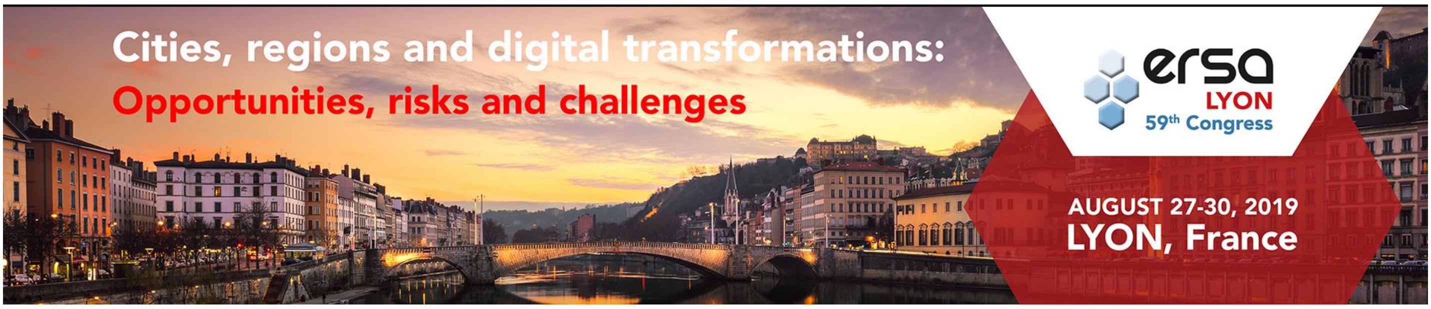

Firm soundness and knowledge externalities: a comparative regional analysis

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Abstract

This paper investigates the role of regional context with regard to human capital and knowledge spillover effects in SMEs' financial soundness. Our empirical setting is based on the multilevel analysis for panel data, which better allows for the treatment of hierarchical data. It is applied to firms belonging to the industrial sector and operating in four European countries over the 2010–2015 period. We find that a combination of individual- and regional-level characteristics explain firm soundness more accurately than individual features alone. Furthermore, we find that a higher local educational level and knowledge spillover improve the firm soundness.

Keywords: Firm effects, regional effects, human capital, firm robustness, multilevel longitudinal model

JEL references: I25, L26, R11, C33

1. Introduction

Firm heterogeneity has long been recognized to be caused by individual differences, but a growing literature presents evidence for the effect of location on firm survival, growth and profitability (Audretsch and Dohse, 2007; Cassia and Colombelli, 2010, Grillitsch and Nilsson, 2019). International comparisons show that macroeconomic conditions and national institutions shape firms' trajectories (Ipinnaiye et al., 2017; Mazzucato and Parris, 2015) but that local characteristics matter as well.

Numerous papers have investigated the relationship between individual performance and local conditions, and the regional level has been identified as a relevant dimension in this field of research. The regional context especially influences small businesses for several reasons (Karlsson and Dahlberg, 2003). First, regional features facilitate the formation and transmission of social capital and constitute a local labour market from which firms can find and develop social capital (Huggins and Thompson, 2015), and different levels of social capital are linked to different levels of financial development within a region, which drives firm performance (Guiso et al., 2004). Second, research and innovation are created and developed at a local level, and knowledge regional spillovers tend to be localized. Regional innovation systems, clusters and, broadly speaking, smart regional innovation policies capitalize on this geographical proximity, which is considered a factor facilitating coordination between innovation actors (Gerber and Loh, 2015). Third, transaction costs, markets, and self-reinforcing growth have been found to be especially relevant at the regional level, as shown by the new economic geography literature (Krugman, 1991, 1998). For all of these reasons, the present work fits into a local approach to firm performance and growth while shedding light on a barely studied topic: the relationship between the firm soundness perspective and local context.

This paper aims to determine to what extend the regional context shapes firm soundness, a question often considered from an institutional point of view (Acs et al., 2016; García-Posada and Mora-Sanguinetti, 2015). We enrich this field of research by paying attention to intangible resources made available at the regional level. This choice is relevant from knowledge economy and open innovation perspectives (Cooke, 2002; Mina et al., 2014).

To shed light on the relationship between regional context and firm soundness, we mobilize a unique dataset of a panel of enterprises located in four European countries. The dataset includes accounting and financial information, as well as characteristics such as firm size, age, activity and location. These data are complemented with a series of indicators computed at the regional level to describe local context. The estimations are run using a multilevel model estimation technique (Hox, 2010; Hox and Roberts, 2011) that allows one to consider in a single equation various variables computed at different levels of aggregation (time, firm, and region) without bias.

Our results show that a combination of individual- and regional-level (NUTS 2) characteristics explains firm soundness more accurately than individual features alone. In particular, a higher level of education and employment in high-tech industries improve the robustness of small and medium-sized enterprises (SMEs).

This paper is novel in that to our knowledge, it represents a first attempt to correlate companies' financial soundness with local characteristics and more precisely to knowledge context. It also relies on the use of new multilevel estimation technique, making it possible to take into account the hierarchical structure of data (individual and regional variables). Another contribution relates to the broadness of the empirical analysis, which focuses on 22,079 companies operating in 91 regions of four European countries from 2010 to 2015.

The remainder of the paper is structured as follows. Section 2 provides a review of related literature and formulates the hypotheses to be tested. Section 3 introduces the empirical strategy used. Section 4 presents the results, and section 5 concludes.

2. Theoretical framework

2.1 Firm and local context

Over the past decades, firms' trajectories have been widely investigated in reference to different factors. A significant proportion of these contributions has focused on firm-specific factors such as firm size and age (Mueller and Stegmaier, 2014) or on minimally efficient scales, the timing of entry (Klepper, 1996), intellectual assets (Hormiga et al., 2010), social networks (Abou-Moghli and Al-kasasbeh, 2012) and the development of firm-specific assets through advertising and R&D expenditures (Esteve-Pérez and Mañez-Castillejo, 2008). This heuristic approach has been complemented with research aiming to propose different statistical techniques with which to assess firms' exposure to default risk. Financial factors such as leverage, profitability, cash flow, and debt structures combined with the size and age of firms have finally been found to influence financial strength (See Altman, 1984; Freeman et al., 1983; Kale and Arditi, 1998). Following the structure-conduct-performance paradigm (Porter, 1979), another set of papers considers industrial-specific factors to complete this field of analysis, revealing the role of industry-specific factors such as market evolution (Agarwal and Gort, 1996; Ilmakunnas and Topi, 1999), technological regimes (Audretsch, 1991; Kim and Lee, 2016), intra-industry diversification (Li and Greenwood, 2004) and the stage of the industry life cycle (Agarwal and Audretsch, 2001).

However, firm- and industry-level factors are not sufficient to explain why some companies have better financial health than others. In addition to studies examining variables depicting individual and sectoral characteristics, another part of the literature explains the empirical evidence related to firm soundness with attention to location-specific factors (Klepper, 2002; Strotmann, 2007). Geographical concentration or agglomeration (Sorenson and Audia, 2000), economies of scale (Audretsch, 1995), unemployment rate, income level within each region (Scott, 1988; Backman, 2013), business climate (Ciccone and Hall, 1996), and institutional legitimacy (Shane and Foo, 1999) are likely to have significant implications for the competitiveness of firms.

Despite the general belief that country effects should diminish and especially within groups of countries based on their core-periphery status or membership in trade blocs, due to globalization and institutional convergence, technologies, and institutions (Berry et al., 2014; Ramajo et al., 2008), recent studies show that regional specificities still prevail (Huggins et al., 2017; Robert and Thompson, 2015).

Furthermore, some studies have analysed firm soundness within or across regions while considering indicators computed at the regional level: the financial context (Arcuri and Levratto, 2018; Guiso et al., 2004), networks (Littunen, 2000), agglomeration economies (Glaeser and Kerr, 2009) and, more generally speaking, local conditions (Karlsson et al., 2015), whereas it has long been recognized that "performance differences between regions cannot be perceived as a direct result of macro-economic differences between regions. Instead, they are a by-product of firms' individual behaviours" (Van Oort et al., 2012). These considerations lead us to formulate our first hypothesis:

H1: A combination of individual and local levels explains firm soundness more accurately than individual characteristics alone.

2.2 The role of human capital as a resource

From endogenous growth theory (Krugman, 1991), human capital has been shown to be a critical factor explaining the level of regional competitiveness, and the various endowments observed explain regional heterogeneity. This relation holds at the regional level as shown by Acs and Armington (2004) and Backman (2014).

Indeed, employing a large number of highly educated and skilled workers benefits a firm through a productivity effect. From Barro (1991) this factor has long been identified as one of the main determinants of economic growth and plays an important role in the technological progress of countries. Moreover, a local labour market characterized by a significant share of highly educated and skilled workers increases the productivity of the whole work force through human capital externalities (Moretti, 2004; Rauch, 1993), allowing local firms to be more efficient and profitable. These knowledge externalities tend to improve firm performance (Audretsch and Lehman, 2005) through direct hiring or thanks to easier access to knowledge intensive business services (Doloreux et al., 2010). This thesis is confirmed by Cassia et al. (2009), who in reference to a sample of UK public companies from 1995 to 2006, present evidence on the effects of external sources of knowledge on firm growth. McGuirk et al. (2015) also present evidence on the beneficial influence of human capital on small firms, considering that this category of firms is more sensitive to the four components encapsulated in human capital, i.e., education, training, a willingness to change in the workplace and job satisfaction, and they in turn overcome the limitations of measurements used previously.

The role of human capital has been explored in the new-firm survival literature (Acs et al., 2007). The influence of human capital has mostly been analysed from an internal point of view while focusing on the correlation between education and the skills and competencies of workers, managers, or entrepreneurs (Blundell et al., 1999; Rauch, 1993) when the firm perspective is privileged. When the spatial perspective prevails such that human capital is aggregated at the regional level, the vast majority of papers aim to determine its influence on regional performance measured as a difference in GDP or in the number of workers computed at the region level (Badinger et al., 2003; Florida et al., 2008).

Due to the possibility of interactions occurring between a firm and its environment, we adopt a different view that combines individual and local dimensions. Following Huggins et al. (2017), according to the fact that “location of the firm may increase or decrease the likelihood of survival through the threats faced and opportunities available that originate from outside the firm” (p.5), we hypothesize that a higher level of human capital in a region could have a significant effect on the soundness of SMEs.

These considerations lead us to formulate our second hypothesis:

*H2: A higher education level in a region positively influences firm soundnes*s.

2.3 Agglomeration effects and knowledge spillovers

Agglomeration forces, geographical clustering and knowledge spillovers have been widely examined, and it is broadly recognized that advantages can arise when companies operate geographically close to one another.

The fist advantage of geographical clustering derives from agglomeration benefits that lead to higher levels of firm performance due to improved production and/or increased demand (Harrison, 2015; Krugman, 1991; Storper, 1995). Agglomeration economies arise primarily from the set of shared resources available to firms co-locating in the same area. This thesis is rooted in the so-called “diamond” theorized by Porter (2000), which links firm performance to the quality of a firm’s environment. In a more dense and large local market, it is possible for a firm to obtain a greater variety of intermediate inputs, generating productivity gains through higher levels of vertical disintegration and specialization (Henderson, 2003). The availability of a wider variety of consumer goods also attracts consumers and as a consequence increases the level of demand. In the case of increasing returns, companies benefit from the presence of a larger number of easily accessible consumers. The same holds for labour. In a broader employment area, workers tend to be more specialized and thus more productive since when faced with a larger number of job opportunities, they do not hesitate to specialize. Finally, any exchange of information between companies concerning the characteristics of demand or production technologies occurs more easily when the density of economic actors is higher. Thus, the creation, accumulation and dissemination of knowledge are facilitated in the most densely populated areas. Although the geographic scope of a cluster can range from county to country, its common resources and capabilities are generally shaped by geographic proximity.

Knowledge spillovers are also associated with Marshallian external economies. Van Der Panne (2004) estimates that the most frequent knowledge transfers are inter-industrial. The diversity of geographically concentrated industries and their specialization stimulates innovation as Jacobs (1969) pointed out. Interactions between different sectors are at the heart of this process: a common scientific base facilitates the generation and exchange of existing ideas between distinct but complementary industries (Feldman and Audretsch, 1999). Local knowledge spillovers are all the more beneficial to a company, as they are able to capture ideas and inputs (competencies, technologies and underlying knowledge bases) from other related activities (Boschma and Iammarino, 2009). Positioning close from knowledge producers should allow a firm to benefit from other firms’ spillovers. Since high-tech industries in which knowledge plays a key role as an input and output are usually identified as ‘knowledge-intensive’ and given that the marginal cost of transmitting knowledge increases with distance (Audretsch and Feldman, 1996), we formulate the following third hypothesis:

*H3: A higher concentration of high-tech firms in a region positively influences firm soundnes*s.

3. Empirical strategy

3.1 Data

We assess the influence of local context on firm soundness for a panel of SMEs operating in four European countries belonging to the industrial sector. We limit the sample to SMEs because they are more sensitive to local context than larger enterprises (Carreira and Lopes, 2015).

Our dataset is developed through the merging of two datasets. The first is the Amadeus dataset provided by Bureau Van Dijk, which contains comprehensive financial and non-financial information on European companies, and the second dataset includes regional information compiled by Eurostat and computed at the NUTS 2 level.

A technical constraint guided us to review four countries (Belgium, France, Italy, and Germany) covered most fully by Amadeus. Moreover, these countries are representative of the economic situation that prevails in Western Europe, present a diversity of regions ranging from high density regions to more rural regions and include a large variety of industrial profiles. The countries include 91 NUTS 2 regions.

From Amadeus, we extracted a list of companies with complete accounting documents covering at least two consecutive years in the 2010-2015 period. The research period starts in 2010, following the global shock that hit European countries from 2008-2009 because, according to Sensier et al. (2016), some regions in Belgium, France, and Germany started to recover beginning in 2010. After applying a cleaning procedure to all companies presenting missing or faulty data, from the population we only examine companies with at least two successive years of data, a condition to respect when using a panel. After performing these operations, we obtain an unbalanced panel of 86,839 observations.

Definitions and sources of the variables used are presented in Table 1, while descriptive statistics and a correlation matrix for the variables are reported in the Appendix.

Table 1. Variables

Name	Definition	Source
Dependent variable	Zeta score	Amadeus
Explanatory variables		
Regional variables		
Education	Population aged 25-64 with a tertiary education (levels 5-8) (%)	Eurostat
HTEmploy	% of employees employed in technology- and knowledge-intensive sectors in NUTS 2 regions	Eurostat
GdpPerCapita	Ln(Gross Domestic Production / Thousands inhabitants)	Eurostat

Density	Ln(Number of employees / NUTS 2 area (square metres))	Eurostat
Firm variables		
Size	Logarithm of AnnualTurnover	Amadeus
Age	Current year – Registration year	Amadeus
Liquidity	(Current Assets – Stock)/Total Assets	Amadeus

3.2 Dependent variable

Our dependent variable measuring the financial soundness of firms is the Altman Z-Score. As one of the most widely used indicators (Altman and Hotchkiss, 2006), the Altman Z'-Score was selected as it can be adapted to non-publicly traded firms like those utilized in the present work. The index was elaborated by Altman through the use of a multiple discriminate analysis (MDA) where discrimination is determined by a score and the «Z-score» is calculated on the basis of accounting ratios. More specifically, as a dependent variable we used the Z''-Score (1983), which has been found to perform satisfactorily when applied to an international context for the prevision of bankruptcy (Altman et al., 2017).

The variable is calculated as follows:

$$Z''\,score = 3.25 + 6.56\,\mathrm{X1} + 3.26\,\mathrm{X2} + 6.72\,\mathrm{X3} + 1.05\,\mathrm{X4}$$

X1 is defined as Working Capital/Total Assets (WC/TA).

The working capital/total assets ratio frequently used in studies on corporate problems is a measure of the net liquid assets of a firm relative to total capitalization. Working capital is defined as the difference between current assets and current liabilities. Liquidity and size characteristics are explicitly considered.

X2 is defined as Retained Earnings/Total Assets (RE/TA).

Retained earnings correspond to the total amount of reinvested earnings and/or losses of a firm over its entire lifecycle. The account is also referred to as an earned surplus. The age of a firm is implicitly considered in this ratio. For example, a relatively young firm is likely to have a low RE/TA ratio because it has not had sufficient time to build up its cumulative profits.

X3 is defined as Earnings before Interest and Taxes/Total Assets (EBIT/TA).

This ratio is a measure of the true productivity of a firm's assets independent of any tax or leverage factors. Since a firm's ultimate existence is based on the earning power of its assets, the ratio appears to be particularly appropriate for studies dealing with corporate failure.

X4 is defined as the Book Value of Equity/the Book Value of Total Liabilities (BVE/TL).

This measure shows to what extent a firm's assets can decline in value (measured by the market value of equity plus debt) before liabilities exceed assets and the firm becomes insolvent.

3.3 Independent variables

The explanatory variables considered in the models are designed to reflect firm characteristics on one hand and local characteristics on the other. All firm-level variables are drawn from the Amadeus dataset.

At the firm level, we first introduce two classical variables determining firm soundness, i.e., *Size* and *Age* (Coad, 2009; Hatem, 2014). We include firm *Size* as a proxy of creditworthiness. Fama and French (1995) show that small firms have persistently low earnings, higher levels of financial leverage, and more earnings uncertainty and are more likely to reduce dividends than large firms. Consistent with this view, many previous empirical findings state a positive effect of size on firm performance with the conclusion that larger firms are characterized by higher levels of profitability (Hurst and Pugsley 2011; Fort et al. 2013) and consequently face less bankruptcy risk than small firms (Arcuri et al., 2019). To take into account a possible non-linear effect on firm performance at the local level (Raspe and Van Oort, 2008), we also introduce into the model the size squared. Following Coad (2009), we adopt an accounting conception of firm size and define this variable (*Size*) by the logarithm of the annual turnover of a company.

The relationship between a firm's age and its growth rate has also been frequently investigated in the literature (Coad et al., 2013; Strotmann, 2007). Coad et al. (2013) note that age influences firm performance in three ways (selection, learning-by-doing, and inertia effects) depending on whether firm performance remains the same, improves or declines over time. We thus introduce it into the equation to be estimated. Age is computed as the difference between the year of registration and the current year.

In addition to these classical individual characteristics and in line with Bridges and Guariglia (2008) and Musso and Schiavo (2008), we introduce a variable denoting a firm's short term-capacity for repayment as an explanatory variable of its future robustness. The liquidity ratio can be used as a proxy for financial constraint since constrained firms tend to sell equipment and corporate assets to prevent credit rationing, especially during an economic crisis (Campello et al., 2010). Constrained firms thus adopt optimal cash policies to balance the profitability of current with future investments while reducing their investment plans, a cut that can have a negative impact on their growth path (Chowdhury et al., 2016; Kaplan and Zingales, 1997). The liquidity ratio is also a signal of a better probability of repayment, an element that should provide better access to credit, which in turn reduces the risk of firm failure (Arcuri and Levratto, 2018). We compute the liquidity ratio, ***liquidity*,** as (Current Assets – Stock)/Total Assets.

At the local level, we take into account human capital, agglomeration economies, and the demand side of market opportunities from variables provided by Eurostat. All of these variables are computed for the NUTS 2 regions of the four countries under review.

As a proxy of human capital, we consider educational attainment levels of the population. The variable *Education* is calculated by dividing the number of employed people aged 20-64 years having completed tertiary education (ISCED 2011 levels 5-8[1]) by the total population of the same age group. Tertiary education includes what is commonly understood as academic education and advanced vocational or professional education and corresponds to a higher level of skill in the educational system. The second indicator used to proxy knowledge intensive spillovers is employment in technology and knowledge-intensive sectors of NUTS 2 regions (NACE Rév. 2). This approach rests upon the sectoral strategy adopted by Eurostat[2] and corresponds to the percentage of those older than 15 and younger than 74 working in high-tech sectors. In addition, we control for *GDPpercapita* as a measure of macroeconomic conditions calculated as the logarithm of GDP per thousand inhabitants. Finally, to measure the effect of external agglomeration economies at the regional level, we include the variable *Density* defined as the logarithm of the number of employees on the number of squared metres of each region. For the regions considered in this study, the variables that are at measured the local level are displayed in the following figures.

Industry and country dummies are also included to capture industry- and country-specific unobserved characteristics.

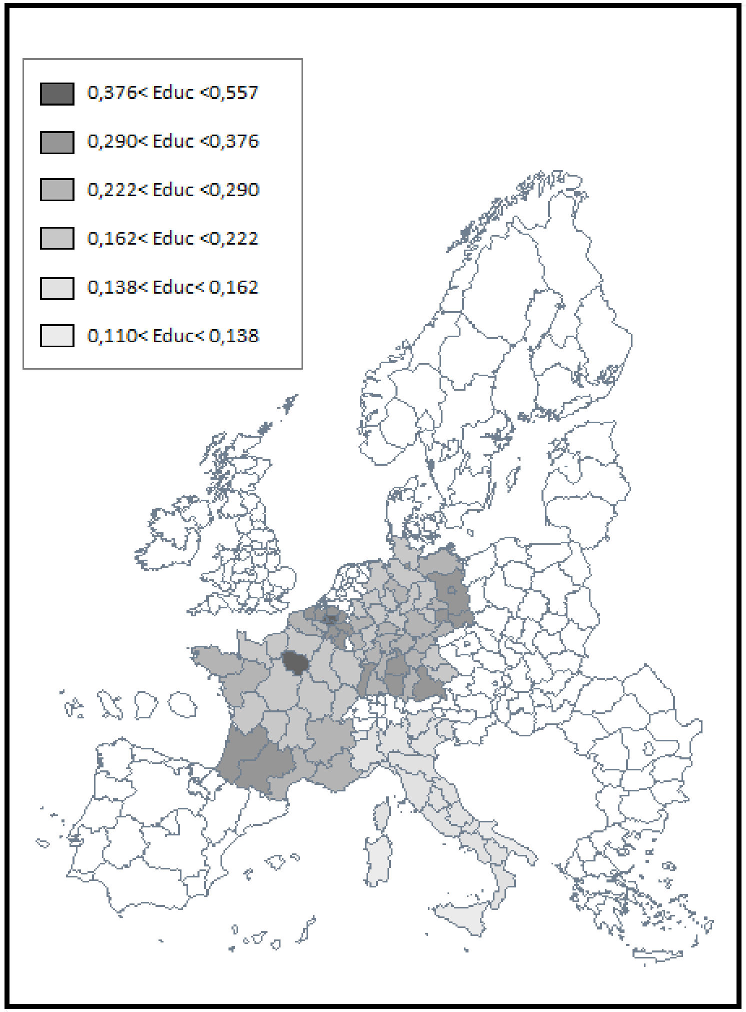
3.4 The model

Companies operate in a socio-economic context that significantly affects the performance of business processes (Audretsch and Dohse, 2007; Garsaa and Levratto, 2016). This finding is highlighted, as apparently weak ties between an organization and external parties can have a relevant impact not only on competitiveness and business performance but also on institutional structures and entrepreneurial goals. In other words, firms operating in the same territory share the same external environment; consequently, they are likely to be more similar to one another than firms operating in different geographical areas. From an econometric perspective, the most important effect of this similarity relates to the fact that the assumption of independence of standard errors is violated. This problem is resolved by using a multilevel approach, which provides efficient estimates of coefficients since it controls for spatial dependence and correct standard errors of variables.

[1] Levels 5, 6, 7 and 8 of the International Standard Classification of Education are defined as short-cycle tertiary education, a Bachelor's degree or equivalent education, a Master's degree or equivalent education, and a Doctoral degree or equivalent education, respectively (UNESCO, 2012)

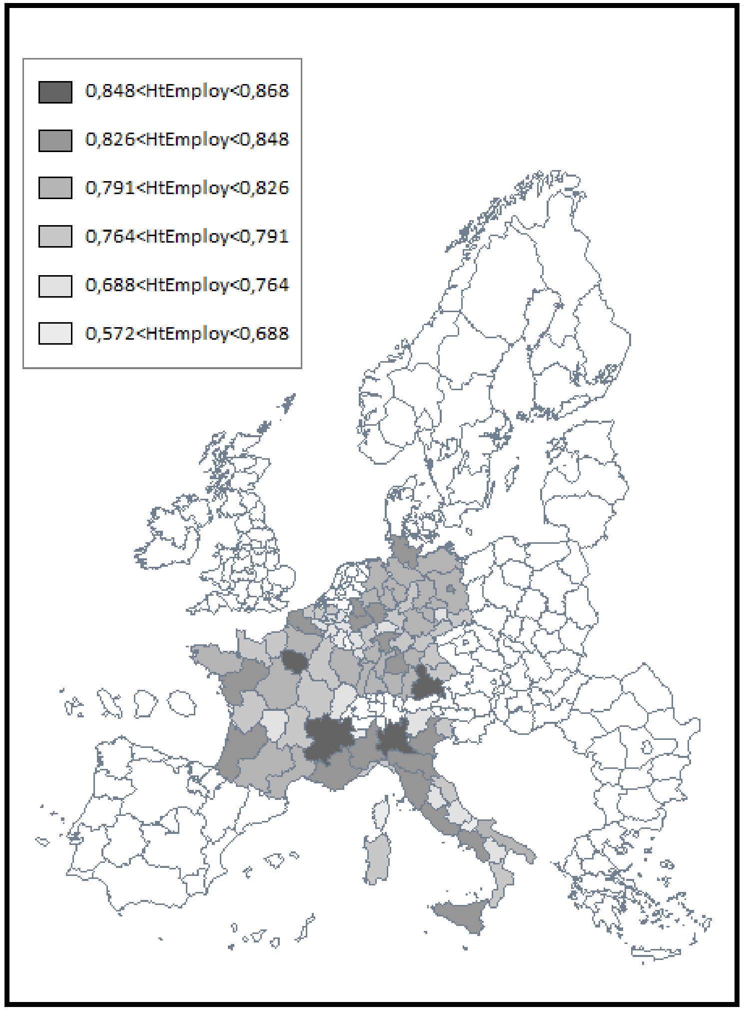
[2] More information on the computational methodology used is available at: http://ec.europa.eu/eurostat/cache/metadata/en/htec_esms.htm

Figure 1: Level of Education (Mean values 2010-2015)



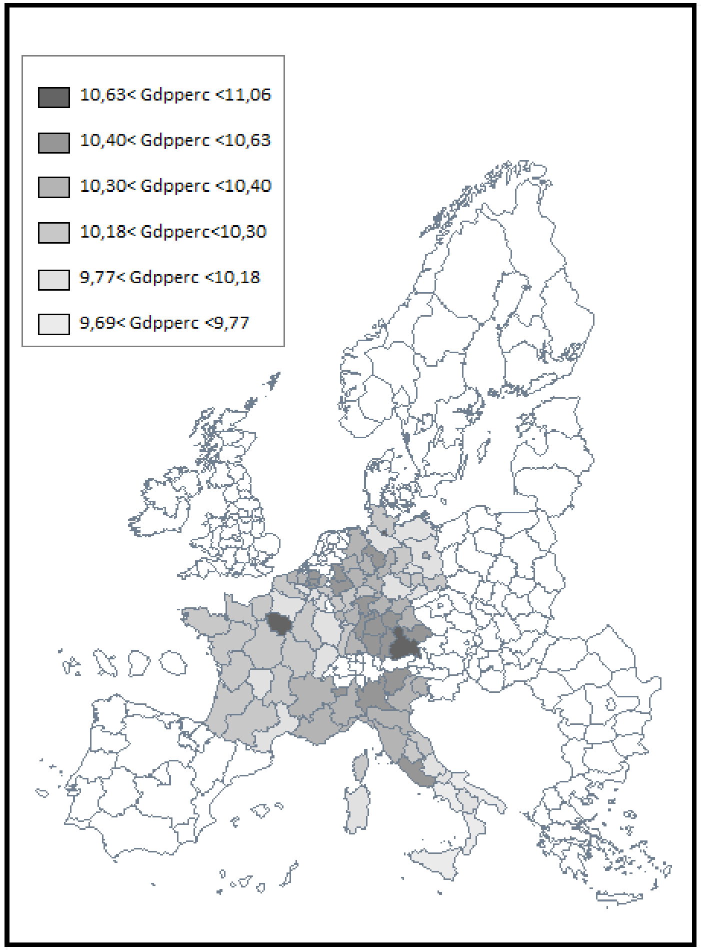
Source: Authors' elaboration based on the Eurostat Dataset

Figure 2: Level of Employment in HT (Mean values 2010-2015)



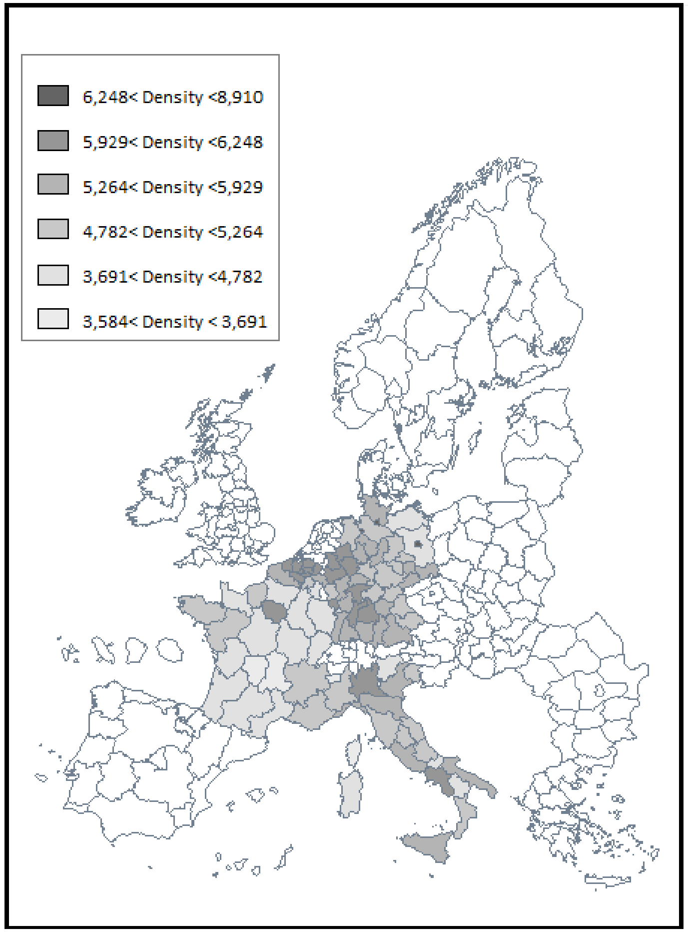
Source: Authors' elaboration based on the Eurostat Dataset

Figure 3: Level of GDP per capita (Mean values 2010-2015)



Source: Authors' elaboration based on the Eurostat Dataset

Figure 4: Level of Density (Mean values 2010-2015)



Source: Authors' elaboration based on the Eurostat Dataset

The analysis focuses on SMEs for the 2010–2015 period. Then, as SMEs are embedded in local markets, a hierarchy of three levels is used. Multiple measurements of the firm soundness index for different time points represent level 1 of the hierarchy. Punctual-time observations nested within SMEs represent level 2 of the model. Further, SMEs nested in local markets (NUTS 2) represent level 3 of the structure. This hierarchy is widely in multilevel model literature on panel data (Steele, 2008; Aiello and Bonanno, 2018). The basic model is:

$$y_{tij} = \beta_{0ij} + e_{tij} \tag{1}$$

where y_{tij} is the vector of a firm's soundness measure of the i-th corporation operating in the j-th region (with t=2010...,2015, I= 1..., Nj and j=1,…,p) at time *t*.

Erratic component e_{tij} captures randomness due to time.

In Equation (1) element β_{0ij} varies across firms and regions. It is composed of a constant (γ_{000}) and random variations due to the regional (μ_{00j}) and firm levels (μ_{0ij}). Thus, Equation 1 becomes:

$$y_{tij} = \gamma_{000} + \mu_{00j} + \mu_{0ij} + e_{tij} \tag{2}$$

Equation 2 represents the empty model, a multilevel model without explanatory variables. From Equation (2), it is possible to identify the overall intercept (γ_{000}) and three different components of the variance of y_{tij}: the variance of random error e_{tij} (σ_e^2), the within group variance, the variance of u_{00j} (σ_{uj}^2), the between group variance of regions and the variance of μ_{0ij} (σ_{ui}^2) for the between group variance at the firm level.

A useful way to exploit this information involves computing the intra-class correlation (ICC), which represents the proportion of variance underlying each level of the model hierarchy and which thus explains to what extent the heterogeneity of the dependent variable can be attributed to each level. The ICC for the regional level is computed as the ratio between the regional and total variance as follows:

$$ICC_j = \frac{\sigma_{uj}^2}{\sigma_{uj}^2+\sigma_{ui}^2+\sigma_e^2} \tag{3}$$

Consequently, the ICC for the firm and time level are respectively:

$$ICC_i = \frac{\sigma_{ui}^2}{\sigma_{uj}^2+\sigma_{ui}^2+\sigma_e^2} \tag{4}$$

$$ICC_t = \frac{\sigma_e^2}{\sigma_{uj}^2+\sigma_{ui}^2+\sigma_e^2} \tag{5}$$

Since our data follow a panel structure, the multilevel specification controls for the effect of time. Consequently, time can be considered a variable to add to Equation 2, which becomes:

$$y_{tij} = \gamma_{000} + \mu_{00j} + \mu_{0ij} + \delta_{.ij}Time + e_{tij} \tag{6}$$

Finally, the model allows for the simultaneous consideration of variables defined at the firm level (X_{htij} where h is the number of covariates) and of regional variables ($R_{kt.j}$ where k is the number of local covariates). Thus, the final econometric specification can be written as follows:

$$y_{tij} = \gamma_{000} + \sum_{h=1}^{r} \beta_h X_{htij} + \sum_{k=1}^{s} \rho_k R_{kt.j} + \mu_{00j} + \mu_{0ij} + \delta_{.ij}Time + e_{tij} \tag{7}$$

4. Results

4.1 From the empty model to the effect of local features.

This section refers to estimations obtained from applying the multilevel model to our data. First, we consider the empty model, which allows us to evaluate how much of the variation in outcomes can be strictly attributed to unobserved factors operating at each level. In our case, the three levels are as follows: time, firm and region. Second, we present results obtained when the model is augmented with firm-specific and local variables as the principal aim of our analysis.

Table 2 shows the results obtained when running the empty model. The empty multilevel model allows one to understand how much of the variation in outcomes may be attributable to unobserved factors at each level. The first result to be discussed is the value of the likelihood ratio test (LR test), which compares the empty multilevel model to the standard OLS regression, for which the null hypothesis states that there is no random intercept in the model. When the null hypothesis is true, the OLS regression can be used instead of a mixed model. According to our results, the test is highly significant for every specification of the empty model, supporting the use of the multilevel model. Consequently, intercepts related to the different clusters should be treated as group by group variant coefficients.

Table 2. Explaining heterogeneity in firm soundness: Empty model.

	(1) No time effect	(2) Time effect (intercept)	(3) Time effect (intercept and level 3 slopes)
Constant	5.980***	-126.0***	-118.5***
	(0.0778)	(3.455)	(9.206)
year		0.0656***	0.0619***
		(0.00172)	(0.005)
Variance			
Firm (intercept)	3.058***	3.064***	3.064***
	(0.031)	(0.031)	(0.031)
Region (intercept)	0.502***	0.502***	0.501***
	(0.797)	(0.798)	(0.080)
Region (slope)			0.00108***
			(0.000317)
Residual	0.474***	0.464***	0.463***
	(0.003)	(0.003)	(0.080)
ICC (%)			
Region	12.4	12.4	12.4
Firm	75.8	76.0	76.2
Time	11.8	11.6	11.4
N observations	86,839	86,839	86,839
N of groups			
Firm level	22,079	22,079	22,079
Regional level	91	91	91
Log likelihood	-126368.6	-125652.0	-125608.1
LR test	1.1e+05***	1.2e+05***	1.2e+05***

Note: Standard errors are shown in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Results of the multilevel regressions run with command xtmixed are available from Stata13 version.

Column 1 of Table 2 refers to the random intercept empty model in which the second level is formed by 22,079 SMEs, while the third level is composed of 91 NUTS 2 regions. The value of the ICC represents the proportion of variability underlying each level of the model hierarchy: unaccounted regional-specific features capture 12.4% of firm robustness, time-specific factors explain 11.8% of variability, while the remaining 75.8% is attributable to firm-specific features. The relevant percentage of heterogeneity explained by the regional level confirms hypothesis H1 stating that coherent with the SCP approach, a combination of individual- and local-level factors explains firm soundness more accurately than individual characteristics alone.

Column 2 of Table 2 shows the results obtained when we augment the empty model with the variable *year*. This variable has a positive sign and is statistically significant at 0.1%, showing that the robustness of European SMEs increases with time, and this finding shows that small and medium-sized enterprises have been able to absorb effects of the financial crisis that hit the global economy in 2008. This specification shows the same percentage of heterogeneity explained by regionally specific unobservable factors (12.4%). Column 3 shows the results for the empty model obtained when time is added as a source of randomness in regional intercepts and slopes, confirming the same percentage of heterogeneity influenced by the local level.

Table 3 shows the estimations obtained when we augment the multilevel model with a set of firm- and region-specific factors[3].

Column 1 of Table 3 shows estimations obtained for the full model. We find a non-linear relationship between firm *Size* and our proxy of firm robustness (*Z-score''*), confirming the results obtained by Kim (2016). The linear component of this variable is positive and statistically significant at 0.1%, and therefore larger companies are characterized by a higher degree of financial robustness. The variable *Age* has a positive sign and is statistically significant at 0.1%. This finding confirms evidence from the literature showing that age and size increase the soundness of companies and as a consequence that young and very small firms are more likely to exit from the market than other firms (Kale and Arditi, 1998; Thornhill and Amit, 2003). The variable *Year* of the empty model has a positive sign and is statistically significant at 0.1%, confirming that small and medium-sized enterprises have been able to absorb the effects of the financial crisis that hit the global economy in 2008. The variable *liquidity* has a positive sign and is statistically significant, showing that the firms' short-term capacities for repayment are relevant in increasing firm soundness, as they can be considered an element that should provide a better access to credit, and this in turn reduces the risk of firm failure (Arcuri and Levratto, 2018).

[3] All regressions control for country- and industry-specific unobserved characteristics.

Table 3: Model with firm- and region-specific variables

	(1) Full sample	(2) Cluster A: Low knowledge intensive regions	(3) Cluster B: Medium knowledge intensive regions	(4) Cluster C: High knowledge intensive regions
Size	0.237***	0.274***	-0.0249	0.578***
	(0.055)	(0.0669)	(0.105)	(0.170)
Size^2	-0.0126***	-0.0130***	-0.00393	-0.0245***
	(0.002)	(0.00239)	(0.00354)	(0.00561)
Liquidity	3.528***	3.005***	3.589***	4.204***
	(0.034)	(0.0545)	(0.0552)	(0.0724)
Age	0.0164***	0.0269***	0.0132***	0.0132***
	(0.001)	(0.00120)	(0.000860)	(0.00109)
Education	1.078***	2.126***	1.920**	0.429
	(0.310)	(0.636)	(0.626)	(0.452)
HTEmploy	0.809**	0.989*	1.041*	0.293
	(0.277)	(0.399)	(0.515)	(0.624)
Density	-0.0624	0.137*	-0.0605	-0.0597
	(0.037)	(0.0588)	(0.0953)	(0.0515)
GDPpercapita	0.0244	-0.113	0.591	-0.00514
	(0.124)	(0.162)	(0.304)	(0.201)
year	0.0516***	0.0345***	0.0454***	0.0561***
	(0.005)	(0.00819)	(0.0106)	(0.00857)
constant	-102.3***	-68.05***	-94.30***	-111.7***
	(9.875)	(16.15)	(20.12)	(16.89)
Industry dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Number of observations	86,839	31,791	33,947	21,101
N of regions	91	21	37	33
Log likelihood	-120071.6	-40974.1	-47314.2	-31202.7

Note: Standard errors are shown in parentheses * p < 0.05, ** p < 0.01, *** p < 0.001. Results of multilevel regressions run with the command xtmixed are available from Stata13 version.

In focusing on the specific objectives of this paper, it is worth discussing the empirical findings on how the regional features considered in this study affect firm robustness.

The variable *Education* has a positive sign and is statistically significant at 0.1%, suggesting that a higher level of tertiary education in a certain region tends to increase firm soundness. This finding confirms hypothesis H2 stating that a higher education level in a region positively influences firm soundness. This is coherent with previous empirical findings showing that a local market characterized by a significant share of highly educated and skilled workers increases the productivity of the whole work force through human capital externalities (Moretti, 2004; Rauch, 1993), allowing firms to be more efficient. Thus, human capital can be considered a critical factor accounting for levels of regional success and competitiveness. We obtain the same effect for the variable *HTEmploy*, suggesting that a higher employment level in high-tech industries positively influences firm soundness, thus confirming hypothesis H3. Local knowledge spillovers are beneficial to a company, as they are able to capture ideas and inputs (competencies, technologies and underlying knowledge bases) from other related activities (Boschma and Iammarino, 2009). Proximity to knowledge producers allows a firm to benefit from other firms' spillovers.

To decode the spatial distribution of firm robustness across regions, we conduct cluster analyses to classify regions by degree of knowledge intensiveness. With regard to regional knowledge levels, we choose as our clustering variable a composite index of education and employment in high tech industries and thereby classify 91 NUTS 2 regions into three groups (*A*, *B*, *C*) for which we estimate our model separately[4]. Each observation is assigned to the group whose median is the closest, and then based on this categorization new group medians are determined. These steps continue until observations no longer change groups. Low levels of knowledge intensity are found for the regions grouped under cluster A. The highest levels of are measured for the regions of cluster C. Our aim is to ascertain if the effects of education and employment levels in high-tech industries at the local level depend on the initial level of knowledge that characterizes a certain region. Corresponding results are shown in Table 3, columns 2-4.

Cluster A corresponds to almost all Italian regions and to some remote French regions typically characterized by economic problems. In these regions, *Education*, *HTEmploy* and *Density* have a positive effect on firm soundness. These results confirm Krugman's theory on the role played by agglomeration and density in economic development. By contrast, in cluster C, one finds the richest European regions, most of which are located in Belgium and Germany with some exceptional regions in France. These regions correspond to the so-called blue-banana region, which differs from other European regions in demographic, economic, infrastructural and cultural-educational features (Polese, 2010). In these regions, density, education and HT employment levels are already high, and thus, an increase in their value does not generate any improvement in firm soundness, as shown by non-significant coefficients associated with the local variables. This can correspond to a threshold effect beyond which the marginal effect exerted by agglomeration economies tends to be cancelled out. The intermediate cluster (B) is more diverse and includes the northern Italian regions, areas of former East Germany (except for major cities) and the remaining French regions. In this cluster, *Density* is no longer significant, while *Education* and *HTEmploy* still have a positive influence on firm soundness at the local level.

4.2 Robustness checks

[4] The map and list of regions for the three clusters are available in Appendix 3.

Table 4: Robustness checks

	(1) Excluding small regions	(2) Excluding large regions	(3) 2 step-GMM
Size	0.235***	0.385***	0.401***
	(0.0546)	(0.0707)	(3.47)
$Size^2$	-0.0125***	-0.0177***	-0.0194***
	(0.00188)	(0.00243)	(-4.63)
Liquidity	3.524***	3.696***	3.474***
	(0.0344)	(0.0440)	(21.93)
Age	0.0165***	0.0135***	0.130***
	(0.000588)	(0.000688)	(5.99)
Educ	1.054***	0.687*	2.802*
	(0.310)	(0.341)	(1.99)
HTEmploy	0.802**	0.679*	6.759***
	(0.277)	(0.303)	(3.37)
Density	-0.0544	-0.0423	-0.0253
	(0.0375)	(0.0384)	(-0.04)
GDPpercapita	0.0338	-0.0684	-0.697
	(0.126)	(0.137)	(-0.56)
year	0.0517***	0.0580***	
	(0.00504)	(0.00547)	
cons	-102.6***	-115.3***	
	(9.899)	(10.76)	
Industry dummies	YES	YES	
Country dummies	YES	YES	
Number of observations	86,644	54,503	54,283
Log-likelihood	-119758.9	-78015.7	
Centred R^2			0.1169
Fisher statistic			166.70***
Underidentification test (Kleibergen-Paap)			13.463**
Hansen J statistic			1.137

Note: Standard errors are shown in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Results from the multilevel regressions run with the command xtmixed available in Stata13 version.
Results of the two-step GMM-HAC model run with command xtivreg2 with the robust, cluster and gmm2s options sets.

Two checks of robustness are performed. The first robustness exercise, following the approach proposed by Fazio and Piacentino (2010), investigates to what extent our results are affected by the smallest and the largest groups. Hence, we created a classification of region size in terms of the number of firms, and we run separate regressions in which the smallest (5^{th} percentile) or largest regions (regions exceeding the 95^{th} percentile) are dropped from the sample. Again, as can be observed from columns 1 and 2 of Table 4, the results do not change significantly. Second, to test the robustness of our results, we run fixed effects[5] instrumental variable estimations with clustered-robust standard errors (two-step GMM-HAC) that correspond to the cluster-robust covariance matrix for the fixed-effects model developed by Arellano (1987). In this context, the two-step GMM-HAC technique allows us to address at least four problems. First, correlations between firm fixed effects (the time-invariant component of the composed error term) and explanatory variables can be controlled by fixed effects modelling. Second, correlations between the time-variant part of the composed error term and local variables, which can lead to endogeneity bias, can be controlled using the instrumental variables method[6]. Third, the clustering of standard errors allows us to control for within-region correlations[7]. Fourth, standard errors can be controlled for classical autocorrelations and heteroscedasticity bias. The estimations provided by this last model (column 3 of Table 4) confirm results obtained with the multilevel model for panel data.

5. Conclusion

This paper investigates the role of regional context with regard to the effect of human capital and knowledge spillovers on firm soundness.

We find that firm soundness is shaped by a combination of individual characteristics and local features. In particular, a higher level of education and knowledge spillovers at the regional level enhance the robustness of SMEs. These results could be of interest to policy makers at the national and European levels. In a context of budgetary constraints, less advantaged regions should be targeted by local development programmes that should focus on education and HT employment, whose effects are observable over the medium-term.

Notwithstanding the above findings and contributions, this study and its outcomes have some limitations. A first limitation relates to the nature of the dependent variable, the Z-score based on accounting data, which may be sensitive to national accounting practices and budget policies. Furthermore, our results may depend on the regional scale considered. By limiting the analysed local context, one may be able to consider spatial effects of agglomeration economies, which are typically bounded to a limited scale.

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[5] Overall, a fixed effect model is the most preferred estimation tool, as suggested by the Hausman test, which measures the difference between the FE and RE estimators of coefficients. This test yields a $\chi 2$ value of 794.35 and a *p* value of 0.00. These findings lead us to reject the null hypothesis (according to which differences in the coefficients are not systematic) and to conclude that the FE estimator is consistent.

[6] Six instruments have been used for the four local variables: the annual rate of variation in the regional level of education, the rate of variation in the active population, the rate of variation in the economic weight of the region, variation in regional unemployment, the rate of variation in regional density, and educational level elasticity relative to regional gross value added.

[7] In our case, the number of clusters (NUTS 2) is equal to 91, which is greater than the efficient threshold of 50 (Kézdi, 2004).

Appendices

A1. Descriptive statistics

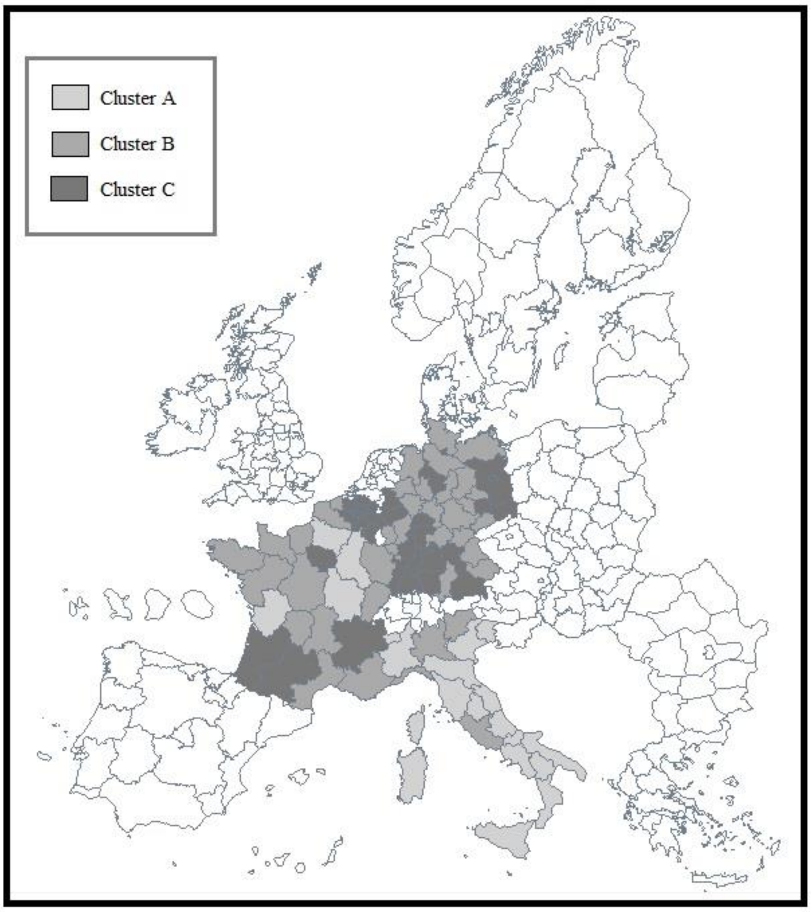
	mean	Standard deviation	min	p10	p25	p50	p75	p90	max
Z score	5.828	2.008	0.021	3.376	4.351	5.657	7.192	8.580	12.348
Size	15.657	1.048	2.773	14.477	15.063	15.638	16.325	16.940	19.946
Liquidity	0.460	0.196	0.000	0.205	0.315	0.455	0.600	0.725	1.000
Age	27.856	19.222	1.000	9.000	15.000	25.000	36.000	51.000	637.000
Educ	0.234	0.082	0.110	0.141	0.162	0.222	0.290	0.349	0.557
HTEmpl	0.787	0.050	0.572	0.723	0.764	0.791	0.826	0.844	0.873
Density	5.293	0.753	3.584	4.234	4.782	5.264	5.929	6.058	8.910
GDPperc	10.291	0.219	9.693	10.073	10.177	10.299	10.404	10.483	11.056
Observations	86839								

A2. Correlation Matrix

Variable	Zscore	Size	Liquidity	age	Educ	HTEmpl	Density	GDPperc
Z score	1.000							
Size	0.089	1.000						
Liquidity	0.342	0.191	1.000					
Age	0.153	0.143	-0.074	1.000				
Educ	0.334	0.188	0.109	0.096	1.000			
HTEmpl	-0.067	0.115	-0.009	0.073	-0.170	1.000		
Density	-0.139	0.048	-0.028	0.031	-0.008	0.204	1.000	
GDPperc	0.056	0.134	0.043	0.111	0.358	0.636	0.544	1.000

A3. Regions by cluster (map and list)

Figure 5: Regions by cluster



Source: Authors' elaboration based on the Eurostat Dataset.

Table 5: List of regions by cluster (Name and NUTS 2 Code)

Cluster A	Code	Cluster B	Code	Cluster C	Code
Champagne-Ardenne	FR21	Prov. West-Vlaanderen	BE25	Région de Bruxelles-Capitale	BE10
Picardie	FR22	Niederbayern	DE22	Prov. Antwerpen	BE21
Bourgogne	FR26	Oberpfalz	DE23	Prov. Limburg (BE)	BE22
Poitou-Charentes	FR53	Oberfranken	DE24	Prov. Oost-Vlaanderen	BE23
Corse	FR83	Unterfranken	DE26	Prov. Vlaams-Brabant	BE24
Piemonte	ITC1	Schwaben	DE27	Prov. Brabant Wallon	BE31
Valle d'Aosta/Vallée d'Aoste	ITC2	Kassel	DE73	Prov. Hainaut	BE32
Abruzzo	ITF1	Mecklenburg-Vorpommern	DE80	Prov. Liège	BE33
Molise	ITF2	Braunschweig	DE91	Prov. Luxembourg (BE)	BE34
Campania	ITF3	Lüneburg	DE93	Prov. Namur	BE35
Puglia	ITF4	Weser-Ems	DE94	Stuttgart	DE11
Basilicata	ITF5	Münster	DEA3	Karlsruhe	DE12
Calabria	ITF6	Detmold	DEA4	Freiburg	DE13
Sicilia	ITG1	Arnsberg	DEA5	Tübingen	DE14
Sardegna	ITG2	Koblenz	DEB1	Oberbayern	DE21
Veneto	ITH3	Trier	DEB2	Mittelfranken	DE25
Friuli-Venezia Giulia	ITH4	Saarland	DEC0	Berlin	DE30
Emilia-Romagna	ITH5	Chemnitz	DED4	Brandenburg	DE40
Toscana	ITI1	Sachsen-Anhalt	DEE0	Bremen	DE50
Umbria	ITI2	Schleswig-Holstein	DEF0	Hamburg	DE60
Marche	ITI3	Thüringen	DEG0	Darmstadt	DE71
		Haute-Normandie	FR23	Gießen	DE72
			FR24	Hannover	DE92
		Basse-Normandie	FR25	Düsseldorf	DEA1
		Nord - Pas-de-Calais	FR30	Köln	DEA2
		Lorraine	FR41	Rheinhessen-Pfalz	DEB3
		Franche-Comté	FR43	Dresden	DED2
		Pays de la Loire	FR51	Leipzig	DED5
		Bretagne	FR52	Île de France	FR10
		Limousin	FR63	Alsace	FR42
		Auvergne	FR72	Aquitaine	FR61
		Languedoc-Roussillon	FR81	Midi-Pyrénées	FR62
		Provence-Alpes-Côte d'Azur	FR82	Rhône-Alpes	FR71
		Liguria	ITC3		
		Lombardia	ITC4		
		Trentino Alto Adige	ITH2		
		Lazio	ITI4		

References

Abou-Moghli, A. A., & Al-kasasbeh, M. M. (2012). Social Network and the Success of Business Start-Up. *International Journal of Business and Management*, *7*(9), 134–141. https://doi.org/10.5539/ijbm.v7n9p134

Acs, Z., Armington, C., & Zhang, T. (2007). The determinants of new-firm survival across regional economies: The role of human capital stock and knowledge spillover. *Papers in Regional Science*, *86*(3), 367–391.

Acs, Z., Åstebro, T., Audretsch, D., & Robinson, D. T. (2016). Public policy to promote entrepreneurship: a call to arms. *Small Business Economics*, *47*(1), 35–51. https://doi.org/10.1007/s11187-016-9712-2

Acs, Z. J., & Armington, C. (2004). The impact of geographic differences in human capital on service firm formation rates. *Journal of Urban Economics*, *56*(2), 244–278. https://doi.org/10.1016/j.jue.2004.03.008

Agarwal, R., & Audretsch, D. B. (2001). Does Entry Size Matter? The Impact of the Life Cycle and Technology on Firm Survival. *Journal of Industrial Economics*, *49*(1), 21–43. https://doi.org/10.1111/1467-6451.00136

Agarwal, R., & Gort, M. (1996). The Evolution of Markets and Entry, Exit and Survival of Firms. *The Review of Economics and Statistics*, *78*(3), 489–498. https://doi.org/10.2307/2109796

Aiello, F., & Bonanno, G. (2018). Multilevel empirics for small banks in local markets. Papers in Regional Science, 97(4), 1017-1037. doi:https://doi.org/10.1111/pirs.12285

Altman, E. I. (1984). The success of business failure prediction models: An international survey. *Journal of Banking & Finance*, *8*(2), 171–198. https://doi.org/10.1016/0378-4266(84)90003-7

Altman, E. I., & Hotchkiss, E. (2006). Corporate Financial Distress & Bankruptcy (3 ed.). Wiley.

Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial Distress Prediction in an International Context: A Review and Empirical Analysis of Altman's Z-Score Model. *Journal of International Financial Management and Accounting*, *28*(2), 131–171. https://doi.org/10.1111/jifm.12053

Arcuri, G., Brunetto, M., & Levratto, N. (2019). Spatial patterns and determinants of firm exit: an empirical analysis on France. Annals of regional science, 62(1), 99-118. doi:https://doi.org/10.1007/s00168-018-0887-0

Arcuri, G., & Levratto, N. (2018). Early stage SME bankruptcy: does the local banking market matter? *Small Business Economics*. https://doi.org/10.1007/s11187-018-0042-4

Arellano, M. (1987). Computing Robust Standard Errors for Within-Groups Estimators. Oxford Bulletin of Economics and Statistics, 49(4), 431-434. doi: https://doi.org/10.1111/j.1468-0084.1987.mp49004006.x

Audretsch, D. B. (1991). New-Firm Survival and the Technological Regime. *The Review of Economics and Statistics*, *73*(3), 441. https://doi.org/10.2307/2109568

Audretsch, D. B. (1995). *Innovation and Industry Evolution*. Cambridge MA: MIT Press.

Audretsch, D. B., & Dohse, D. (2007). Location: A Neglected Determinant of Firm Growth. *Review of World Economics*, *143*(1), 79–107.

Audretsch, D. B., & Feldman, M. P. (1996). R&D Spillovers and the Geography of Innovation and Production. *American Economic Review*, *86*(3), 630–640. https://doi.org/Article

Audretsch, D. B., & Lehman, E. E. (2005). Mansfield's Missing Link: The Impact of Knowledge Spillovers on Firm Growth. *Journal of Technology Transfer*, *30*, 207–210.

Backman, M. (2014). Human capital in firms and regions: Impact on firm productivity. *Papers in Regional Science*, *93*(3), 557–575. https://doi.org/10.1111/pirs.12005

Backman, M. (2013). Regions, Human Capital and New Firm Formation. JIBS Dissertation Series(86).

Badinger, H., Tondl, G., & Fingleton, B. (2003). Trade, human capital and innovation: the engines of European regional growth in the 1990s. *American Journal of Agricultural Economics*, *88*(2), 215–238. https://doi.org/10.1111/j.1467-8276.2006.00863.x

Barro, R. J. (1991). Economic growth in a cross section of countries. *Quarterly Journal of Economics*, *106*(2), 407–443.

Berry, H., Guillén, M. F., & Hendi, A. S. (2014). Is there convergence across countries? A spatial approach. *Journal of International Business Studies*, *45*(4), 387–404. https://doi.org/10.1057/jibs.2013.72

Blundell, R., Dearden, L., Meghir, C., & Sianesi, B. (1999). Human capital investment: the returns from education and training to the individual, the firm and the economy. *Fiscal Studies*, *20*(1), 1–23.

Boschma, R., & Iammarino, S. (2009). Related variety,trade linkages, and regional growth in Italy. *Economic Geography*, *85*(3), 289–311. https://doi.org/10.1111/j.1944-8287.2009.01034.x

Bridges, S., & Guariglia, A. (2008). Financial constraints, global engagement, and firm survival in the United Kingdom: Evidence from micro data. *Scottish Journal of Political Economy*, *55*(4), 444–464. https://doi.org/10.1111/j.1467-9485.2008.00461.x

Campello, M., Graham, J. R., & Harvey, C. R. (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics*, *97*(3), 470–487. https://doi.org/10.1016/j.jfineco.2010.02.009

Carreira, C., & Lopes, L. (2015). Are Small Firms More Dependent on the Local Environment than Larger Firms? Evidence from Portuguese Manufacturing Firms. In R. Baptista & J. Leitão (Eds.), *Entrepreneurship, Human Capital, and Regional Development: Labor Networks, Knowledge Flows, and Industry Growth* (pp. 263–280). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-12871-9_13

Cassia, L., & Colombelli, A. (2010). Growth factors in medium-sized enterprises : the case of Italian regions. *International Entrepreneurship and Management Journal*, *6*(4), 437–458.

Cassia, L., Colombelli, A., & Palearia, S. (2009). Firms' growth: Does the innovation system matter? *Structural Change and Economic Dynamics*, *20*(3), 211–220.

Chowdhury, J., Kumar, R., & Shome, D. (2016). Investment-cash flow sensitivity under changing information asymmetry. *Journal of Banking and Finance*, *62*, 28–40. https://doi.org/10.1016/j.jbankfin.2015.07.003

Ciccone, A., & Hall, R. E. (1996). Productivity and the density of economic activity. *American Economic Review*, *86*(1), 54–70.

Coad, A. (2009). *The Growth of Firms: a Survey of Theories and Empirical Evidence*. Cheltenham, UK and Northampton, MA, USA: Edward Elgar.

Coad, A., Segarra, A., & Teruel, M. (2013). Like milk or wine: Does firm performance improve with age? *Structural Change and Economic Dynamics*, *24*(1), 173–189. https://doi.org/10.1016/j.strueco.2012.07.002

Cooke, P. (2002). Knowledge economies. Clusters, learning and cooperative advantage. *Routledge Studies in International Business and the World Economy*, (26), xii, 218 p. https://doi.org/10.4324/9780203445402

Doloreux, D., Freel, M., & Shearmur, R. (2010). *Knowledge-intensive business services: Geography and innovation.* Farnham, UK: Ashgate Publishing Ltd.

Esteve-Pérez, S., & Mañez-Castillejo, J. A. (2008). The resource-based theory of the firm and firm survival. *Small Business Economics*, *30*(3), 231–249. https://doi.org/10.1007/s11187-006-9011-4

Fama, E. F., & French, K. R. (1995). Size and Book- to- Market Factors in Earnings and Returns. The Journal of Finance, 50(1), 131-155. doi: https://doi.org/10.1111/j.1540-6261.1995.tb05169.x

Fama E. F and French K. R. (1992) The cross-section of expected stock returns. *Journal of Finance*, 47:427-465

Fazio, G., & Piacentino, D. (2010). A Spatial Multilevel Analysis of Italian SMEs' Productivity. Spatial Economic Analysis, 5(3), 299-316. doi:10.1080/17421772.2010.493953
Feldman, M. P., & Audretsch, D. B. (1999). Innovation in cities: Science-based diversity, specialization and localized competition. *European Economic Review*, *43*(2), 409–429. https://doi.org/10.1016/S0014-2921(98)00047-6
Florida, R., Mellander, C., & Stolarick, K. (2008). Inside the black box of regional development - Human capital, the creative class and tolerance. *Journal of Economic Geography*, *8*(5), 615–649. https://doi.org/10.1093/jeg/lbn023
Fort, T. C., Haltiwanger, J. C., Jarmin, R. S.,& Miranda, J. (2013). How firms respond to business cycles: The role of firm age and firm size. IMF Economic Review, 61, 520–559.
Freeman, J., Carroll, G. R., & Hannan, M. T. (1983). The liability of newness: Age dependence in organizational death rates. *American Sociological Review*, *48*(5), 692–710.
García-Posada, M., & Mora-Sanguinetti, J. S. (2015). Entrepreneurship and enforcement institutions: disaggregated evidence for Spain. *European Journal of Law and Economics*, *40*(1), 49–74. https://doi.org/10.1007/s10657-014-9470-z
Garsaa, A., & Levratto, N. (2016). Does the employment growth rate depend on local context? An analysis of French industrial establishments over the 2004-2010 period. Revue d'économie industrielle, 153, 47-89.
Gerber, E. R., & Loh, C. G. (2015). Spatial Dynamics of Vertical and Horizontal Intergovernmental Collaboration. *Journal of Urban Affairs*, *37*(3), 270–288. https://doi.org/10.1111/juaf.12139
Glaeser, E. L., & Kerr, W. R. (2009). Local industrial conditions and entrepreneurship: How much of the spatial distribution can we explain? In *Journal of Economics and Management Strategy*. https://doi.org/10.1111/j.1530-9134.2009.00225.x
Grillitsch, M., & Nilsson, M. (2019). Knowledge externalities and firm heterogeneity: Effects on high and low growth firms. *Papers in Regional Science*, *98*(1), 93–114.
Guiso, L., Sapienza, P., & Zingales, L. (2004). Does local financial development matter? *Quarterly Journal of Economics*, *119*(3), 929–969. https://doi.org/10.1007/978-3-7908-2112-3_3
Harrison, J. (2015). Introduction: New Horizons in Regional Studies. *Regional Studies*, *49*(1), 1–4. https://doi.org/10.1080/00343404.2014.980637
Hatem, B. S. (2014). Determinants of Firm Performance: A Comparison of European Countries. *International Journal of Economics and Finance*, *6*(10). https://doi.org/10.5539/ijef.v6n10p243
Henderson, J. V. (2003). Marshall's scale economies. *Journal of Urban Economics*, *53*(1), 1–28. https://doi.org/10.1016/S0094-1190(02)00505-3
Hormiga, E., Batista-Canino, R. M., & Sánchez-Medina, A. (2010). The role of intellectual capital in the success of new ventures. *International Entrepreneurship and Management Journal*, *7*(1), 71–92. https://doi.org/10.1007/s11365-010-0139-y
Hox, J. J. (2010). *Multilevel analysis: Techniques and applications* (Second edi). New York, DC.: Routledge.
Hox, J. J., & Roberts, J. K. (2011). *Handbook of advanced multilevel analysis*. New York, DC.: Routledge.
Huggins, R., Prokop, D., & Thompson, P. (2017). Entrepreneurship and the determinants of firm survival within regions: human capital, growth motivation and locational conditions. *Entrepreneurship & Regional Development*, *29*(3–4), 357–389. https://doi.org/10.1080/08985626.2016.1271830
Huggins, R., & Thompson, P. (2015). Culture and Place-Based Development: A Socio-Economic Analysis. *Regional Studies*, *49*(1), 130–159. https://doi.org/10.1080/00343404.2014.889817
Hurst, E., & Pugsley, B.W. (2011).What do small businesses do? Brookings Papers on Economic Activity, 2011(2), 73–118.
Ilmakunnas, P., & Topi, J. (1999). Microeconomic and macroeconomic influences on entry and exit of firms. *Review of Industrial Organization*, *15*(3), 283–301. https://doi.org/10.1023/A:1007786719982
Ipinnaiye, O., Dineen, D., & Lenihan, H. (2017). Drivers of SME performance: a holistic and multivariate approach. *Small Business Economics*, *48*(4), 883–911. https://doi.org/10.1007/s11187-016-9819-5
Jacobs, J. (1969). *The economies of cities*. New York: Random House.
Kale, S., & Arditi, D. (1998). Business failures: Liabilities of newness, adolescence, and smallness. Journal of Construction Engineering and Management, 124(6), 458–64. doi:10.1061/(ASCE)0733-9364(1998)124:6(458)
Kaplan, S. N., & Zingales, L. (1997). Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints? *The Quarterly Journal of Economics*, *112*(1), 169–215. https://doi.org/10.1162/003355397555163
Karlsson, C., & Dahlberg, R. (2003). Entrepreneurship, Firm Growth and Regional Development in the New Economic Geography: Introduction. *Small Business Economics*, *21*(1), 73–76.
Karlsson, C., Klaesson, J., & Öner, Ö. (2015). Regional Characteristics and the Survival of New Firms. In *55th Congress of the European Regional Science Association: "World Renaissance: Changing roles for people and places"* (p. Lisbon, Portugal).
Kézdi, G. (2004). Robust Standard Error Estimation in Fixed-Effects Panel Models. Hungarian Statistical Review(9), 95-116.
Kim, J., & Lee, C. Y. (2016). Technological regimes and firm survival. *Research Policy*, *45*(1), 232–243. https://doi.org/10.1016/j.respol.2015.09.006
Klepper, S. (1996). Entry, Exit, Growth, and Innovation over the Product Life Cycle. *The American Economic Review*, *86*(3), 562–583.
Klepper, S. (2002). Firm Survival and the Evolution of Oligopoly. *The RAND Journal of Economics*, *33*(1), 37–61. https://doi.org/10.2307/2696374
Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy*, *99*(3), 483–499.
Krugman, P. (1998). Space: The final frontier. *Journal of Economic Perspectives*, *12*(2), 161–174.
Li, S. X., & Greenwood, R. (2004). The effect of within-industry diversification on firm performance: Synergy creation, multi-market contact and market structuration. *Strategic Management Journal*, *25*(12), 1131–1153. https://doi.org/10.1002/smj.418
Littunen, H. (2000). Networks and Local Environmental Characteristics in the Survival of New Firms. *Small Business Economics*, *15*, 59–71. https://doi.org/10.1023/A:1026553424833
Mazzucato, M., & Parris, S. (2015). High-growth firms in changing competitive environments: The US pharmaceutical industry (1963 to 2002). *Small Business Economics*, *44*(1), 145–170.
McGuirk, H., Lenihan, H., & Hart, M. (2015). Measuring the impact of innovative human capital on small firms' propensity to innovate. *Research Policy*, *44*(4), 965–976. https://doi.org/10.1016/j.respol.2014.11.008
Mina, A., Bascavusoglu-Moreau, E., & Hughes, A. (2014). Open service innovation and the firm's search for external knowledge. *Research Policy*, *43*(5), 853–866. https://doi.org/10.1016/j.respol.2013.07.004
Moretti, E. (2004). Estimating the social return to higher education: evidence from longitudinal and repeated cross-sectional data. *Journal of Econometrics*, *121*(1–2), 175–212.
Mueller, S., & Stegmaier, J. (2014). Economic failure and the role of plant age and size. *Small Business Economics*, *44*(3), 621–638. https://doi.org/10.1007/s11187-014-9616-y
Musso, P., & Schiavo, S. (2008). The Impact of Financial Constraints on Firms Survival and Growth. *Journal of Evolutionary Economics*, *18*(2), 135–149. https://doi.org/10.17576/JEM-2015-4902-08
Polese, M. (2010). *The Wealth and Poverty of Regions: Why Cities Matter*. The University of Chicago Press.

Porter, M. (2000). Location, clusters and company strategy. In G. L. Clark, M. P. Feldman, & M. S. Gertler (Eds.), *The Oxford handbook of economic geography* (pp. 253–274). Oxford University Press. https://doi.org/10.1002/jqs.2586
Porter, M. E. (1979). The Structure within Industries and Companies' Performance. *The Review of Economics and Statistics*, *61*(2), 214–227. https://doi.org/Article
Ramajo, J., Márquez, M. A., Hewings, G. J. D., & Salinas, M. M. (2008). Spatial heterogeneity and interregional spillovers in the European Union: Do cohesion policies encourage convergence across regions? *European Economic Review*, *52*(3), 551–567. https://doi.org/10.1016/j.euroecorev.2007.05.006
Raspe, O., & van Oort, F. (2008). Firm growth and localized knowledge externalities. *The Journal of Regional Analysis and Policy*, *38*(2), 100–116.
Rauch, J. E. (1993). Productivity Gains from Geographic Concentration of Human Capital: Evidence from the cities. *Journal of Urban Economics*, *34*(3), 380-400.
Robert, H., & Thompson, P. (2015). Urban and Regional Horizons Culture and Place-Based Development : A Socio-Economic Analysis. *Regional Studies*, *49*(1), 130–159.
Scott, A. (1988). Metropolis: From the Division of Labor to Urban Form. University of California Press.
Sensier, M., Bristow, G., & Healy, A. (2016). Measuring Regional Economic Resilience across Europe: Operationalizing a complex concept. *Spatial Economic Analysis*, *11*(2), 128–151. https://doi.org/10.1080/17421772.2016.1129435
Shane, S., & Foo, M.-D. (1999). New firm survival: Institutional explanations for new franchisor mortality. *Management Science*, *45*(2), 142–159. https://doi.org/10.1287/mnsc.45.2.142
Sorenson, O., & Audia, P. G. (2000). The Social Structure of Entrepreneurial Activity: Geographic Concentration of Footwear Production in the United States, 1940-1989. *American Journal of Sociology*, *106*(2), 424–462. https://doi.org/10.1086/316962
Steele, F. (2008). Multilevel models for longitudinal data. Journal of the Royal Statistical Society, Series A, 171(1), 5-19.
Storper, M. (1995). The resurgence of regional economies, ten years later: the region as a nexus of untraded interdependencies. *European Urban and Regional Studies*, *2*(3), 191–221.
Strotmann, H. (2007). Entrepreneurial survival. *Small Business Economics*, *28*(1), 87–104. https://doi.org/10.1007/s11187-005-8859-z https://doi.org/10.1023/B:APJM.0000024083.66366.b1
Thornhill, S., & Amit, R. (2003). Learning About Failure: Bankruptcy, Firm Age, and the Resource-Based View. Organization Science, 14(5), 497–509.
UNESCO. (2012). *International Standard Classification of Edication - ISCED 2011*. Montreal (CA).
Van Der Panne, G. (2004). Agglomeration externalities: Marshall versus Jacobs. *Journal of Evolutionary Economics*, *14*(5), 593–604. https://doi.org/10.1007/s00191-004-0232-x
Van Oort, F. G., Burger, M. J., Knoben, J., & Raspe, O. (2012). Multilevel approaches and the firm-agglomeration ambiguity in economic growth studies. *Journal of Economic Surveys*, *26*(3), 468–491. https://doi.org/10.1111/j.1467-6419.2012.00723.x