture and new business venturing (Audretsch & Belitski, 2013).

- Insert table 7 about here -

Model 3 considers possible effects of substitution between both variables of main interest, venture and creative capital. Results report that both creative and venture capital foster start up

rates indicating that neither of them is substitute of each other. When local attendance of creative class and venture capital are not substitutable, there might be interactions between the two predictors. Model 4 suggests that there is no significant interplay between smart finance and smart people for locations´ entrepreneurship growth.

Regarding our controls, findings support traditional and recent literature: For instance, human capital is undisputedly meant to drive innovation and entrepreneurship growth (Dakhli & De Clercq, 2004; Florida et al., 2008). Across all models, we can support the positive influence of human capital. Contrary to common approaches within the field of research and entrepreneurship policy, we find a robust and negative impact of local R&D intensity on entrepreneurship rates. A closer look on the included regions and places reveals this effect. First, our definition of hard regions encompasses the location of big multinational firms, like Volkswagen in Wolfsburg. Although they operate worldwide, their investment in R&D and patents are almost attributed to their headquarter and the respective location. A high percentage of the big multinational companies in the automotive, steel, chemical and engineering sector are located within the 'hard regions'. Secondly, our outcome measures mainly start up rates in information and communication technologies. R&D efforts are usually associated with high technology innovation and 'hard', patentable industrial research; however, ICT industries require 'softer', that means smarter and creative problem-solving rather than formal research (Brandstätter, 1997; Chell, 2008; Rauch & Frese, 2007a, 2007b; Zhao, Seibert, & Lumpkin, 2010). In order to test this idea, we provide primarily evidence.

- insert table 8 about here -

Table 8 reports the results of our regression analysis with patents as proxy for hard places. Findings indicate that hard places rely on different factor conditions towards their ecosystem. In contrast to smart places that value 'informal', thus, creative and venture capital, locations with high patent outcomes built on more codified knowledge and physically-intensive

resources, e.g. formal human capital and R&D. Findings partly support our primarily intuition: Across all models R&D intensity highly affects patent outcomes. Human capital, however, shows positive but, except from model 1, insignificant results. That might be reasonable due to operationalization: We proxy R&D with employees in R&D professions, which is highly overlapping with our variable for human capital measuring local share of people with academic background. We run several robustness checks while dropping unusual or influential data. For our smart places outcome, the city of Berlin is heavily outlining. Berlin is hotspot and championing Germany´s start up scene. With 540 locally registered ICT startups, Berlin has a more than 3-times higher entrepreneurship rate than the next highest ones, that are Munich (163), Hamburg (149) followed by Cologne (94) and Düsseldorf – recently, all hosts of vibrant creative milieu. When dropping Berlin, findings remain robust and stable. Considering hard places, the city of Erlangen seems most influential towards its patent activity. After 1945 Erlangen has become a R&D cluster for medical and environmental and energy technologies hosting, a research university and several private and state-governed research institutions (Max Plank Society, Fraunhofer Instituts). Furthermore, Erlangen is home base of Siemens and plays an important role in Germany´s energy agenda/turn as it's clustering solar tech industry. In our sample, Erlangen is the first in number of patents per inhabitants followed by Furth and Mulheim a. d. Ruhr and ranks top 3 in R&D intensity while showing no ICT-related entrepreneurship. Thus, Erlangen can be considered as archetypes of a hard place according to our definition, i.e. a place characterized by R&D and technology-intensive industries and tied research-industry bounds. However, controlling for possible influences while dropping Erlangen out of regression analysis, results even remain robust. Controlling for spatial effects within our dataset, we further test for spatial autocorrelation and spatial dependency. Testing for both spatial lag as well as spatial error effects display no conspicuous results (rho and lambda, p-value>0.5). This is in correspondence with the intuition suggested by figure 2 and 3 provides. Both figures map the geographical distribution of our exogenous variable indicating

that a) there seem to be a systematic difference between smart and hard places and b) spatial proximity or cluster structures play no crucial role for the local patenting and startup performance.

The results of our study strongly confirm the 'smart-region-smart-finance' match as a prerequisite for above average entrepreneurial activity. This effect of stimulating entrepreneurial activity and new venture creation appears to be consistent with at least three mechanisms. First, nascent and would-be entrepreneurship is highly correlated and shaped with the regional endowment of creativity as expressed by measures of the creative class (Florida, 2004; Lehmann & Seitz, 2016a, 2016b). This result is expressed by the positive and significant correlation of the two variables and confirmed by the several estimation models (table 7). The variable indicating the smartness of a region (creative class) enters all regressions positive and significant. Second, would-be entrepreneurs in need of external financial sources may incorporate the availability of such smart finance instead of traditional credit lending into their calculations when trying to decide whether to start a new venture or not (Samila & Sorenson, 2011). This is shown by the positive and significant effect of the smart finance variable (VC transactions) in the different regression models. This effect of venture capital on new firm creation however is undisputed in the literature (Bertoni et al., 2011; Colombo & Grilli, 2010; Ghio, Guerini, Lehmann, & Rossi-Lamastra, 2014). Third, venture capitalists as providers of smart finance may serve as an inspiration and training ground for future entrepreneurs and venture capitalists but also be shaped by the smartness of the region. This result is depicted in table 7 by the interaction variable. Beyond the isolated effect of either the creative class or venture capital transactions, the interaction variable clearly shows a positive and highly significant value. This result confirms our main theses that the smartness of a region and the provision of smart finance are strong strategic complements in fostering and shaping new venture creation.

From a theoretical perspective, our findings are quite consistent with recent notions that new venture creation is almost shaped by national and regional systems of entrepreneurship (Acs et al., 2016), where new venture creation is mainly shaped by the complementarity of institutions and endowment with soft assets and capital on the regional level.

Given that both, the smartness of the region and smart finance, accelerate and stimulate new venture creation, our results lead to several implications for policy makers and management. First, if both effects are strong complements, this may lead to adverse effects in that the smartest regions get smarter. New venture creation increases the demand for smart finance and leads to an increase of venture capital firms in that regions. This attracts more people from the creative class to locate within these regions – or hinder them to move away, which increases the quantity and perhaps quality of would-be entrepreneurs. This, in the end, could lead to a vicious circle where new venture hotspots are becoming more and more concentrated, at least within one or two locations. This could be observed in Germany, where the quantity and quality of new venture creation and its dynamic is concentrated in Berlin and Munich (Audretsch & Lehmann, 2016). Both cities are labeled as coolest places in Germany.

Managerial implications are that would-be entrepreneurs in need of smart finance incorporate the availability of this kind of financial resources into their strategic location decision. Since new-venture creation is a trade-off decision between cost and benefits, the availability, the supply and costs of external capital thus shape the decision to start a new venture. The provision of smart finance turns the balance towards the smart region.[6] In addition, smart finance companies located in smart regions could increase their financial bases by attracting other firms and companies to invest their money within them.

[6] This, however, would increase the costs of location. In an international context, these costs may be comparable low. Audretsch and Lehmann (2016a, 162ff.) describe that Berlin attracts thousands of would-be entrepreneurs not only from other parts of Germany but also from the UK and the US because of lower costs of living and a vivant scene of smart finance.

Finally, new ventures are often the desired targets of companies within their corporate entrepreneurship strategy (Lehmann & Schwerdtfeger, 2015; Vismara, Signori, & Paleari, 2015). This increases the attractiveness of smart regions for large and established companies as focal points of detecting new target firms and trends.

Spillover effects of smart regions could thus be the promotor of a broader economic dynamic and growth as the desired outcome of the new European policy framework of smart growth. However, this concept and framework could then also lead to adverse effects, when smart regions not only compete for smart people and smart finance leading to a rat race where only a few hot spots in Europe are winning, but also serve as a source of knowledge and technology spillover towards the broader geographical area.

5. CONCLUSION AND FURTHER RESEARCH

In this study we have examined the role of smart finance within smart regions. Our main part of the empirical analysis was based on 69 metropolitan areas in Germany. Our analysis clearly shows that creativity embodied in a close regional area increases the base of new venture creation. In addition, the supply of smart finance, measured by venture capital transactions, increases the number of new venture creation. The main result of our analysis is, however, the interplay and complementarity of both, smart regions and smart finance.

Our findings also shed some light on the future development of cities and regions. While inequality across countries and nations is diminishing, inequality across regions and cities within countries is increasing, leading to sunset and sunrise regions (Audretsch and Lehmann, 2016b). Following a vicious circle, attractive places select creative people which foster and spur new venture creation. Smart finance works as a strong complement by providing the necessary financial resources to spur new venture creation and growth.

Our results lead to some important questions for further research. First, the dynamic and complementary effects of hotspots, places with both smart regions and smart finance, may lead to a concentration within an economy. This would then lead to undesired and adverse effects with an increase of future inequality in both economic dynamic and social wellbeing. Second, it would be rather interesting to compare our results for Germany within an international context. And third, additional research is needed and desirable to include additional proxies for smart regions and smart finance, like crowdfunding (Vismara, 2016), on a longitudinal basis. In particular the rise of new ventures in the financial sector, the so-called fin-techs, are assumed to play an important role in making places smarter. Future research should thus focus on the financial side of new venture creation in dependence of the attractiveness of places, including exit strategies like IPOs or M&A activities (Signori & Vismara, 2015; Vismara, Paleari & Ritter, 2012).

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Appendix

Table 1: Characteristic features of smart and hard places

	Hard Places	*Smart Places*
Logic	Uniformity and monotony	Diversity and pluralism
Clustering of firms	Homogenous clusters	Heterogeneous clustering
Size distribution of firms	High concentrated	Low concentration
Competition	Defending market shares; competition for demand	Low, competition for resources
Regional dynamic	Low, stagnant	High entry and exit dynamic
Regional capital	Financial and physical capital	Knowledge and social capital
Production line	Mass production, economies of scale	Flexible production, economies of scope
Cost structure	High set up, entry and exit costs	Low set-up, entry, and exit costs
Markets of firms	Mass markets	Niche and target markets
Integration	Vertical integration	Reliance on networks
Spillovers	R&D spillovers	Knowledge spillovers
Human capital	Low and medium skilled	High skilled
Infrastructure	Basic and static	Complex and dynamic
Dominant Industries	Steel production, Automobile, large scale manufacturing, machinery, Chemical, Pharmaceutical	Engineering, high tech manufacturing, Biotech, ICT, Media
Workforce	Rather homogenous	Rather heterogeneous
Residential population	Elderly, declining	Young, increasing
Working population	Industrial sector, working class	High tech sector, academics, entrepreneurs,
Mobility of population	Low	High
General public	Working class	Creative class

Table 2: Characteristic features of hard and smart finance

	Hard finance	*Smart finance*
Logic	Debt and securities	Equity and intangibles
Financial service	Debt, credit	Equity
Players	Banks	Venture capitalists, business angels, crowdfunding
Corporate Governance	Passive investors	Active shareholders
Securities	Tangible and marketable	Intangible
Information	Hard, codified	Soft, tacit
Communication	Impersonally, standardized	Personal, Face-to-face
Returns	Fixed interest rates	Flexible
Project risk	Low and expected profits	High and unexpected profits
Investment logic	Trust, based on past reputation	Confidence, based on promises for the future
relationship	Long term, relationship banking, monopolistic house bank	Short term, syndication, periodically
Additional services	Consulting, advising	Coaching, networking
Exit	Repayment, bankruptcy	Selling shares (IPO, M&A) or insolvency
Refunding	Internal cash flows, refinancing by central banks, issuing bonds, other banks	External equity market, debt market, large shareholders, investees, reinvestments

Table 3: Descriptive Statistics

Variables	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Description**
Startups (2014)	69	1	3.79	0.0	29.42	Number of start-ups listed in the Gründerszene.de (source Gründerszene.de); Location quotient
Venture capital (log, 2006-2011)	69	0.63	0.76	0.0	3.78	Number of transactions in each city (source: BVK e.V., Bund deutscher Kapitalgesellschaften); mean 2006-2011
Creative class (2008-2012)	67	8.14	1.26	5.71	11.78	Share of people working in creative industries (source: German Bureau of Statistics); mean 2008-2012
Human capital (log, 2011)	69	2.60	0.42	1.77	3.45	Share of employees with minimum bachelor degree (source: German Bureau of Statistics
GDP (2010)	69	27.61	6.51	17.5	45.11	Grossdomestic product per capita (in thousand) in urban area (source: German Bureau of Statistics)
Density (2010)	69	1727.89	727.74	592.41	4392.48	Number of inhabitant per square meter (source: German Bureau of Statistics)
R&D (2011)	69	13.47	14.39	1.1	62.8	Share of employees working in R&D (source: German Bureau of Statistics)
Patents (2014)	69	19.03	13.18	0.5	88.3	Number of patents per capita (source: German Bureau of Statistics)

Table 4: The ten smartest cities (by startup index)

		Startup index	GDP per capita	Population density
1	Berlin	29.4	28.9	3730.0
2	Munich	8.8	57.9	4392.5
3	Hamburg	8.0	51.9	2274.8
4	Cologne	5.1	46.4	2502.8
5	Düsseldorf	1.6	69.9	2712.2
6	Frankfurt am Main	1.4	79.5	2724.5
7	Karlsruhe	1.1	50.0	1683.4
8	Leipzig	1.1	27.7	1715.1
9	Stuttgart	1.1	61.7	2850.3
10	Aachen	0.7	28.4	1483.8

Table 5: The ten most successful hard places (by number of patents per capita)

		Patents	GDP per capita	Population density
1	Erlangen	88.3	68.4	1355.6
2	Fürth	52.0	29.4	1841.2
3	Mülheim an der Ruhr	51.1	37.4	1827.4
4	Jena	36.4	31.8	929.7
5	Stuttgart	35.7	61.7	2850.3
6	Bielefeld	35.3	32.9	1264.2
7	Munich	34.1	57.9	4392.5
8	Darmstadt	33.7	52.4	1194.6
9	Leverkusen	31.9	40.9	2020.7
10	Freiburg im Breisgau	29.6	39.4	1399.7

Table 6: Correlation matrix

		1	2	3	4	5	6	7	8
1	Startups (2014)	1							
2	Venture capital (lo g, 2006-2011)	0.7312	1						
3	Human capital (log, 2011)	0.1535	0.5375	1					
4	GDP (2010)	0.1132	0.1529	0.109	1				
5	Density (2010)	0.5072	0.5182	0.0249	0.4571	1			
6	R&D (2011)	0.0069	0.1464	0.2647	0.3193	0.0152	1		
7	Creative class (2008-2012)	0.5658	0.7962	0.5987	0.3869	0.574	0.035	1	
8	Patents (2014)	0.0027	0.1028	0.2876	0.1219	0.0585	0.4363	0.0987	1

Table 7: Regression results based on the number of startups

	Model 1	*Model 2*	*Model 3*	*Model 4*	
Venture capital	1.497*** (37.35)		1.052*** (6.39)	2.164** (2.33)	-0.655 (-1.04)
Creative class		1.290*** (9.49)	0.428*** (2.70)	0.532*** (4.83)	1.177*** (9.05)
Venture capital x Creative class				-0.100 (-1.31)	-0.081 (1.50)
Human capital					0.594** (2.11)
GDP					-0.058*** (-6.16)
Density					-0.000 (-0.12)
R&D					-0.017*** (-3.37)
Constant	-2.255*** (-15.17)	12.220*** (-10.07)	-5.627*** (-4.50)	-6.715*** (-7.59)	-11.150*** (-10.44)
Lnalpha Constant	-16.26*** (-20.29)	-1.703*** (-4.02)	-16.73*** (-4.07)	22.26 (.)	-17.77*** (-65.10)
Observations	*69*	67	67	67	67

t statistics in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 8: Regression results on the number of patents

	Model 1	*Model 2*	*Model 3*	*Model 4*	
Venture capital	0.091 (1.00)		0.048 (0.22)	0.730 (0.97)	-0.382 (-0.60)
Creative class		0.060 (0.99)	0.036 (0.25)	0.103 (0.84)	0.062 (0.51)
Venture capital x Creative class				-0.071 (-1.09)	0.013 (0.24)
Human capital					0.384 (1.49)
GDP					-0.004 (0.28)
Density					0.000 (0.92)
R&D					0.017** (2.49)
Constant	2.886*** (29.34)	2.455*** (4.58)	2.619** (2.39)	2.066** (2.21)	1.209 (1.37)
Lnalpha Constant	-1.193*** (-4.67)	-1.172*** (-4.36)	-1.174*** (-4.47)	-1.200*** (-4.92)	-1.511*** (-7.04)
Observations	69	67	67	67	67

t statistics in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Figure 1: Venture capital and creativity growth

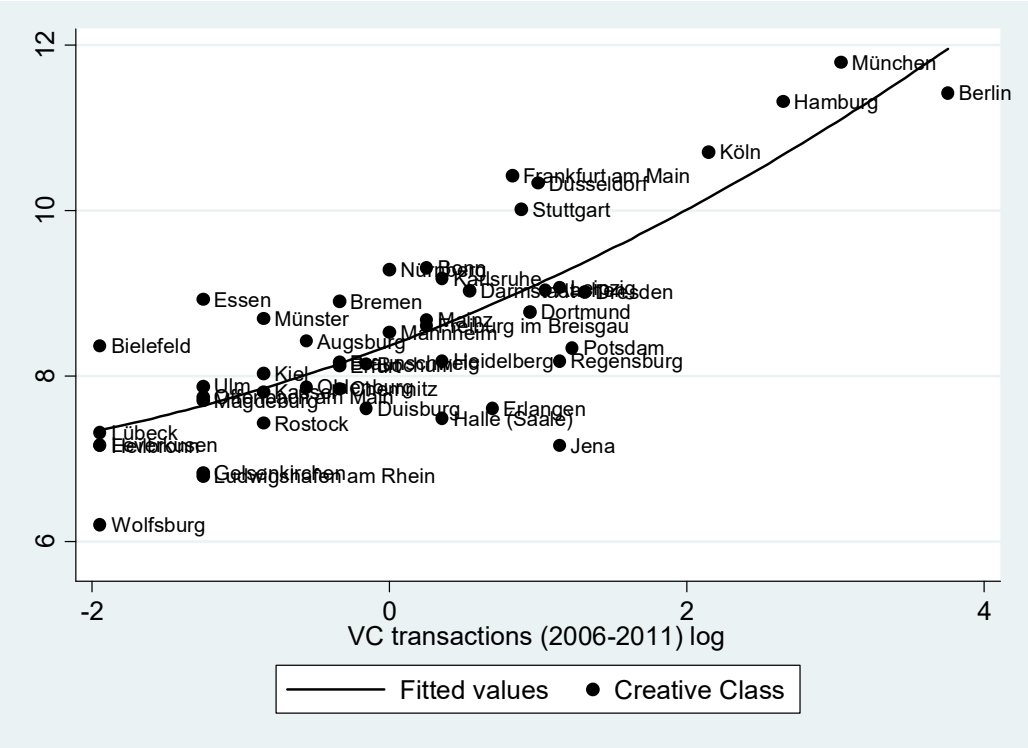

Figure 2: The ten smartest cities (by startup index)

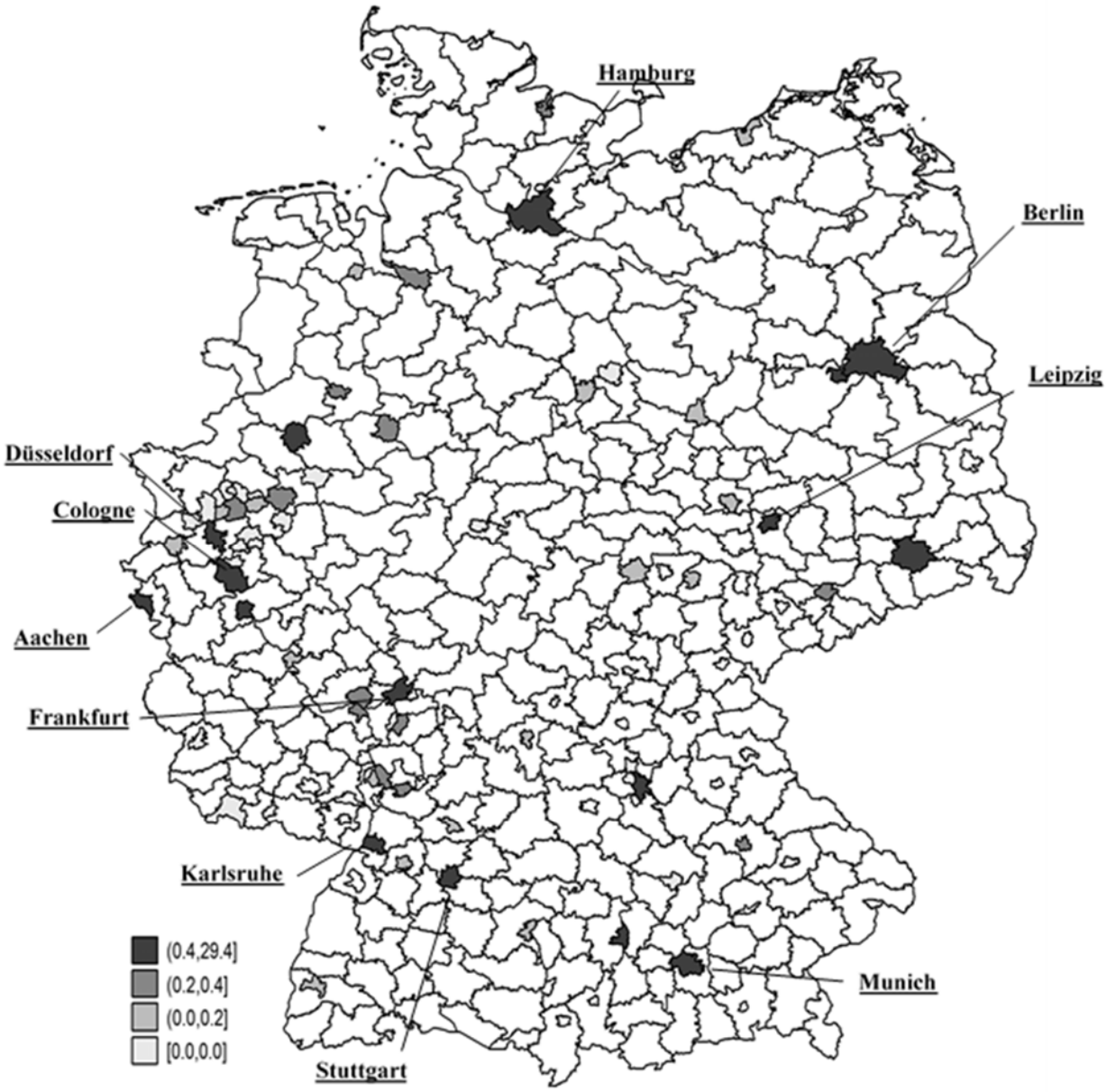

Figure 3: The ten most successful hard places (by number of patents per capita)