Empirical analysis of the effects of related variety at national and regional level in EU

Jeroen Content, Koen Frenken, Jacob Jordaan

Document Identifier

D3.4 Empirical analysis of the effects of related variety at national and regional level in EU

Version

1.0

Date Due

M34

Submission date

28/02/2018

WorkPackage

3

Lead Beneficiary

FSU JENA

Grant Agreement Number 649378

Change log

Version[1]	Date	Amended by	Changes
1.0	23-11-2017	Jeroen Content	Send in to Regional Studies for peer review.
0.3	23-11-2017	Jeroen Content	Changes made according to feedback given by: Páger Balázs & Márkus Gábor.
0.2	01-10-2017	Jeroen Content	Changes made according to feedback given by: Andrea Hermann
0.1	09-06-2017	Jeroen Content	First draft

Partners involved

Number	Partner name	People involved
1	Utrecht University	Jeroen Content, Koen Frenken, Jacob Jordaan

[1]Please start with version 0.1. All minor changes will lead to a new number (0.2, 0.3, 0.4 etc.). The first complete draft will get the number 1.0. Again all minor revisions will lead to a new decimal number (1.1, 1.2, 1.3 etc.). A major revision will become 2.0 etc. etc. Until there is a final version which will be called 'final'.

Content

1. Executive summary

A number of studies have shown the positive effects of related variety among a region's sectors on a region's employment growth. However, the exact pathways through which spillovers between related sectors translate into new employment are left unanswered. Entrepreneurship may be a key vehicle through which business opportunities result from knowledge spillovers that lead to new jobs. By using pan-European survey data that distinguishes between opportunity- and necessity-driven entrepreneurs, we find that regional related variety positively affects regional opportunity-driven entrepreneurship, while no effect is found for necessity-driven entrepreneurship. These results hold also after controlling for national institutions affecting entrepreneurship.

2. Introduction

The investigation of the effects of different types of agglomeration externalities on the development of regional economies has motivated a vast expanding body of research ever since the seminal contributions of Glaeser et al. (1992) and Henderson et al. (1995). Particular interest has been in the question whether variety ('Jacobs externalities') or specialisation ('MAR externalities') promotes regional growth. To date, however, the empirical evidence has been inconclusive (Beaudry & Schiffauerova, 2009; de Groot et al., 2015). Making a distinction between related and unrelated variety, Frenken et al. (2007) argued that related variety can be expected to generate most of the spillovers between sectors, as knowledge from related sectors is more easily understood and recombined compared to knowledge from unrelated sectors. A recent review by Content & Frenken (2016) concluded that, although the evidence base is still rather small, the majority of studies on related variety support the hypothesis that related variety is a significant driver of regional growth, in particular, of regional employment growth.

Though the studies that associate related variety and regional growth are suggestive of processes where inter-industry spillovers lead to new business opportunities, the exact pathways through which such opportunities are recognized and exploited remains underexplored. In this study, we analyse whether related variety spurs entrepreneurship (while assuming that entrepreneurship, in turn, leads to employment growth). Access to knowledge spillovers can cause individuals to recognize entrepreneurial opportunities and in some cases, act upon them by becoming entrepreneurial (Audretsch, 1995; Audretsch & Lehmann, 2005; Acs et al., 2013). If we assume related varieties to be technologically proximate so that the knowledge necessary for these activities has similarities, it will be easier for individuals to learn and discover new ways of combining their knowledge with related activities. Hence, knowledge of one knowledge area enables individuals to identify entrepreneurial opportunities in related knowledge areas (Shane, 2000). Entrepreneurship in turn, then, is expected to promote employment growth and economic development on regional level as many studies have shown (Acs & Armington, 2004; Audretsch et al. 2006; Carree & Thurik, 2010; Fritsch, 2007; Fritsch & Mueller, 2004).

Our study is not the first to test whether related variety increases regional entrepreneurship. Previous studies have tested this hypothesis for regions in Great Britain, Italy, China and Sweden (Bishop, 2012; Colombelli, 2016; Guo, He, & Li, 2015; Tavassoli & Jienwatcharamongkhol, 2016), and tended to find a positive association indeed. Instead of looking at the direct of effects of related- and unrelated variety, Fritsch and Kublina (2017) found that unrelated variety positively moderates the

effect of the start-up rate on employment growth. Our study goes beyond these studies in two ways. First, we present a pan-European study covering many more regions. This allows us to control for institutional effects on the national level, as different 'varieties of capitalism' are expected to exhibit different types and relates of entrepreneurship. Second, rather than using the start-up rate or new firm formation as proxy for entrepreneurship, we measure entrepreneurship using survey data, which distinguishes between necessity- and opportunity-driven entrepreneurship. This distinction is important as the drivers of necessity- and opportunity-driven entrepreneurship are likely to be different and filters out those start-ups that are setup solely for legal reasons. Furthermore, regional policy focuses primarily on stimulating opportunity-driven entrepreneurship given their expected positive impact on regional employment growth.

The paper is organized as follows. Section two provides a brief literature review that we use to inform our hypotheses. Section three describes the data and methodology. Section four presents the main findings from our study, which can be summarised as follows. Finally, section five summarises and concludes.

3. Theoretical framework

Agglomeration economies have been a topic of research for almost a century. By building on the early work of Marshall (1920), scholars have argued that firms benefit from being located near firms operating in the same sector (Arrow, 1962; Romer, 1990). This type of agglomeration externalities is usually referred to as localisation externalities. Relative high concentrations of economic activity in a sector enables the opportunity for labour market pooling and the use of common suppliers, which in turn reduces costs (Henderson, 2003). Being co-located with similar firms additionally creates the opportunity for knowledge spillovers, as firms operating in the same sector can relate to each other's stock of knowledge and are able to exchange and recombine their ideas. In contrast, scholars have also argued that firms benefit from being located in local agglomerations with a dense and diversified variety of economic activity (Jacobs, 1969). Geographical proximity of firms in different sectors improves the opportunities of inter-sectoral exchange and recombination of ideas, which benefits the development of the local economy overall. Such externalities are usually referred to as Jacob's externalities.

Empirically, the investigation of the effects of different types of agglomeration externalities on the development of regional economies has ensured a vast expanding literature ever since the seminal contributions of Glaeser et al. (1992) and Henderson et al. (1995). This literature, however, is inconclusive in terms of which type of these agglomeration externalities is most accurate. Depending on the circumstances in which they are tested, both can be right. The disparity in these findings can largely be explained by measurement and methodological differences, as well as differences in the level of geographical and industrial agglomeration (Beaudry & Schiffauerova, 2009; de Groot et al., 2015).

Frenken et al., (2007) agreed with Jacobs that innovation indeed might be a recombinant process, in which different bits of knowledge are recombined to develop new innovations, but argued that some bits of knowledge might be easier to recombine than others. By making a distinction between related and unrelated variety, the authors presented a new interpretation of Jacobs externalities by arguing that for these externalities to be effective, some form of proximity should exist in order for inter-

sectoral knowledge spillovers to occur. Regions with more related varieties -or economic activity in cognitive proximate sectors- would therefore experience employment growth as a result of new recombinations that form new products and services, which in turn are expected to create new jobs. Having economic activity in cognitive distant sectors - i.e. unrelated variety would make regions more resilient to sector specific shocks and in the long-run experience lower unemployment growth. Frenken et al., (2007) found evidence to support their argument that related variety increases the rate of employment growth and unrelated variety decreases the rate of unemployment growth for Dutch regions. Following these findings, a number of studies have tried to replicate the related variety hypothesis for regions in other countries. In their review, Content & Frenken (2016) concluded that, although the evidence base is still rather small, the majority of studies supports the hypothesis that related variety acts as a driver for regional employment growth, and only few the auxiliary hypothesis that related variety would also spur regional productivity growth.

Although the evidence so far is suggestive of recombinant mechanisms that exploit the related variety among a region's activities into new business opportunities and employment, the question what pathways or channels matter in such processes remains unanswered. Entrepreneurship may well be such a pathway as entrepreneurs are typically actors to recognize business opportunities by associating knowledge from one domain in the context of another domain (Shane, 2000). This reasoning is consistent with the Knowledge Spillover Theory of Entrepreneurship (KSTE), which highlights the role of entrepreneurs in seizing the opportunities generated by regional knowledge spillovers. At this point, it is important to distinguish between two types of entrepreneurship that both result in new firm formation, but are driven by different motives (Reynolds et al., 2001). First, there is 'opportunity-driven' entrepreneurship where individuals start new firms to exploit business opportunities unrecognized by fellow market participants. This type of entrepreneurship is likely to generate employment growth as such new business exploiting untapped market opportunities created by spillovers. Second, there is 'necessity-driven' entrepreneurship referring to self-employed individuals who set up a firm due to lack of other employment opportunities. These firms are often less productive and typically remain without any additional employees.

A first attempt to connect regionally bound knowledge spillovers to entrepreneurship was made by Audretsch (1995), who theorized that the knowledge generated by incumbent firms is not fully appropriated and leaves opportunities for new firms to exploit. Audretsch & Lehmann (2005) tested for this by looking whether there is an association between regional investment in knowledge by universities and entrepreneurial activity. They concluded that the number of firms located around universities, typically opportunity-driven, seems positively influenced by knowledge capacity and knowledge output of those universities. Later, Acs et al. (2009) proposed a more general model of the 'the knowledge filter' linking the stock of knowledge and the efficiency of incumbents in commercialising their R&D efforts with the level entrepreneurial activity. They derived that the stock of knowledge positively affects entrepreneurial activity, while incumbents' efficiency in appropriating new knowledge negatively affects entrepreneurial activity (as fewer opportunities are left to exploit for entrepreneurs). Hence, both the actor characteristics and the environment in which actors operate influence the probability that the knowledge filter is penetrated.

Turning to inter-industry spillovers between related sectors as a source of knowledge, one can analogously theorize that related variety positively affects entrepreneurship, while incumbents'

efficiency in using such spillovers to their own benefit would negatively affect entrepreneurship. The possession of proximate knowledge thus increases individual's absorptive capacity and enables them to identify entrepreneurial opportunities (Shane, 2000; Shane & Venkataraman, 2000). A region characterised by a high degree of related variety implies that individuals possess proximate knowledge and therefore would be better in recognizing entrepreneurial opportunities if these were to occur. Following Acs et al. (2009), the extent to which such opportunities lead to the establishment of new firms would then depend on the ability and efficiency of incumbent firms to exploit spillovers among related industries.

The innovation strategy of incumbent firms relates to the institutional environment it operates (Freeman 1987). In this context, two major 'varieties of capitalism' are generally distinguished (Hall & Soskice, 2001): coordinated market economies (CMEs), of which Germany is the most illustrative example, and liberal market economies (LMEs), of which the UK is the most prominent example in Europa. The most important difference between these two varieties of capitalism is the extent to which institutions promote either cooperation or competition between economic actors. In CMEs, patient capital, labour protection and high levels of trust in suppliers and clients all promote long-term collaborations in a complementary fashion. This lends itself for continuous innovation along the supply chain as well as for informal knowledge exchange and collaborative projects among firms in related sectors. Given the high level of training and long-term commitment of a firm's employees, entrepreneurial opportunities will be relatively often exploited within incumbent firms rather than in new firms poaching ideas and labour from established firms. At the same time, given the strong labour protection and social security in CMEs, fewer people will be forced into necessity-driven entrepreneurship. LMEs by contrast, relations are more transactional, opportunistic and dynamic, while labour is less protected and committed. At the same time, employees are little restricted by non-compete clauses in setting up their own business and more venture capital and tax relief for start-ups is available. Compared to CMEs, then, entrepreneurial opportunities in LMEs are more likely to be exploited by opportunity-driven entrepreneurs setting up their own firms. And, as labour protection and social security in LMEs are relatively weak, necessity-driven entrepreneurship is also expected to be higher in LMEs than in CMEs.

In addition to these two varieties of capitalism, we will also distinguish between Mediterranean market economies (MME) and dependent market economies (DME). Hall & Soskice (2001) mention the Mediterranean group of economies as not fitting into either the CME group or the LME group. These countries have rather intensive government intervention and regulation, a significant agrarian sector, and lower levels of educational attainment (Amable, 2003; Schmidt, 2016). Social security is reasonably developed for selected professions and state organizations, but welfare and unemployment benefits are generally lower than in CMEs. East-European countries have been considered as a fourth variety of capitalism with a history of socialism. Between these East-European economies, institutional differences exist as well, as some have developed more into the direction of LMEs and others more into the direction of CMEs (Lane & Myant, 2007). In particular, the Baltic States have introduced drastic liberal reforms and low tax rates, and are now commonly classified as LMEs (Feldmann, 2006; Schmidt, 2016). The other Eastern European countries have reformed at a slower pace and can be considered a fourth variety of capitalism known as Dependent Market Economies (DMEs) (Nölke & Vliegenthart, 2009). Their financial institutions remain underdeveloped and their development strategy mostly rests on foreign direct investment combined with an

educated, but relatively cheap labour. The exception has been Slovenia, which has very similar institutions to neighbouring Austria, and is commonly considered a CME.

Combining the Knowledge Spillover Theory of Entrepreneurship with the notion of related variety leads us to suggest that regions with high degrees of related variety can anticipate knowledge spillovers and consequently higher rates of entrepreneurship, which ultimately leads to regional economic growth. Taking into account the current issues in the literature the following hypotheses will be tested:

> **Hypothesis 1:** Related variety positively impacts the rate of opportunity-driven entrepreneurial activity.
>
> **Hypothesis 2a:** Relative to CME, MME and DMEs, LMEs have the highest rates of opportunity-driven entrepreneurial activity.
>
> **Hypothesis 2b:** Relative to LME, MME and DMEs, CMEs have the lowest rates of necessity-driven entrepreneurial activity.

4. Data and methodology

4.1 Entrepreneurship

Our study is not the first to analyse the relationship between related variety and regional rates of entrepreneurship. A study by Bishop (2012) investigates how the rate of new firm formation in British regions is affected by the diversity and the stock of knowledge. He concluded that besides the stock of knowledge, related and unrelated variety in this stock positively impacts the rate of new firm formation. Using data on Chinese regions, Guo et al. (2015) tested whether related variety, relative to unrelated variety, has a larger positive effect on new firm formation. They found support for this hypothesis for the manufacturing industry at the city level. Colombelli (2016) also found evidence that a knowledge base characterized by related variety promotes entrepreneurial activity in Italian regions. Tavassoli & Jienwatcharamongkhol (2016) looked at related variety and survival rates of newly established firms in Sweden. As previous survival studies neglected regional characteristics, the authors investigate the role of different types of agglomeration externalities. They find that the survival rate of Swedish entrepreneurial firms operating in knowledge intensive business sectors is positively influenced by related variety.

These studies all rely on new firm formation as a proxy for entrepreneurship. However, as already argued, this indicator ignores the difference between firms created out of opportunities and firms created out of necessity (or simply for legal reasons). Here, we are especially interested in opportunity-driven entrepreneurship as to test the hypothesis that related variety fosters such opportunities through inter-industry spillovers. Entrepreneurship, then, does not start with the creation of a new firm. Rather, it is the discovery of opportunities that is key, which (often much later) results in a new firm (Shane, 2000). Measuring entrepreneurship should thus start before the registration of a firm already and it should be able to distinguish between those firms that are registered to exploit opportunities and those that are registered for different reasons. Since 2001, the Global Entrepreneurship Monitor (GEM) distinguishes opportunity-driven entrepreneurs and necessity-driven entrepreneurs (Reynolds et al., 2001). The difference between these types of

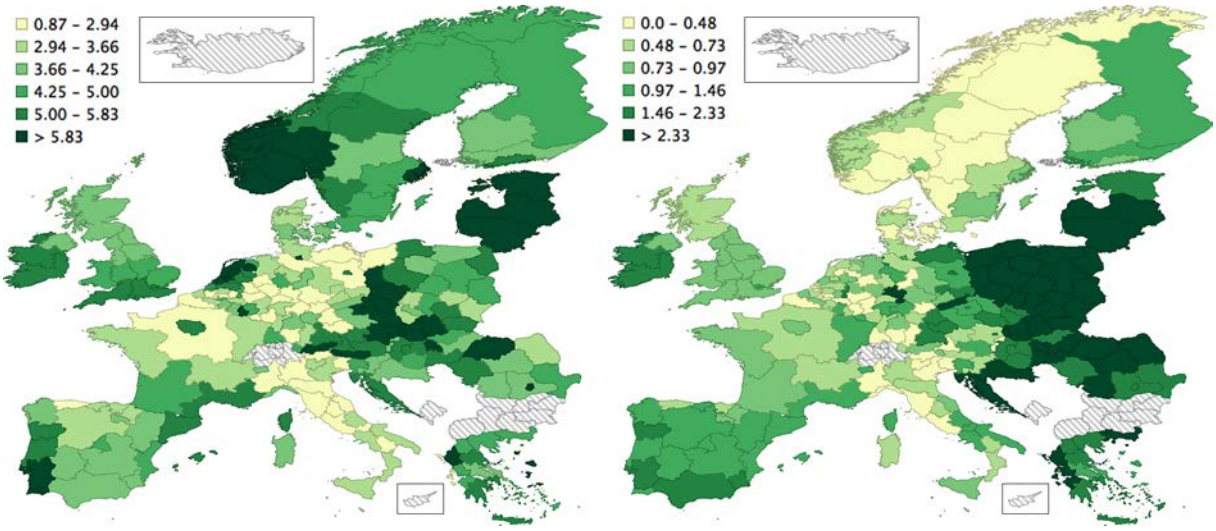
entrepreneurs lies within their motivation to become one. Opportunity-driven entrepreneurs start a business to pursue business opportunities, whereas necessity-driven entrepreneurs would start a business out a lack of employment options. Empirically, this distinction has proven to be relevant from the macro perspective as opportunity-driven entrepreneurs are over-represented in developed and underrepresented in less-developed regions, while for necessity-driven entrepreneurs it is the other way around (Wennekers, van Stel, Thurik, & Reynolds, 2005). From a policy perspective, this distinction is also relevant as opportunity-driven entrepreneurs in general have more profitable firms than necessity-driven entrepreneurs (Block & Wagner, 2010).

Using data provided by the Global Entrepreneurship Monitor (GEM), which is survey-based data, we will be able to explicitly distinguish between necessity- and opportunity-driven entrepreneurship. Each year, the GEM conducts an adult population survey on a representative sample containing at least 2000 individuals per country, who are different each year. Using this data, total entrepreneurial activity is measured as the share of the working age population (from 18 until 64) that is involved in the creation of a business at the time the survey was conducted. Someone classifies as an entrepreneur when he or she engaged in any activity to start and those running a new business less than 3.5 years old. Therefore, our data also contains individuals, which have identified an entrepreneurial opportunity, however, have not formally started a firm.

Since we break down the country numbers into regional numbers at the NUTS2 and NUTS1 level, the annual survey-waves are not representative at the regional level, as these are based on the 2000 individuals sampled at the national level. For this reason, we pool regional data over multiple waves and take the mean number over the waves, as to get a reliable estimate for regional total entrepreneurial activity. Of course, this comes at the cost of time variation. We were able to extract regional data on entrepreneurs on the NUTS2 level for 24 European countries (184 regions) and on the NUTS1 level for 2 European countries (20 regions) for the period 2007 to 2014.

Figure 4.1 depicts the average rate of opportunity- and necessity-driven entrepreneurship for this period. As some countries do not participate in the GEM or do not have enough observations to produce reliable measures at the NUTS2 level, some regions in figure 4.1 are not filled. These regions are not included in the analysis of this study. We see that opportunity-driven entrepreneurship is rather scattered and especially high in Eastern Europe and selected regions outside Eastern Europa, while the lowest levels of opportunity-driven entrepreneurship are found in Belgium, France, Germany and Italy. Necessity entrepreneurship displays a more pronounced core-periphery pattern with highest rates in Eastern Europe, Greece, Spain and Ireland, but lowest levels in Scandinavia. Finally note that the correlation between opportunity- and necessity-driven entrepreneurship is rather low (0.23).

Figure 4.1 Opportunity-(left) and necessity-driven entrepreneurship (right).



4.2 Related- and unrelated variety

Following the approach of Frenken et al. (2007), we calculate entropy measures for related and unrelated variety using employment shares at different levels of industry aggregation. Following Cortinovis and Van Oort (2015), we use the ORBIS database provided by Bureau van Dijk, which contains annual individual firm level data until 2015 that can be aggregated to our spatial unit of analysis (NUTS 1 and NUTS2). Information on the type of industry using the NACE or SIC classification schemes is available at the 4-digit level. This allows one to construct related variety measure at a detailed 4-digit level for all European regions, in contrast to other data sources which have much less detail (de Groot et al., 2015). A disadvantage in using this data, however, holds that the distribution of firms in terms of size is not representative as only those firms that are obligated to annually report are included, which tend to be larger firms than average. This biases the shares towards industries with a higher firm size. In order to ensure a sufficient time-lag we calculate the indicators of related and unrelated variety using the ORBIS data from 2006.

For the calculation of unrelated variety, we make the assumption that firms who belong to one of the 2-digit sectors are unrelated. Additionally, 4-digit sectors within each of the 2-digit sectors are assumed to be related, because they belong to the same 2-digit sector. The 4-digit shares P_i are summed to derive the 2-digit shares P_g:

$$(1) \quad P_g = \sum_{i \in S_g} p_i$$

Unrelated variety (UV), the entropy *between* the 2-digit sectors, is then calculated as:

$$(2) \quad UV = \sum_{g=1}^{G} P_g log_2 \left(\frac{1}{P_g} \right)$$

Entropy *within* each 2-digit sector, H_g, is given by:

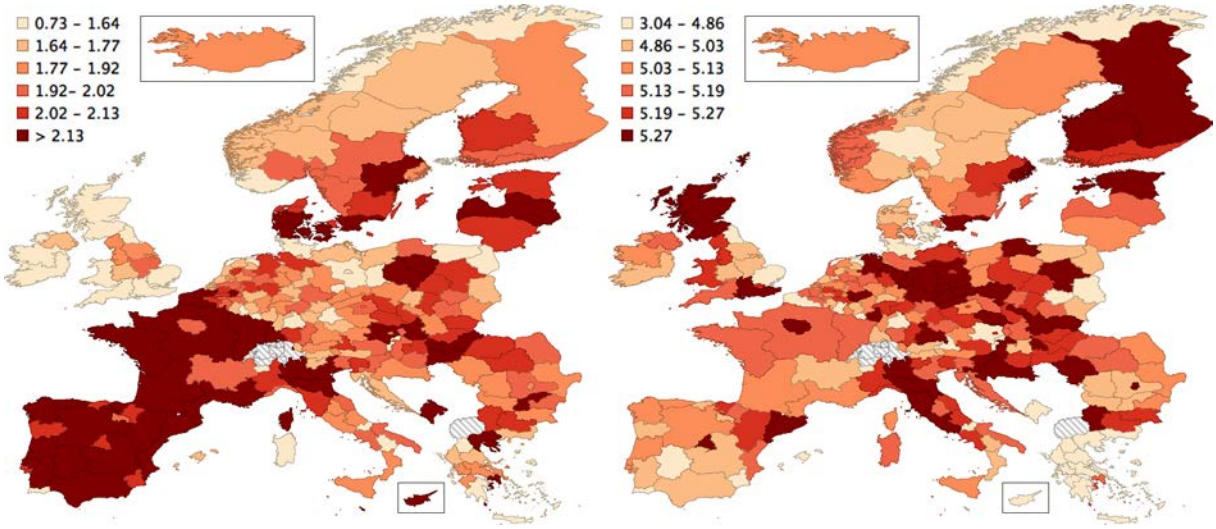
$$(3)\quad H_g = \sum_{i \in S_g} \frac{p_i}{P_g} log_2 \left(\frac{1}{p_i / P_g} \right)$$

Related variety (RV), then, is given by the sum of entropy within each sector (3), weighted by employment shares (1):

$$(4)\quad RV = \sum_{g=1}^{G} P_g H_g$$

The maps in figure 4.2 depict the related and unrelated variety measures for the year 2006. The left map represents related variety, whereas the map on the right represents unrelated variety.

Figure 4.2 Related (left) and unrelated variety (right) in 2006.



There are some spatial patterns observable in the levels of related variety. In particular, most regions in Spain, France and Northern Italy have high levels, while the UK and Ireland score rather low. Unrelated variety levels are more diffuse. Interestingly, the correlation between related and unrelated variety is quite high (0.64).[2]

4.3 Estimation method

To test the hypotheses a cross-sectional regression model will be applied. The model will be estimated using an Ordinary Least Squares estimator at the NUTS1 and NUTS2 level and is specified as

$$y_i = \alpha_i + \lambda W y_i + \beta_1 UV_i + \beta_2 RV_i + {'X_i}'\varphi + {'VOC_i}'\vartheta + \rho W u_i + \varepsilon_i$$

[2] Note that some South-East European countries are excluded in the maps 2 (i.e. Bosnia and Herzegovina, Serbia, Albania, Macedonia, and Montenegro). This is because the ORBIS dataset does not contain enough information about these specific countries to construct the variety measures. These regions were already excluded from the analysis, as the dependent variables are also lacking for these countries.

where y_i is total entrepreneurial activity, opportunity-driven entrepreneurial activity, or necessity-driven entrepreneurial activity in region *i*. The primary explanatory variables in our model are related variety RV_i and unrelated variety UV_i. Different varieties of capitalism are included as the dummy variables LME_i, CME_i, MME_i, and DME_i and are represented by the vector $'VOC_i$. The control variables, captured in the vector $'X_i$, will be discussed more elaborately when the data will be discussed. Two spatial terms are included; the first term λWy_i accounts for the spatial autoregressive process of the dependent variable, including only this term would result in a spatial error model (SEM). The second term ρWu_i captures the spatial correlation in residuals of neighbouring regions, including only this term would result in a spatial lag model (SAR). Including both spatial terms results in a spatial autoregressive model with autoregressive disturbances (SARAR).

To test and if necessary control for spatial correlation in the residuals and/or dependant variable, we follow Hendry's methodology (Florax, Folmer, & Rey, 2003). This means we start with the restricted and unrestricted models (SARAR and SEM) using a maximum likelihood estimator and subsequently test the common factor restriction using a likelihood ratio test. If spatial autocorrelation seems to be present, the result of this test will then determine whether we should make use of a spatial error model or a spatial lag model. An inverse distance spatial weight matrix will be constructed to account for potential geographical dependencies. Regions will be classified as neighbours when the distance between them is smaller than 750 kilometres, their weight will be the inverse of the distance between them. If the distance between regions is larger than that, their weight will be zero. The matrix will be row-standardised such that the impact of neighbouring regions is equalized.

4.4 Control variables

We control for several factors that are likely to influence regional entrepreneurial activity. Table 4.1 gives an overview of all the variables used in this analysis, while summary statistics and a correlation matrix as provided in the appendix. We control for income levels by including Gross Regional Product (GRP), as the overall development of a region is likely to influence the amount of entrepreneurial opportunities available. More densely populated regions are also expected to produce more entrepreneurs due to urbanisation economies and specialized demand. We control for population density as the average number of inhabitants per square kilometre as well as by the presence of a city with more than half a million inhabitants. The level of human capital is likely to influence potential entrepreneurs' ability and skills to identify opportunities and consequently act upon them. We further control for human capital by including the percentage of the working age population having completed tertiary education in our model. Finally, we control for the rate of unemployment, in particular, as unemployment often motivates individuals to engage in necessity-driven entrepreneurship.

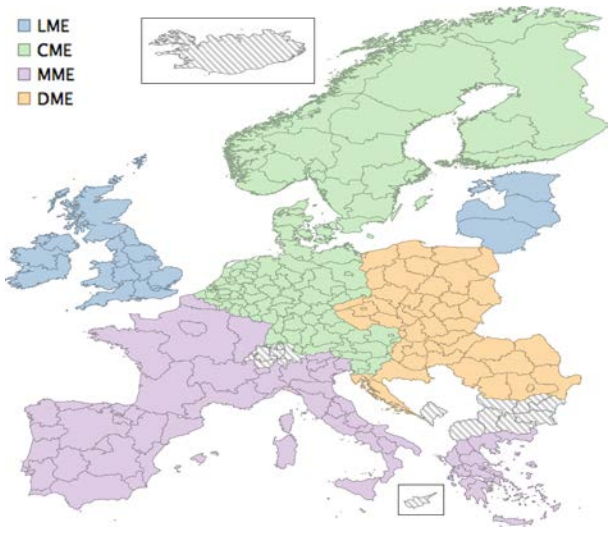
Table 4.1 Variables description

Variable	Description	Source
TEA	Average percentage of the working age population involved in entrepreneurship over the period 2007-2014.	GEM
TEA_OPP	Average percentage of the working age population involved in opportunity-driven entrepreneurship over the period 2007-2014.	GEM
TEA_NEC	Average percentage of the working age population involved in necessity-	GEM

	driven entrepreneurship over the period 2007-2014.	
UV	Unrelated variety in 2006.	BvD
RV	Related variety in 2006.	BvD
LNGRPPC	Logarithm of Gross Regional Product per/capita in 2006 (log).	Eurostat
LNPDEN	Logarithm of population density in 2006 (log).	Eurostat
HC	Percentage points of working age population who completed tertiary education in 2006.	Eurostat
CITY	Presence of a city with >500,000 inhabitants in 2006.	Eurostat
UNEMP	Average rate of unemployment over the period 2007 until 2014.	Eurostat
VOC	LME (Estonia, Ireland, Latvia, Lithuania, United Kingdom), CME (Austria, Belgium, Denmark, Finland, Germany, Luxembourg, Netherlands, Norway, Slovenia, Sweden), MME (France, Greece, Italy, Portugal, Spain), DME (Croatia, Czech Republic, Hungary, Poland, Slovakia)	

Figure 4.3 shows the different varieties of capitalism in Europe. It shows that CMEs are clustered more to the north of Europe, whereas DMEs are mainly present in the east. Apart from the Baltic States, most East-European countries are classified as DME.

Figure 4.3 Varieties of capitalism



5. Introduction

The estimation results of the model presented in the previous section are summarized in tables 5.1, 5.2, and 5.3 below. Table 5.1 presents the general estimation of our model in which we look at what the effect of unrelated and related variety is on entrepreneurship. In table 5.2, we repeat the analyses of table 5.1, but excluding the VoC dummies, as to compare the models with and without the effect of national institutions as indicated by the VoC dummies. In Table 5.3, we ran a number of additional analyses to account for spatial dependencies between regions as to further tests of our main hypothesis that related variety fosters regional opportunity-driven entrepreneurship.

Table 5.1 General estimation results.

	(1) TEA	(2) TEA	(3) TEA_OPP	(4) TEA_NEC

UV	-0.286	(0.379)	-1.632***	(0.413)	-1.243***	(0.361)	-0.412***	(0.156)
RV	-0.301	(0.499)	0.562	(0.485)	0.815**	(0.401)	-0.215	(0.178)
LNGRPPC			1.322**	(0.572)	1.939***	(0.435)	-0.701***	(0.211)
CITY			0.705**	(0.298)	0.346	(0.233)	0.340***	(0.120)
LNPDEN			-0.294***	(0.108)	-0.233***	(0.0839)	-0.0453	(0.0383)
UNEMP			0.0744**	(0.0328)	0.0368	(0.0249)	0.0439***	(0.0129)
HC			0.0224	(0.0221)	0.00595	(0.0179)	0.0155**	(0.0068)
VOC_LME			-		-		0.00699	(0.148)
VOC_CME			-1.131**	(0.522)	-1.142***	(0.423)	-	
VOC_MME			-1.826***	(0.657)	-1.690***	(0.529)	-0.0416	(0.127)
VOC_EEU			2.785***	(0.738)	1.183**	(0.586)	1.659***	(0.215)
Constant	8.259***	(1.534)	0.560	(6.190)	-8.875*	(4.757)	9.852***	(2.337)
Observations	204		204		204		204	
R-squared	0.007		0.407		0.274		0.652	

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

Model (1) in table 5.1 shows that there is no association between related and unrelated variety on the one hand and total regional entrepreneurship on the other. When controlling for other factors including VoC dummies in Model (2), the estimated coefficient of related variety persists to be insignificant, while unrelated variety carries a significant coefficient with a negative sign, indicating that unrelated variety lowers the degree of total regional entrepreneurship. Once we split total entrepreneurship into opportunity-driven entrepreneurship in Model (3) and necessity-driven entrepreneurship in Model (4), we observe that related variety indeed increases regional opportunity-driven entrepreneurship. This finding provides evidence for hypothesis 1. Looking at the drivers of necessity-driven entrepreneurship, unrelated variety exercises a significant negative effect and related variety does not affect necessity-driven entrepreneurship.

Regarding the effects of the other control variables, we find that GRP per capita increases the rate of opportunity-driven entrepreneurs, whereas it decreases the rate of necessity-driven entrepreneurs. This result is likely to reflect that more developed economies on average offer better opportunities for entrepreneurship, while individuals in less developed economies are by contrast more often pushed into starting up a firm due to limited employment options. It is further noteworthy that unemployment increases necessity-based entrepreneurship supporting the notion that lack of employment opportunities pushes individuals into setting up their own firm. Perhaps surprisingly, the control variable population density, presence of a large city and human capital do not support opportunity-driven entrepreneurship, while some effect of these variables on necessity-driven entrepreneurship is observable.

The dummy variables with the prefix VOC represent the different varieties of capitalism. The omitted variable VOC_LME is the reference category except for the model with necessity-driven entrepreneurship as the dependent variable where we take VOC_CME as reference. This is done because hypothesis 2a regarding opportunity-driven entrepreneurship compared LMEs to other varieties, while hypothesis 2b regarding necessity-driven entrepreneurship compares CMEs to other varieties. We can observe from Model (3) that, following hypothesis 2a, opportunity-driven entrepreneurship is indeed higher in LMEs than in CMEs and MMEs. However, surprisingly, the

highest rates of opportunity-driven entrepreneurship are found in the DMEs in Eastern Europe. Moving to Model (4), we observe that following hypothesis 2b, necessity-driven entrepreneurship is indeed lower in CMEs than in MMEs. Contrary to our expectation, however, no significant differences were found between CMEs, LMEs and MMEs.

Table 5.2 Estimation results without VOC dummies.

	(1) TEA		(2) TEA		(3) TEA_OPP		(4) TEA_NEC	
UV	-0.286	(0.379)	-0.717	(0.497)	-0.607	(0.393)	-0.152	(0.190)
RV	-0.301	(0.499)	-0.574	(0.556)	-0.0887	(0.414)	-0.415**	(0.192)
LNGRPPC			-2.078***	(0.496)	-0.226	(0.346)	-1.932***	(0.234)
CITY			0.965***	(0.366)	0.567**	(0.267)	0.399***	(0.142)
LNPDEN			-0.115	(0.121)	-0.134	(0.0962)	0.0332	(0.0397)
UNEMP			-0.0531*	(0.0297)	-0.0490**	(0.0204)	0.00692	(0.0128)
HC			0.0372	(0.0231)	0.0219	(0.0183)	0.0121*	(0.00719)
Constant	8.259***	(1.534)	31.63***	(5.608)	10.48***	(3.949)	21.61***	(2.657)
Observations	204		204		204		204	
R-squared	0.007		0.126		0.058		0.480	

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

A final observation regarding varieties of capitalisms can be made by comparing the results reported in Table 5.1 including the VoC dummies and Table 5.2 excluding the VoC dummies. The R^2-values of models including VoC dummies is much higher than the values in the corresponding models excluding these dummies. This difference indicates that regional entrepreneurship patterns are to an important extent structured by national institutions and their complementarities underlying the notion of Varieties of Capitalism. To further analyse how differences between these the different VoC moderate our findings with regards to the effects of UV and RV on entrepreneurship, we also estimated a model with interaction terms of the dummy variables and UV and RV. The results of this estimation are shown in the appendix table A.3.

Table 5.3 Spatial autocorrelation.

	(1) SARAR		(2) SEM		(3) SAR	
UV	-1.094***	(0.353)	-1.185***	(0.334)	-1.095***	(0.339)
RV	0.705*	(0.417)	0.807*	(0.413)	0.694*	(0.419)
LNGRPPC	1.886***	(0.424)	1.936***	(0.397)	1.876***	(0.416)
CITY	0.376	(0.237)	0.369	(0.239)	0.366	(0.236)
LNPDEN	-0.225***	(0.0834)	-0.222***	(0.0829)	-0.225***	(0.0832)
UNEMP	0.0183	(0.0279)	0.0298	(0.0283)	0.0187	(0.0293)
HC	0.00540	(0.0158)	0.00468	(0.0158)	0.00579	(0.0158)
VOC_LME *(omitted)*	-		-		-	
VOC_CME	-1.400***	(0.404)	-1.316***	(0.397)	-1.358***	(0.386)
VOC_MME	-1.949***	(0.472)	-1.893***	(0.472)	-1.891***	(0.448)
VOC_DME	0.865*	(0.458)	0.973**	(0.451)	0.898*	(0.460)
λ	0.237	(0.415)	0.538*	(0.302)	-	
ρ	0.647**	(0.329)	-		0.724***	(0.251)

σ^2	1.560***	(0.155)	1.577***	(0.156)	1.560***	(0.155)
Constant	-9.531**	(4.668)	-11.36***	(4.372)	-8.341*	(4.357)
Log likelihood	-335.502		-336.326		-335.634	
Observations	204		204		204	

Dependent variable: TEA_OPP (opportunity-driven entrepreneurship). Standard errors in parentheses. Significant levels: *** p<0.01, ** p<0.05, * p<0.1.

Table 5.3 shows the results when spatial terms are added to the model explaining opportunity-driven entrepreneurship to further scrutinize our main finding that related variety fosters opportunity-driven entrepreneurship. Following Hendry's method (Florax et al., 2003), we started by estimating our restricted spatial model (SARAR) and unrestricted spatial model (SEM) using a maximum likelihood estimator, respectively shown in columns (1) and (2). Using a likelihood ratio test, the common factor restriction got rejected at the 1% significance level. Subsequently a spatial lag model (SAR) is estimated, which is shown in column (3). The significant coefficient of ρ means the specification as in column (3) is our final spatial specification. Looking at the coefficient of unrelated, we notice that compared to our specification without spatial terms, it has reduced slightly. The same applies for the estimated effect of related variety, although still statically significant, the effect has reduced after spatial lags are controlled for. Besides the effect of income levels and population density, the other control variables do to seem to have an effect on the rate of opportunity-driven entrepreneurship anymore.[3]

6. Conclusion

Recent studies reported positive effects of related variety on regional employment growth. However, *how* related variety leads to employment growth has remained implicit (Content & Frenken, 2016). This study examined whether related variety fosters entrepreneurship motivated by the knowledge spillover theory of entrepreneurship, which states that regions endowed with more knowledge spillovers can expect more entrepreneurial activity, and, in turn, more employment growth (Acs et al., 2009). The present study is the first that analyses the effect of unrelated and related variety on regional entrepreneurial activity across Europe. Importantly, we distinguished between opportunity-driven and necessity-driven entrepreneurship, as spillovers from related industries are expected to foster the latter type of entrepreneurship. Elaborating on Hall & Soskice (2001), we further hypothesized that different 'varieties of capitalisms' show different rates of opportunity-driven and necessity-driven entrepreneurship.

The main finding holds, as hypothesized, that related variety has a positive impact on opportunity-driven entrepreneurship, but no impact on necessity-driven entrepreneurship. We understand this result as reflecting that necessity-driven entrepreneurs start a business out of a lack of employment options, rather than out of opportunities from knowledge spillovers stemming from related variety. This interpretation is further supported by a robust association between regional unemployment and necessity-driven entrepreneurship. Opportunity-driven entrepreneurs, by contrast, leverage opportunities stemming from knowledge spillovers caused by related variety. Varieties of Capitalisms

[3] We as well estimated the SARAR model with different dependent variables, i.e. total entrepreneurial activity (TEA) and necessity-driven entrepreneurship (TEA_NEC). The results where similar to those of table 4.1 and our shown in table A.4 of the appendix.

also explain part of the variation in entrepreneurship levels. Liberal Market Economies host more opportunity-driven entrepreneurs compared to Coordinated Market Economies. We understand this result from differences in institutions. Entrepreneurial opportunities in LMEs are more often exploited by new ventures (especially spinoffs), while such opportunities in CMEs are captured more often by incumbent firms and their employees. Unexpectedly, regions in Eastern Europe display rates of opportunity-driven entrepreneurship as high as LMEs despite the assertion that their institutions are less supportive for new ventures.

Our study can be considered a first attempt to unpack the channels through which related variety among a region's industries supports regional employment growth. We suggest that opportunity-driven entrepreneurship may well be one such channel, as spillovers create business opportunities that entrepreneurs aim to exploit. This leaves open the question what other channels exist. For example, one can expect that related variety increases social networking as well as labour moves across industries (Breschi & Lissoni, 2009). Furthermore, relatedness in a region's industrial structure provides a platform for specific actors with recombinant capabilities such as knowledge-intensive business services and applied research organizations (Asheim, Boschma, & Cooke, 2011). As a second line of research, we advocate a further theoretical and empirical deepening to the national institutions affecting entrepreneurship. In particular, an interesting question remains to what extent the institutions – and their complementarities – relevant to entrepreneurship map onto the existing varieties of capitalism that have been distinguished so far. A third follow-up question is to validate the assertion that opportunity-driven entrepreneurship, as well as the other aforementioned spillover channels, indeed foster employment growth. A fully-fledged model of related variety, then, would analyse both the direct effect of variety on employment growth and the indirect effects mediated by various spillover channels. Although such an analysis is more demanding in terms of empirical data, it is certainly worthwhile for the related variety literature to 'come full circle'.

Although the data on entrepreneurial activity provided by GEM is carefully weighted for the age structure of the concerned regions and has a questionnaire design that is been developed and improved during quite some time now, the usual limitations that come with using survey data do apply for this research as well. Issues like questions that are vulnerable for misinterpretation or respondents that might not feel encouraged or comfortable in providing accurate answers cannot fully be ruled out as possibilities. Another limitation of this research concerns the ORBIS dataset, in which only those firms that are obligated to annually report their financial numbers are included. This means the effects that small firms might have in this respect are not captured in our analysis. Lastly, our unit of analysis (NUTS1 and NUTS2) might not to be the optimal level aggregation. As this research is concerned with knowledge spillovers from related varieties, labour market regions (NUTS3) might have been the more appropriate spatial unit of analysis.

References

Acs, Z., & Armington, C. (2004). Employment Growth and Entrepreneurial Activity in Cities. *Regional Studies*, *38*(8), 911–927. https://doi.org/10.1080/0034340042000280938

Acs, Z., Braunerhjelm, P., Audretsch, D. B., & Carlsson, B. (2009). The knowledge spillover theory of entrepreneurship. *Small Business Economics*, *32*(1), 15–30. https://doi.org/10.1007/s11187-008-9157-3

Acs, Z. J., Audretsch, D. B., & Lehmann, E. E. (2013). The knowledge spillover theory of entrepreneurship. *Small Business Economics*, *41*(4), 757–774. https://doi.org/10.1007/s11187-013-9505-9

Amable, B. (2003). *The diversity of modern capitalism*. Oxford ; New York: Oxford University Press.

Arrow, K. (1962). Economic welfare and the allocation of resources for invention. In *The rate and direction of inventive activity: Economic and social factors* (pp. 609–626). Princeton University Press. Retrieved from http://www.nber.org/chapters/c2144.pdf

Asheim, B. T., Boschma, R., & Cooke, P. (2011). Constructing Regional Advantage: Platform Policies Based on Related Variety and Differentiated Knowledge Bases. *Regional Studies*, *45*(7), 893–904. https://doi.org/10.1080/00343404.2010.543126

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

Audretsch, D. B., Keilbach, M. C., & Lehmann, E. E. (2006). *Entrepreneurship and Economic Growth*. Oxford University Press, USA.

Audretsch, D. B., & Lehmann, E. E. (2005). Does the Knowledge Spillover Theory of Entrepreneurship hold for regions? *Research Policy*, *34*(8), 1191–1202. https://doi.org/10.1016/j.respol.2005.03.012

Beaudry, C., & Schiffauerova, A. (2009). Who's right, Marshall or Jacobs? The localization versus urbanization debate. *Research Policy*, *38*(2), 318–337. https://doi.org/10.1016/j.respol.2008.11.010

Bishop, P. (2012). Knowledge, diversity and entrepreneurship: a spatial analysis of new firm formation in Great Britain. *Entrepreneurship & Regional Development*, *24*(7–8), 641–660. https://doi.org/10.1080/08985626.2011.617786

Block, J. H., & Wagner, M. (2010). *Necessity and Opportunity Entrepreneurs in Germany: Characteristics and Earnings Differentials* (SSRN Scholarly Paper No. ID 1604117). Rochester, NY: Social Science Research Network. Retrieved from http://papers.ssrn.com/abstract=1604117

Bosma, N., Coduras, A., Litvosky, Y., & Seaman, J. (2012). GEM Manual: A report on the design, data and quality control of the Global Entrepreneurship Monitor. GEM Consortium.

Breschi, S., & Lissoni, F. (2009). Mobility of skilled workers and co-invention networks: an anatomy of localized knowledge flows. *Journal of Economic Geography*, *9*(4), 439–468. https://doi.org/10.1093/jeg/lbp008

Carree, M. A., & Thurik, A. R. (2010). The Impact of Entrepreneurship on Economic Growth. In Z. J. Acs & D. B. Audretsch (Eds.), *Handbook of Entrepreneurship Research* (pp. 557–594). New York, NY: Springer New York. Retrieved from http://link.springer.com/10.1007/978-1-4419-1191-9_20

Colombelli, A. (2016). The impact of local knowledge bases on the creation of innovative start-ups in Italy. *Small Business Economics*. https://doi.org/10.1007/s11187-016-9722-0

Content, J., & Frenken, K. (2016). Related variety and economic development: a literature review. *European Planning Studies*, *0*(0), 1–16. https://doi.org/10.1080/09654313.2016.1246517

de Groot, H. L. F., Poot, J., & Smit, M. J. (2015). Which Agglomeration Externalities Matter Most and Why? *Journal of Economic Surveys*, n/a-n/a. https://doi.org/10.1111/joes.12112

Feldmann, M. (2006). Emerging Varieties of Capitalism in Transition Countries: Industrial Relations and Wage Bargaining in Estonia and Slovenia. *Comparative Political Studies*, *39*(7), 829–854. https://doi.org/10.1177/0010414006288261

Florax, R. J. G. M., Folmer, H., & Rey, S. J. (2003). Specification searches in spatial econometrics: the relevance of Hendry's methodology. *Regional Science and Urban Economics*, *33*(5), 557–579. https://doi.org/10.1016/S0166-0462(03)00002-4

Frenken, K., Van Oort, F., & Verburg, T. (2007). Related Variety, Unrelated Variety and Regional Economic Growth. *Regional Studies*, *41*(5), 685–697. https://doi.org/10.1080/00343400601120296

Fritsch, M. (2007). How does new business formation affect regional development? Introduction to the special issue. *Small Business Economics*, *30*(1), 1–14. https://doi.org/10.1007/s11187-007-9057-y

Fritsch, M., & Kublina, S. (2017). Related variety, unrelated variety and regional growth: the role of absorptive capacity and entrepreneurship. *Regional Studies*, 1–12. https://doi.org/10.1080/00343404.2017.1388914

Fritsch, M., & Mueller, P. (2004). Effects of New Business Formation on Regional Development over Time. *Regional Studies*, *38*(8), 961–975. https://doi.org/10.1080/0034340042000280965

Glaeser, E. L., Kallal, H. D., Scheinkman, J. A., & Shleifer, A. (1992). Growth in Cities. *Journal of Political Economy*, *100*(6), 1126–1152.

Guo, Q., He, C., & Li, D. (2015). Entrepreneurship in China: The role of localisation and urbanisation economies. *Urban Studies*. https://doi.org/10.1177/0042098015595598

Hall, P. A., & Soskice, D. (2001). *Varieties of capitalism: The institutional foundations of comparative advantage*. OUP Oxford.

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

Henderson, V., Kuncoro, A., & Turner, M. (1995). Industrial Development in Cities. *Journal of Political Economy*, *103*(5), 1067–1090.

Jacobs, J. (1969). *The economy of cities*. New York, NY: Random House.

Lane, D., & Myant, M. (2007). Introduction. In D. Lane & M. Myant (Eds.), *Varieties of Capitalism in Post-Communist Countries* (pp. 1–9). Palgrave Macmillan UK. https://doi.org/10.1057/9780230627574_1

Marshall, A. (1920). *Principles of Economics: An Introductory Volume*. London: Mcmillan.

Nölke, A., & Vliegenthart, A. (2009). Enlarging the Varieties of Capitalism: The Emergence of Dependent Market Economies in East Central Europe. *World Politics*, *61*(4), 670–702. https://doi.org/10.1017/S0043887109990098

Reynolds, P. D., Camp, S. M., Bygrave, W. D., Autio, E., & Hay, M. (2001). *Global Entrepreneurship Monitor 2001 Executive Report*. GEM Consortium.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, *98*(5, Part 2), S71–S102.

Schmidt, V. A. (2016). Varieties of Capitalism: A Distinct French Model?. In Robert Elgie, Amy Mazur, Emiliano Grossman, Andrew Appleton (eds) Oxford Handbook of French Politics. *Oxford Handbook of French Politics.* Retrieved from https://pdfs.semanticscholar.org/f707/2357f65962d19756dcb0fbe7e354c340462e.pdf

Shane, S. (2000). Prior Knowledge and the Discovery of Entrepreneurial Opportunities. *Organization Science*, *11*(4), 448–469. https://doi.org/10.1287/orsc.11.4.448.14602

Shane, S., & Venkataraman, S. (2000). The Promise of Entrepreneurship as a Field of Research. *Academy of Management Review*, *25*(1), 217–226. https://doi.org/10.5465/AMR.2000.2791611

Tavassoli, S., & Jienwatcharamongkhol, V. (2016). Survival of entrepreneurial firms: the role of agglomeration externalities. *Entrepreneurship & Regional Development*, 1–22. https://doi.org/10.1080/08985626.2016.1247916

Wennekers, S., van Stel, A., Thurik, R., & Reynolds, P. (2005). Nascent Entrepreneurship and the Level of Economic Development. *Small Business Economics*, *24*(3), 293–309. https://doi.org/10.1007/s11187-005-1994-8

Appendix

Table A.1 Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
TEA	204	6.245	2.104	2.332	14.358
TEA_OPP	204	4.577	1.489	1.187	10.241
TEA_NEC	204	1.352	1.103	0.080	7.145
UV	204	5.044	0.380	3.040	5.547
RV	204	1.893	0.297	0.727	2.445
LNGRPPC	204	10.020	0.441	8.672	11.290
CITY	204	0.368	0.483	0	1
LNPDEN	204	4.945	1.233	1.194	8.759
UNEMP	204	9.231	4.857	2.463	27.375
HC	204	22.701	8.417	8.000	45.700
LME	204	0.083	0.277	0	1
CME	204	0.412	0.493	0	1
MME	204	0.289	0.455	0	1
DME	204	0.216	0.412	0	1

Table A.2 Correlation matrix.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	TEA	1													
2	TEA_OPP	0.867	1												
3	TEA_NEC	0.673	0.233	1											
4	UV	-0.075	-0.071	-0.066	1										
5	RV	-0.071	-0.084	-0.004	0.550	1									
6	LNGRPPC	-0.249	0.085	-0.651	0.011	-0.166	1								
7	CITY	0.071	0.103	-0.010	0.260	0.076	0.267	1							
8	LNPDEN	-0.057	-0.033	-0.065	0.128	-0.035	0.252	0.435	1						
9	UNEMP	0.048	-0.098	0.290	-0.264	0.026	-0.325	0.059	-0.036	1					
10	HC	-0.076	0.107	-0.339	0.151	-0.047	0.625	0.285	0.223	-0.121	1				
11	LME	0.082	0.141	-0.050	0.072	-0.240	0.064	0.285	0.056	-0.053	0.233	1			
12	CME	-0.270	-0.069	-0.490	0.075	-0.082	0.507	-0.184	0.044	-0.505	0.411	-0.252	1		
13	MME	-0.220	-0.211	-0.083	-0.282	0.125	0.020	0.119	-0.063	0.604	-0.186	-0.192	-0.534	1	
14	DME	0.510	0.220	0.711	0.172	0.122	-0.672	-0.103	-0.021	-0.026	-0.443	-0.158	-0.439	-0.335	1

Table A.3 Moderating effect of Varieties of Capitalism.

	(1) TEA		(2) TEA_OPP		(3) TEA_NEC	
UV	1.855	(2.334)	1.669	(1.832)	-0.0494	(0.446)
Marginal effect	*-1.368***	*(0.584)*	*-0.604*	*(0.445)*	*-0.664*	*(0.414)*
RV	3.537**	(1.554)	3.211***	(1.217)	0.365	(0.402)
Marginal effect	*0.795*	*(0.503)*	*0.843***	*(0.404)*	*-0.041*	*(0.222)*
LME	-		-		-	

CME	17.59	(12.61)	16.10	(10.03)	0.231	(2.417)
MME	23.89*	(12.54)	18.96*	(10.06)	4.074	(2.501)
EEU	30.04*	(15.79)	12.84	(11.74)	13.23	(9.416)
F-Test	*2.02*		*1.41*		*4.85***	
RV * LME	-		-		-	
RV * CME	-3.632**	(1.723)	-2.702**	(1.368)	-0.840*	(0.439)
RV * MME	-2.646	(1.761)	-2.505*	(1.395)	-0.267	(0.473)
RV * DME	-2.232	(2.002)	-2.456*	(1.483)	0.0752	(0.901)
F-Test	*1.56*		*1.39*		*1.89*	
UV * LME	-		-		-	
UV * CME	-2.467	(2.414)	-2.489	(1.906)	0.232	(0.461)
UV * MME	-4.203*	(2.413)	-3.213*	(1.923)	-0.752	(0.500)
UV * DME	-4.599	(3.076)	-1.480	(2.284)	-2.285	(1.922)
F-test	*1.86*		*1.28*		*4.57***	
Control variables	YES		YES		YES	
Constant	-25.79*	(14.02)	-28.65***	(10.92)	4.893	(3.879)
Observations	204		204		204	
R-squared	0.444		0.320		0.677	

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

Table A.4 Spatial correlation other types of entrepreneurship.

	(1) TEA		(2) TEA_OPP		(3) TEA_NEC	
UV	-1.425***	(0.440)	-1.094***	(0.353)	-0.435***	(0.153)
RV	0.474	(0.530)	0.705+	(0.417)	-0.0510	(0.207)
LNGRPPC	1.237*	(0.502)	1.886***	(0.424)	-0.500*	(0.246)
CITY	0.751*	(0.299)	0.376	(0.237)	0.323***	(0.121)
LNPDEN	-0.270*	(0.105)	-0.225***	(0.0834)	-0.0248	(0.0388)
UNEMP	0.0513	(0.0363)	0.0183	(0.0279)	0.0558***	(0.0163)
LNGRPPC	0.0216	(0.0199)	0.00540	(0.0158)	0.00922	(0.00835)
VOC LME	-		-		-	
VOC CME	-1.541***	(0.502)	-1.400***	(0.404)	-0.194	(0.198)
VOC MME	-2.241***	(0.587)	-1.949***	(0.472)	-0.372	(0.266)
VOC DME	2.236***	(0.581)	0.865+	(0.458)	1.459***	(0.219)
λ	0.522+	(0.274)	0.237	(0.415)	0.526***	(0.113)
ρ	0.485	(0.402)	0.647*	(0.329)	-3.257***	(1.086)
σ^2	2.507***	(0.249)	1.560***	(0.155)	0.370***	(0.0380)
Constant	-2.157	(5.525)	-9.531*	(4.668)	7.106***	(2.460)
Observations	204		204		204	
Log-likelihood	-383.836		-335.502		-193.260	

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