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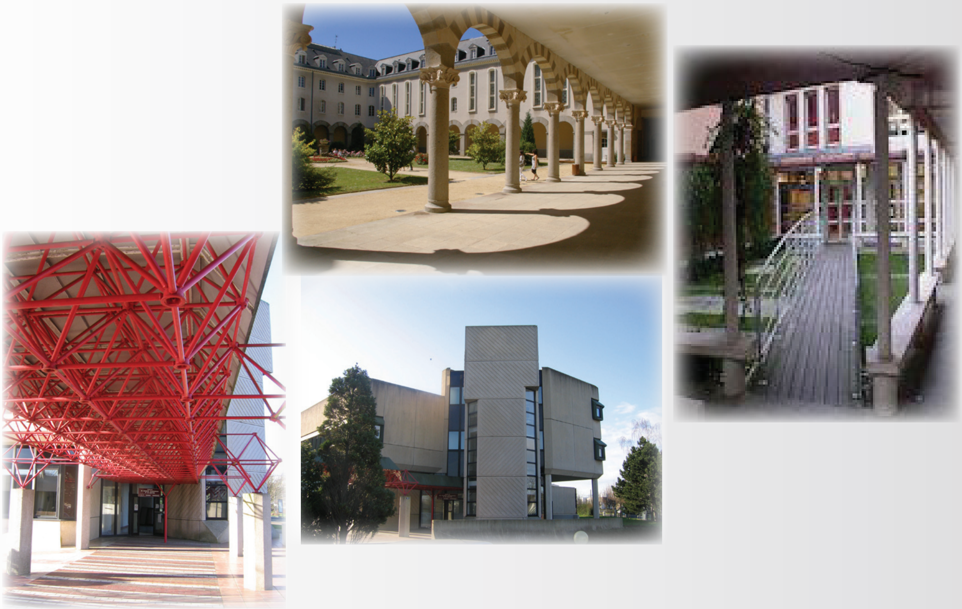

Working Paper

Determinants of Entrepreneurship in French Regions: The Role of Spatial Heterogeneity

Marie-Estelle Binet
University of Rennes 1 - CREM UMR CNRS 6211, France

François Facchini
University of Paris-Sud, Faculty of Jean Monnet, France

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DETERMINANTS OF ENTREPRENEURSHIP IN FRENCH REGIONS:

THE ROLE OF SPATIAL HETEROGENEITY

Marie-Estelle BINET, CREM, UMR 6211 CNRS[1]

François FACCHINI, PARIS-SUD, FACULTE JEAN MONNET (France)[2]

ABSTRACT: This paper deals with the determinants of enterprise creation in the 22 French regions from 1994 to 2003. We then estimate a dynamic panel data model which allows spatial heterogeneity to be modelled and which is compared with a specification without spatial heterogeneity. The estimation results show that an appropriate consideration of spatial heterogeneity can lead to new insights. The results show: 1) that the Holcombe effect and the income effect have a statistically significant and positive impact for all regions; 2) that the age of the population and the size of the firms have the same negative effects for all regions with the exception of Ile-de-France; 3) that at the threshold of 10%, the refugee effect only concerns 10 regions out of 22; 4) that the effect of public R&D remains insignificant for 17 of the 22 regions, but becomes statistically significant in five regions and has a positive effect in three regions only, these being those which exhibit the highest per capita public R&D expenditure levels. Globally, Anselin's (1990) hypothesis, according to which the presence of spatial heterogeneity casts doubt upon the generalizability of theories in regional science, is thus in part confirmed.

JEL Classification: M13, O18, J21

Key-words: Creation of enterprises, spatial heterogeneity, dynamic panel data, refugee effect, public R&D.

[1] University of Rennes 1, Faculty of Economics, 16 place Hoche, CS 86514, 35065 Rennes, France, marie-estelle.binet@univ-rennes1.fr

[2] University of Paris-Sud, Faculty of Jean Monnet, *Facchini:* University of Paris-Sud, Faculté Jean Monnet, 54 Bd. Desgranges, 92 330 Sceaux, France. Phone: +33-614-407-8114. E-mail francois.facchini@u-psud.fr; http://www.adis.u-psud.fr/chercheurs/francois-facchini/

1. INTRODUCTION

The objective of this article is to explain the creation of enterprises in the French regions over the period 1993–2004 through a dynamic panel data specification. France has a relatively low average rate of entrepreneurship compared to other developed countries. However, there are important differences across the 22 administrative regions. Therefore, those data are ideally suited for the analysis of the determinants of entrepreneurship including spatial heterogeneity. Finally, the main innovative feature in this article is to introduce spatial heterogeneity in the econometric specification that is estimated.

There is a considerable body of theoretical literature concerning the relationship between entrepreneurial dynamics and local development (Dejardin 2010; Dejardin and Fritsch 2011). However, in recent years, aside from a few articles (Binet, Facchini and Koning 2010; Bonnet 2010; Boutillier 2010), empirical studies on the determinants of the creation of enterprises in French regions and in more specific local areas are scarce.

This article is therefore an original contribution to empirical regional science literature. In a first step, we estimate a simple dynamic panel data specification to explain entrepreneurship rates across French regions. The results show that the creation of enterprises in French regions depends positively upon an autoregressive term, the regional unemployment rate, and level of regional income. First of all, the lag dependent variable points to the Holcombe effect which stipulates that entrepreneurship creates opportunities for further entrepreneurial activity (Holcombe 1998), i.e. that there is a virtuous effect of the entrepreneurial dynamic in a country. Next, the rate of regional unemployment evaluates the existence of a refugee effect. When the number of salaried jobs becomes rare, the creation of one's own job becomes a more attractive solution than in a situation where there are many jobs (Parker 2006). Lastly, the revenue variable measures a demand effect on the dynamic of profit opportunities operating in a territory.

We also point out, on the one hand, the absence of an effect of public spending on Research & Development (R&D) and, on the other hand, the negative effect of age (proportion of persons over 65 in the total population) and the size of the firms (proportion of firms with more than 50 employees in the total number of firms) on the creation of enterprises in French regions over the period 1993–2005.

However, one of the limitations of this first analysis is that it only highlights average or dominant effects. Therefore, these results must be interpreted with caution as they rely on a global specification of entrepreneurship determinants, with the same coefficients for all of the statistical units, i.e. the regions. However, the relationship between entrepreneurship and its explanatory variables is likely to be different from one region to another. If that is the case, it might explain the lack of significance or the low coefficient values we have obtained. Indeed, French regions do not all register the same rate of creation of enterprises. We derive certain comfort from this in that it seems that regional factors affect the probability of creation of enterprises, (Dejardin 2010, p.62). In this context, the main stake in this article is to test Anselin's (1990) hypothesis according to which the presence of spatial heterogeneity casts doubt upon the generalizability of theories in regional science.

A dynamic panel model explicitly integrating spatial heterogeneity is thus used in a second step. We attempt to differentiate the effects of the determinants of enterprise creation by groups of regions, each group being composed through comparisons of regional averages using the ANOVA spatial method (Le Gallo 2004). The results show: 1) that the Holcombe effect and the income effect have a significant and positive impact for all regions; 2) that the age of the population and the size of the firm have the same negative effect in all regions except for *Île-de-France*; 3) that at the threshold of 10%, the refugee effect only concerns 10 regions out of 22; 4) that the effect of public R&D remains insignificant for 17 of the 22 regions, but is statistically significant in five regions and has a positive effect in three regions only, these being those which exhibit the highest per capita public R&D expenditure levels. Globally, Anselin's (1990) hypothesis is partly confirmed.

This article is organized in four sections. The first succinctly notes the main empirical results obtained in the literature. The second section is devoted to the presentation of the data used and the results of estimates of a dynamic panel model to explain the dynamics of creation of enterprises in French regions between 1993 and 2004, without integrating spatial heterogeneity in the specification. The third section addresses comparison tests of the regional averages of the main variables in the study. We thus try to identify the nature and the scale of the main regional differentiations in terms of unemployment, income per inhabitant, and public spending on R&D. The fourth section presents the results obtained after estimation of the model obtained by differentiating the effects of the determinants of enterprise creation by groups of regions. On the basis of the results obtained, we conclude by centring the analysis on the specificities of the regions with profiles which diverge from the average.

2. REVIEW OF EMPIRICAL LITERATURE

The aim of this section is to illustrate several important results from empirical literature. The standard arbitrage theory between risks and profits of respectively salaried employees and entrepreneurs (Parker 2006, pp.438–439) leads to several precise predictions which can easily be tested. This empirical literature is large and generally based on econometric methods (Parker 2005). The studies generally concern OECD countries and their regions. Alternatively, the Austrian approach proposes a more general theory, which makes the entrepreneur at the same time an alternative to the figure of the optimizing individual and the theory of equilibrium. The entrepreneur is the agent who coordinates supply to meet demand (Kirzner 1979). From this perspective, the number of opportunities for profit and the capacity of individuals to perceive them are the central determinants of entrepreneurial activity and the creation of enterprises if we suppose that at the origin of a new enterprise there is an entrepreneur. This is important as the number of entrepreneurs in a territory is not measured only by the number of creators of enterprises. It is also composed of heads of enterprises already created who want to increase their market share and to grow.

These two approaches to the theory of entrepreneurship allow us to identify most of the determinants of the entrepreneurial dynamic and the creation of enterprises. At the most general level, it is observed that an ageing population is unfavourable to productive entrepreneurial activity (Storey 1994; Kurek and Rachwal 2011), while a high density of population and level of urbanization are more favourable for the creation of enterprises (Henriquez et al. 2002, p.8). It is also observed that the entrepreneur tends to be rather a rich man (not a woman), about 30 years old, married, with entrepreneurial parents, a good education and numerous entrepreneurial experiences (Parker 2006, p.439).

Lastly, the inefficiency of local firms generates opportunities for the creation of new projects. In the USA, Dean and Meyer (1996) observe that numerous factors influence the creation of new firms. Thus, the annual percentage of increase in sales, the intensity of R&D, the extent of publicity spending, the size of firms measured by the number of jobs, the percentage of unionized employees, the age of firms, as well as the vertical integration, are all significant variables capable of explaining the dynamic of the creation of enterprises. Finally, the authors conclude that there is a relationship between changes in industry and the creation of new firms.

The effect of the size of the public sector on the productive activity of entrepreneurs is not clear. On this subject, we can look to the work of Cowling and Bygrave (2007). On the one hand, they find that the number of pensions paid in an economy has no effect on the rate of entrepreneurial activity (REA) as reported in *Global Entrepreneurship Monitoring* for the year 2002 in 37 countries. They observe on the other hand, a slight negative effect of the level of social security on the REA and a negative effect of barriers to entry such as the regulation of liberal professions. Weak market entry barriers are therefore favourable to entrepreneurial activity. There is also inertia in self-employment behaviours: the REA lagged once explains the current REA value. Finally, they highlight the fundamental role of culture in the dynamic of the productive activity of entrepreneurs (Cowling and Bygrave 2007, p.633).

The role played by employment conditions – and by unemployment in particular – in explaining entrepreneurial activity is the relationship most often tested in the literature. Employment conditions constitute an important variable but the effects on business start-up remain undetermined. Two different effects are generally examined. The Schumpeter effect, or the negative effect of enterprise creation on unemployment, has a tendency on average to win over the refugee effect, i.e. the positive effect of unemployment on the creation of enterprises. The results of tests vary greatly according to the country studied and the period of observation. They are also sensitive to the way in which the activity of entrepreneurs is measured and to the statistical techniques used. There is no consensus in the empirical literature. Carree (2002) maintains that there is no refugee effect. In contrast, Storey (1991, p.177) concludes that the Schumpeter effect is observed in cross-sectional analyses. Marlow and Storey (1992) suggest that both effects exist. At a national level, we often observe that the refugee effect does not play a role (Meager 1992, pp.94–95). Conversely, the refugee effect is observed at a regional level (see, for example, Binet, Facchini and Koning 2010).

Table 1 also shows that the results do not converge and that they depend greatly on the explanatory variable chosen, the sample and the time period under study.

Table 1.Refugee effect (RE) versus Schumpeter effect (SE): contrasted empirical results

Articles	**Sample**	**Effect on unemployment rate**
Bregger (1963), Ray (1974), Becker (1984)	USA	RE
Creigh et al. (1986)	English regions	Insignificant
Abell and Smeaton (1995)	UK	
Acs, Audretsch and Evans (1994)	OECD	RE
Bögenhold and Staber (1991)	OECD	RE (except for Belgium and Sweden)
Cooper, Gimeno-Gascon and Woo (1994)	USA	Insignificant
Van Praag (1994)	USA	Insignificant
Cowling and Mitchell (1997)	UK	RE (short term unemployment) SE (long term unemployment)
Rodson (1996, 1998)	UK	SE
Taylor (1999)	UK	RE
Evans and Leighton (1990)		RE (positive effect on the number of entrepreneurs)
Garofoli (1994)		Negative effect of unemployment on number of entrepreneurs
Tervo and Niittykangas (1994)	Finland	Mixed effect (regional level)
Audretsh and Fritsch (1994)	OECD	Negative effect of unemployment on number of entrepreneurs
Storey (1991)	USA	Mixed effect

Sources: Meager (1992), Cowling and Bygrave (2007) and Audretsch, Carree and Thurik (2001).

Finally, the effect of R&D on entrepreneurial activity is a more original variable as R&D in quantitative economic work is generally used to evaluate the economic activity of innovative entrepreneurs (Facchini 2007). However, the relationship between R&D and entrepreneurship has been studied by Audretsch, Keilbach and Lehmann (2006) who uphold the notion that a lack of entrepreneurial capital in an economy cancels the positive effect of R&D activity on economic development. There are no incentives to invest in knowledge if no entrepreneur is able to transform an invention into innovation, or, in other words, into a commercially stable product capable of responding to a consumer demand. On this basis, and considering the availability of data, our model includes the following explanatory variables: an autoregressive term (Holcombe effect), the proportion of persons aged over 65 (one takes fewer risks when age increases), the proportion of enterprises of over 500 employees, the annual income per inhabitant, regional unemployment rate and the amount of public R&D spending per inhabitant.

3. EMPIRICAL MODELLING OF ENTREPRENEURSHIP DETERMINANTS WITHOUT SPATIAL HETEROGENEITY

In this section, we first present the data selected for empirical analysis, then we develop the empirical methodology. Next, the estimation results are discussed.

3.1 DATA DESCRIPTION

The local public sector in France comprises four overlapping administrative divisions. In order, from the lowest level up, there are 36,680 municipalities, 2,599 groups of municipalities, 100 departments, and 22 metropolitan administrative regions which correspond to the regional division at the NUTS 2 level. French regions, which were created by decentralization laws in 1982, form the highest level of local government in France and are specialized in economic policy. Annual data covering the period 1993–2004 have been taken from the *National Institute of Statistical and Economic Studies* (SIRENE data base) and from EUROSTAT. Tables 2 and 3 describe the data and report basic descriptive statistics.

Table 2. Data description and sources, average values 22 French regions, 1993–2004

Variable	**Name**	**Source**	**Mean**	**Max**	**Min**	**Standard deviation**
Number of start-ups per 1,000 inhabitants	START	SIRENE	4.2	9.4	2.46	1.59
Unemployment rate (%)	UNEMP	EUROSTAT	9.71	26	4.9	2.62
Yearly income per capita (Euros)	INC	EUROSTAT	13,914	20,963	10,332	1,789
Percentage of firms with more than 500 employees (%)	P500	SIRENE	0.06	0.22	0	0.042
Percentage of inhabitants over 65 years old (%)	P65	EUROSTAT	16.33	23.13	8.59	2.88
R&D public expenditure per capita (Euros)	RDPUB	EUROSTAT	43.61	293	1.15	58.77

Underpinning Table 2, we observe that the average number of start-ups for 1000 inhabitants between 1993 and 2004 is 4.2 in France. However, we observe in Table 3 a great dispersion with minimum values equal to 2.63 in *Nord-Pas-de-Calais,* 2.81 in *Picardie,* 2.86 in *Champagne,* and maximum values in *Corse* (8.27), *Languedoc-Roussillon* (7.20), *Provence-Alpes-Côte d'Azur* (7.16) and *Île-de-France* (5.94).

Regarding unemployment rates, we note in Table 2 that the country average is 9.71 % between 1994 and 2003 but cross-regional disparities are large and persistent, between 6.50% (*Alsace*) and 14.32% (*Languedoc-Roussillon*) (see Binet and Facchini 2013 for further discussion). Next, we see in Table 3 that a few regions are characterized by high public R&D expenditure levels (*Midi-Pyrénées, Île-de-France* and *Languedoc-Roussillon*), whereas others exhibit low levels (*Limousin, Champagne* and *Franche-Comté*).

Table 3. Data description, regional average values 1993–2004

Region	***START for 1000 inhabitants***	***UNEMP (%)***	***RDPUB (Euros)***	***P500 (%)***	***P65 (%)***	***INC (Euros)***
Île-de-France	5.94	9.11	170	0.20	11.59	17,763
Champagne-Ardennes	2.86	10.29	2.48	0.059	14.94	12,900
Picardie	2.81	10.73	5.38	0.058	13.54	12,920
Haute-Normandie	3.06	10.57	4.11	0.079	13.88	13,130
Centre	3.23	8.50	31.84	0.055	17.02	13,600
Basse-Normandie	3.52	8.96	9.53	0.049	16.45	12,830
Bourgogne	3.25	8.39	16.39	0.050	18.09	13,800
Nord-Pas-de-Calais	2.63	13.59	8.85	0.11	13.29	11,090
Lorraine	2.97	8.94	18.11	0.085	14.59	12,680
Alsace	3.44	6.50	14.50	0.12	13.28	13,650
Franche-Comté	3.22	7.61	2.80	0.038	15.10	12,980
Pays de Loire	3.58	8.84	23.84	0.068	15.66	12,810
Bretagne	3.74	7.72	50.71	0.057	17.16	12,940
Poitou-Charentes	3.84	8.92	13.25	0.035	18.99	12,880
Aquitaine	5.17	10.24	18.86	0.027	18.27	13,520
Midi-Pyrénées	4.91	9.11	213	0.029	18.42	12,940
Limousin	3.27	7.61	1.68	0.027	22.07	13,270
Rhônes-Alpes	4.88	8.37	66.61	0.073	14.26	13,740
Auvergne	3.49	8.53	37.96	0.027	18.67	13,330
Languedoc-Roussillon	7.20	14.32	141.44	0.019	18.48	12,290
Provence-Alpes-Côte d'Azur	7.16	12.96	89.60	0.027	17.66	13,450
Corse	8.27	13.87	18.00	0.005	17.85	11,760

Another notable feature is that some French regions have a high proportion of the population over the age of 65 (*Limousin*, for example) and high per capita income level (*Île-de-France*). Finally, the percentage of firms with more than 500 employees is rather small, with an average value equal to 0.06% and a maximum value of 0.20 % in *Île-de-France*.

Having presented the data, we now move on to the empirical methodology based on a panel data specification.

3.2 EMPIRICAL METHODOLOGY

As the sample happens to be the population, the following dynamic panel data model, including regional fixed effects α_i , is more appropriate than the random effects model:

$$START_{it} = \alpha_i + \beta_1 \, \mathrm{START}_{\mathrm{it\text{-}1}} + \beta_2 X_{it} + \varepsilon_{it} \tag{1}$$

where i=1,..,22 French regions and t=1993–2004 (12 years). *START*, the dependent variable, measures the number of start-ups for 1,000 inhabitants in each region. $START_{it-1}$ is the dependent variable lagged in time to account for the fact that entrepreneurship decisions are part of a dynamic process, i.e. more firm creation in one region seems to create more firms in the same region. X_{it} is a matrix of exogenous explanatory variables including the percentage of inhabitants over 65 years old in the region (P65), regional unemployment rate (UNEMP), the percentage of firms with more than 500 employees (P500), yearly regional income per capita (INC), and per capita R&D spending in the public sector (RDPUP). The inclusion of time invariant individual specific effects controls for geographical, cultural and regional specificities (distance from Paris, credit access, regional policies, regional traditions, etc.).

Equation (1) can be estimated by the generalized method of moment (GMM) estimator. There are two different estimators available to estimate such a dynamic panel data model: the difference GMM estimator (Arellano and Bond 1982) or the system GMM (Blundell and Bond 1998) estimator. The Blundell and Bond (1998) system GMM estimator is chosen as it has been shown to offer much increased efficiency and less finite sample bias compared with the difference GMM estimator. Indeed, efficient estimations combine the set of moment conditions available for the first-differenced equation with the additional moment conditions implied for the level equation.

However, GMM estimators based on too many moment conditions can be subject to potentially severe over-fitting biases in small samples. Therefore, we restrict the number of instruments by defining a maximum number of lags and by collapsing the instruments.[3] We also apply a least square dummy variable estimator (LSDV) to the model, omitting the lagged term, i.e. a static panel data specification, to check the robustness of our empirical results.

[3] Estimates are obtained from the xtabond2 procedure in STATA, see Roodman (2009).

The constitution of the system GMM estimator relies on the validity of the moment conditions which depends on the assumption of absence of serial correlation of the level residuals. First, the overall validity of the moment conditions is checked by the Hansen test. The null hypothesis is that instruments are not correlated with the residuals. The Hansen difference test checks the validity of extra moment conditions over that of weak exogeneity (or the additional restrictions imposed in the system GMM estimator). Third, the Arellano and Bond (1991) test for serial autocorrelation tests the hypothesis that there is no second-order serial correlation in the first-differenced residuals, which in turn implies that the errors from the level equation are serially uncorrelated.

3.3 EMPIRICAL RESULTS WITHOUT SPATIAL HETEROGENEITY

In this specification (1), which does not consider spatial heterogeneity, the parameter $\beta's$ are assumed to be constant across regions. The following table (Table 4) reports the LSDV estimates for the static panel data specification and the one-step system GMM estimates for the dynamic panel data model. To address the problem of too many instruments, we restrict the number of instruments by defining a maximum number of lags corresponding to y_{it-2} and y_{it-3} and by collapsing the instruments.

The validity of the lagged instruments in the first-differenced equations is clearly checked by the Hansen test of over-identifying restrictions (p-value equal to 0.232). The difference in the Hansen statistic that especially tests the additional moment conditions used in the level equation accepts their validity at the 10% level. The Arellano and Bond tests show that the first order autocorrelations are different from zero, while those of the second order are equal to zero. Applied to the residuals in difference, these results suggest the likely presence of valid moment conditions.

The first point of interest, concerning our empirical results, is that GMM estimates give the autoregressive coefficient equal to 0.65 and statistically significant. Therefore, regions with high rates one year are likely to have high rates in the following year. Indeed, this measure checks for the Holcombe effect, i.e. more firm creation in a region seems to create more firms in the same region one time period later. Furthermore, regional fixed effects are significant which shows that the role of institutional factors, regional history, geography and tradition are crucial in determining the level of entrepreneurial activity.

Table 4. Estimation results without spatial heterogeneity, panel data, 22 French regions, t=1993–2004

	Static panel data specification		***Dynamic panel data specification***	
Explanatory variables	Coefficient	p-value	Coefficient	p-value
Lagged dependant variable			0.65	0.008***
Unemployment	0.039	0.024**	0.086	0.09*
Per capita income	0.00014	0.000***	0.00016	0.003***
% firms with more than 500 employees	-3.45	0.099*	-7.54	0.19
% of inhabitants above 65 years old	-0.099	0.000***	-0.044	0.16
R&D public expenditures	-0.0014	0.51	0.0039	0.24
Breush Pagan heteroscedasticity test		0.000***		
F test for fixed effects significance		0.000***		
Hansen test for overidentifying restrictions				0.232
Difference in Hansen test				0.130
Arellano and Bond test for AR(1) in first differences				0.005***
Arellano and Bond test for AR(2) in first differences				0.608

*t statistics are computed with robust standard errors to deal with heteroscedasticity. Significance level: *** for 1%, ** for 5 % and * for 10 %.*

The second point of note is that the coefficients of two entrepreneurship determinants (unemployment and per capita regional income) are robust for both alternative estimators (GMM and LSDV). The results reveal a low but statistically significant refugee effect: one additional unemployment point will generate a maximum increase of 0.086 in the number of start-ups for 1,000 inhabitants in each region. Indeed, the decision to start a new business is therefore a response to unemployment, i.e. a lack of outside alternatives in the labour market. Self-employment is a last resort for certain individuals marginalized in the employed sector and facing lengthy spells of unemployment.

Regional income per capita is also found to have a small but positive effect on entrepreneurship decisions with 1000 additional Euros a year generating an increase of around 0.16 start-ups per 1000 inhabitants. This is likely to be a demand-side effect.

Other empirical results are statistically significant for the static model only. In regions where the percentage of inhabitants aged more than 65 years is high, we observe a lower incentive for people to start their own business. Indeed, estimates obtained with the LSDV procedure show that when the percentage of people over 65 increases by 1%, business start-up decreases by -0,099 for 1000 inhabitants. Next, we focus on the effect of barriers to market entry, proxied by the percentage of firms with more than 500 employees. When barriers to market entry are high, we expect the rate of entrepreneurship will be lower. The results show that this effect is rather important as an increase of 0.1% in firms with more than 500 employees will reduce the number of start-ups by 0.3%. We conclude that competition policy may be critical for the development of new business activity by entrepreneurships. Finally, the coefficient related to public research spending per capita is not statistically significant, which suggests that this variable might not influence the individual decision to create one's own business.

However, these results must be interpreted with care as they rely on a global specification of entrepreneurship determinants, with the same coefficients for all of the statistical units, i.e. the regions. Indeed, the relationship between entrepreneurship and its explanatory variables is likely to be different from one region to another. If this is the case, it might explain the lack of significance and the low coefficient values we have obtained.

Spatial heterogeneity is relevant when data are obtained for a cross-section of spatial units (Anselin 1992). In practice, spatial heterogeneity can be reflected by heteroscedasticity in the error term, coefficients varying with the location, or both. Due to historical and cultural differences at the regional level, France is known to be characterized by strong spatial heterogeneity. The country's territory can be divided into a periphery constituted by a group of different regions and a core constituted by *Île-de-France*, the area around and including the capital, Paris. Furthermore, the Breush Pagan test reveals the presence of heteroscedasticity (see Table 4) and, as suggested by Anselin (1992), an indication of heteroscedasticity may point to the need for a more explicit incorporation of spatial heterogeneity.

To address spatial heterogeneity at the regional level in the next section, we first implement spatial ANOVA tests to analyse spatial differences across the 22 French regions compared to *Île-de-France* for each variable. This preliminary investigation will help to introduce spatial heterogeneity into the empirical specification in the form of spatial regimes for further analysis of entrepreneurship determinants.

4. EMPIRICAL MODELING OF ENTREPRENEURSHIP DETERMINANTS WITH SPATIAL HETEROGENEITY

Spatial ANOVA methodology is described in the first subsection. Corresponding results for each variable described in Table 1 are given in the second one. In the third section, we present and discuss the estimation results for the two spatial regimes models considered.

4.1 SPATIAL ANOVA METHODOLOGY

The spatial ANOVA procedure applied in this study tests the hypothesis that the average value of variable *Y* (between 1993 and 2004) varies across French regions. To this end, we regress *Y* on all the following 22 regional dummy variables except one (d_{i1}):

$$y_{it} = \alpha_1 + \sum_{r=2}^{22} \alpha_r d_{ir} + \varepsilon \qquad (2)$$

with $\begin{cases} d_{ir} = 1 \text{ if the region is region r} \\ \quad\quad\; 0 \text{ otherwise} \end{cases}$

α_1 measures the average value of *Y* in the omitted region 1. Other coefficients α_r can be interpreted as the difference between the average value of *Y* for region *r* and the average value for the omitted region. If this coefficient is statistically different from zero, then the average value for region r is different from the average value for region 1.

Île-de-France, which includes Paris, is the French administrative region which is usually considered to be different from all of the other regions. Indeed, *Île-de-France* is characterized by a high regional growth rate, high population density, and high education level (see Facchini and Koning 2010 for further discussion). Therefore, *Île-de-France* is the region omitted in our empirical analysis.

4.2 SPATIAL ANOVA RESULTS

The following table (Table 5) gives the ANOVA test results for each variable considered in the empirical specification (1).

Table 5. ANOVA test results, coefficient estimates (p-value)

Dummy Variable	*START per 1,000*	*UNEMP %*	*RDPUB €*	*P500 %*	*P65 %*	*INC €*
Constant (Île-de-France)	5.94 (0.000)***	9.11 (0.000)***	170.36 (0.000)***	0.2 (0.000)***	11.59 (0.000)***	17,763 (0.000)***
Champagne-Ardennes	-3.08 (0.000)***	+1.17 (0.005)***	-167.88 (0.000)***	-0.14 (0.000)***	+3.34 (0.000)***	-4,110 (0.000)***
Picardie	-3.13 (0.000)***	+1.61 (0.000)***	-164.97 (0.000)***	-0.14 (0.000)***	+1.95 (0.000)***	-4,033 (0.000)***
Haute-Normandie	-2.88 (0.000)***	+1.45 (0.003)***	-166.24 (0.000)***	-0.12 (0.000)***	+2.28 (0.000)***	-3,772 (0.000)***
Centre	-2.72 (0.000)***	-0.61 (0.120)NS	-138.51 (0.000)***	-0.14 (0.000)***	+5.43 (0.000)***	-3,370 (0.000)***
Basse-Normandie	-2.43 (0.000)***	-0.15 (0.727)NS	-160.83 (0.000)***	-0.15 (0.000)***	+4.86 (0.000)***	-4,340 (0.000)***
Bourgogne	-2.70 (0.000)***	-0.72 (0.061)*	-153.97 (0.000)***	-0.15 (0.000)***	+6.50 (0.000)***	-3,426 (0.000)***
Nord-Pas-de-Calais	-3.31 (0.000)***	+4.47 (0.000)***	-161.50 (0.000)***	-0.09 (0.000)***	+1.69 (0.000)***	-5,845 (0.000)***
Lorraine	-2.97 (0.000)***	-0.17 (0.687)NS	-152.24 (0.000)***	-0.11 (0.000)***	+2.99 (0.000)***	-4,180 (0.000)***
Alsace	-2.50 (0.000)**	-2.61 (0.000)***	-155.86 (0.000)***	-0.08 (0.000)***	+1.68 (0.000)***	-3,148 (0.000)***
Franche-Comté	-2.73 (0.000)***	-1.50 (0.000)***	-167.56 (0.000)***	-0.16 (0.000)***	+3.50 (0.000)***	-3,837 (0.000)***
Pays de Loire	-2.36 (0.000)***	-0.275 (0.517)NS	-146.51 (0.000)***	-0.13 (0.000)***	+4.07 (0.000)***	-4,204 (0.000)***
Bretagne	-2.21 (0.000)***	-1.4 (0.000)***	-119.65 (0.000)***	-0.14 (0.000)***	+5.56 (0.000)***	-4,276 (0.000)***
Poitou-Charentes	-2.10 (0.000)***	-0.19 (0.580)NS	-157.11 (0.000)***	-0.16 (0.000)***	+7.40 (0.000)***	-4,217 (0.000)***
Aquitaine	-0.77 (0.000)***	1.125 (0.000)***	-151.50 (0.000)***	-0.17 (0.000)***	+6.68 (0.000)***	-3,749 (0.000)***
Midi-Pyrénées	-1.03 (0.000)***	-0.008 (0.98)NS	+42.79 (0.001)***	-0.17 (0.000)***	+6.82 (0.000)***	-4,145 (0.000)***
Limousin	-2.67 (0.000)***	-1.50 (0.000)***	-168.68 (0.000)***	-0.17 (0.000)***	+10.47 (0.000)***	-3,663 (0.000)***
Rhônes-Alpes	-1.06 (0.000)***	-0.741 (0.028)**	-103.74 (0.000)***	-0.12 (0.000)***	+2.67 (0.000)***	-3,120 (0.000)***
Auvergne	-2.45 (0.000)***	-0.58 (0.139)NS	-132.40 (0.000)***	-0.17 (0.000)***	+7.08 (0.000)***	-3,742 (0.000)***
Languedoc-Roussillon	+1.26 (0.000)***	+5.20 (0.000)***	-28.92 (0.000)***	-0.18 (0.000)***	+6.88 (0.000)***	-4,798 (0.000)***
Provence-Alpes-Côte d'Azur	+1.21 (0.000)***	+3.85 (0.000)***	-80.75 (0.000)***	-0.17 (0.000)***	+6.06 (0.000)***	-3,507 (0.000)***
Corse	+2.32 (0.000)***	+4.75 (0.001)***	-152.38 (0.000)***	-0.19 (0.000)***	+6.26 (0.000)***	-5,184 (0.000)***

*t statistics are computed with robust standard errors to deal with heteroscedasticity. Significance level: *** 1%, ** 5% and * 10%, NS: non-significant.*

First, the results confirm the spatial heterogeneity in entrepreneurship rates at the regional level in France over the period 1993–2004. Indeed, the spatial ANOVA tests on the dependent variable – start-ups – reveal an average value equal to 5.94 per 1,000 inhabitants in *Île-de-France*. However, as all the coefficients associated with the 21 dummy variables are statistically significant, we conclude that entrepreneurship rates in those regions are different from the entrepreneurship rate in *Île-de-France*. More precisely, most of those peripheral French regions are characterized by an average entrepreneurship rate rather lower than that in *Île-de-France* (*Nord-Pas-de-Calais*, *Picardie*, *Champagne-Ardennes*, *Lorraine*, *Haute-Normandie*, *Franche-Comté*, *Centre*, *Bourgogne*, *Limousin*, *Basse-Normandie*, *Alsace*, *Auvergne*, *Pays Loire*, *Bretagne*, *Poitou-Charentes*, *Rhône-Alpes*, *Midi-Pyrénées*, *Aquitaine*). In contrast, only three regions have higher average entrepreneurship rates than *Île-de-France* (*Corse*, *Languedoc-Roussillon*, *Provence-Alpes-Côte d'Azur*).

Concerning the unemployment rate, the value of the constant is 9.11%, giving the average value in *Île-de-France* between 1993 and 2004. Again, comparison tests reveal spatial disparities across the regions. More precisely, seven regions have a similar average unemployment rate as the corresponding coefficient is not statistically significant at the 10% level (*Centre*, *Basse-Normandie*, *Lorraine*, *Pays-de-Loire*, *Poitou-Charentes*, *Midi-Pyrénées* and *Auvergne*). However, in other French regions, the average unemployment rate is higher than that observed in *Île-de-France* (*Languedoc-Roussillon*, *Nord-Pas de-Calais*, *Corse*, *Provence-Alpes-Côte d'Azur*, *Picardie*, *Haute-Normandie*, *Champagne-Ardennes*, *Aquitaine*). Finally, as the difference between their average values is statistically significant, we conclude that unemployment rates are lower in six French regions compared to *Île-de-France* (*Alsace*, *Franche-Comté*, *Limousin*, *Bretagne*, *Rhône-Alpes*, *Bourgogne*).

The average value of public R&D spending per capita is equal to 170.36 Euros in *Île-de-France*. Except for *Midi-Pyrénées*, all the other French regions have lower values than *Île-de-France* as the coefficient associated with the corresponding dummy variable is negative and statistically significant. Therefore, we observe a strong polarization of public expenditure in terms of R&D in *Île-de-France* and in *Midi-Pyrénées*.

Concerning the other variables, the core-periphery model perfectly describes the spatial distribution of the percentage of firms of more than 500 employees, the proportion of people over 65 years old, and per capita regional income. Indeed, *Île-de-France* (the core) exhibits a high percentage of firms with more than 500 employees (0.2%) compared with other French regions (the periphery), which exhibit lower percentages (between 0.01% in *Corse* and 0.12% in *Alsace*). The same core-periphery configuration describes the spatial distribution of the population over 65 years old. First, in *Île-de-France* the proportion of the elderly in the total population is 11.59% on average between 1993 and 2004. This proportion is higher in all other French regions (from 13.28% in *Alsace* to 19% in *Poitou-Charentes*). Second, *Île-de-France* exhibits a higher per capita income level with a yearly average value of 17,762 Euros, whereas all other French regions are characterized by lower values. Therefore, if we consider the spatial distribution of these three variables, heterogeneity can be modelled by introducing one specific coefficient for *Île-de-France* and a different one for all other regions. Thus, the specificities of *Île-de-France* can be taken into account. Based on these spatial divisions of the French territory, we estimate in the next subsection two spatial regime models.

4.3 SPATIAL REGIMES ESTIMATION RESULTS

To introduce spatial heterogeneity in the specification (1), we use a spatial regimes model (Anselin 1988). Each regime is characterized by specific values for the coefficients associated with the unemployment rate, per capita R&D spending levels, the proxy to measure barriers to entry, the percentage of people over 65 years old, and per capita regional income. The number of regimes is defined by the spatial division of the French territory into regions. Given the spatial ANOVA analysis, we first propose to divide the French territory into two regimes, grouping contiguous French administrative regions together and by differentiating *Île-de-France* from other regions. We introduce, for each variable, one specific coefficient for each explanatory variable when the region is *Île-de-France* and a second coefficient otherwise, i.e. for all other regions. Table 6 (below) reports the one-step system GMM estimates for the corresponding dynamic panel data model.

The Hansen and Arellano and Bond tests confirm the validity of the instruments. First, the empirical results confirm the persistence in entrepreneurship rates as the coefficient associated with the lagged dependent variable is statistically significant and equals 0.79. Next, this specification performs better than the specification without spatial heterogeneity. Indeed, the results exhibit more significant explanatory variables (percentage of firms with more than 500 employees and percentage of people over 65 in *Île-de-France*) and higher coefficient values than the previous specification.

Table 6. Estimation results with spatial regimes Île-de-France (IDF)/other French regions, t=1993–2004

Explanatory variables	***Dynamic panel data specification*** Coefficient	p-value
Lagged dependant variable	0.79	0.000***
Unemployment IDF	0.19	0.000***
Unemployment other regions	0.06	0.11
Per capita income IDF	0.00013	0.000***
Per capita income other regions	0.00013	0.000***
% firms with more than 500 employees IDF	-6.88	0.065*
% firms with more than 500 employees other regions	-6.37	0.38
% of inhabitants over 65 years old IDF	-0.034	0.009***
% of inhabitants over 65 years old other regions	-0.031	0.22
Public R&D expenditure per capita IDF	-0.0010	0.66
Public R&D expenditure per capita other regions	0.0015	0.31
Hansen test for overidentifying restrictions	p-value=0.281	
Difference in Hansen test	p-value=0.111	
Arellano and Bond test for AR(1) in first differences	p-value=0.005***	
Arellano and Bond test for AR(2) in first differences	p-value=0.241	

*t statistics are computed with robust standard errors to address heteroscedasticity. Significance level: *** 1%, ** 5 % and * 10 %.*

In particular, the results reveal a rather high significant refugee effect in *Île-de-France*: one additional unemployment point will generate a maximum increase of 0.19 in the number of start-ups per 1,000 inhabitants in this region (i.e. twice the coefficient obtained in Table 4). Furthermore, we expect that the low and poorly significant refugee effect observed for other French regions could be explained by the existence of such an effect for a few regions only. In the same way, we wonder if the insignificant results concerning public R&D spending we have observed would not hide significant effects in a few regions only or significant effects but with opposite signs.

For further analysis of the effect of unemployment and public R&D on entrepreneurship decisions, we consider another spatial regimes specification including one specific coefficient for each region and for those two variables (i.e. 40 additional coefficients). However, in order to avoid the 'too many moment conditions' problem, we need to restrict the number of instruments. Therefore, we develop a stepwise backward elimination procedure to reduce the model. In Table 7, we present the estimation results obtained for the final spatial regimes model thus defined.

Table 7. Estimation results with spatial regimes, stepwise backward method

Explanatory variables	***Dynamic panel data specification*** Coefficient	p-value
Lagged dependant variable	0.55	0.09*
% of inhabitants above 65 years old IDF	-0.065	0.008***
% of inhabitants above 65 years old other regions	-0.049	0.12
% firms with more than 500 employees IDF	-6.79	0.009***
% firms with more than 500 employees other regions	-6.20	0.27
Per capita income	0.0001	0.000***
Unemployment IDF	0.18	0.000***
Unemployment *Basse-Normandie*	0.014	0.043**
Unemployment *Nord-Pas-de-Calais*	0.010	0.10*
Unemployment *Pays-de-Loire*	0.029	0.005***
Unemployment *Bretagne*	0.042	0.002***
Unemployment *Poitou-Charentes*	0.033	0.000***
Unemployment *Midi-Pyrénées*	0.078	0.036**
Unemployment *Limousin*	0.063	0.001***
Unemployment *Rhône-Alpes*	0.075	0.11
Unemployment *Corse*	0.13	0.06*
Public R&D expenditures *Picardie*	-0.056	0.11
Public R&D expenditures *Aquitaine*	0.037	0.07*
Public R&D expenditures *Limousin*	-0.23	0.000***
Public R&D expenditures *Languedoc-Roussillon*	0.011	0.097*
Public R&D expenditures *Provence-Alpes-Côte d'Azur*	0.017	0.10*
Hansen test for overidentifying restrictions	p-value=0.85	
Difference in Hansen test	p-value=0.57	
Arellano and Bond test for AR(1) in first differences	p-value=0.023**	
Arellano and Bond test for AR(2) in first differences	p-value=0.46	

*t statistics are computed with robust standard errors to deal with heteroscedasticity. Significance level: *** for 1%, ** for 5 % and * for 10 %.*

The estimation results show that an appropriate consideration of spatial heterogeneity can lead to new insights. Indeed, the results reveal a robust refugee effect which concerns 10 French regions (approximately half of the 22 regions under study). In particular, the results confirm a rather high significant refugee effect in *Île-de-France* and reveal almost the same size in *Corse*. As to potential explanations for this finding, it appears that certain regions will always be more likely to consider starting their own business as a response to unemployment than in others. And these results show that the refugee effect concerns both regions with a high unemployment rate (*Corse*, *Nord-Pas-de-Calais*) and regions with a low unemployment rate (*Limousin*, *Bretagne*).

The second point of note is that per capita public R&D spending is statistically significant in five regions, which suggests that this variable does influence individual decisions to create a business, but in a few regions only. However, we obtain contrasting results as in *Limousin* an increase of 10 Euros in per capita R&D public expenditure will reduce the number of start-ups per 1,000 inhabitants by 2.3 (respectively by 0.5 in *Picardie*). Conversely, in *Aquitaine*, *Languedoc-Roussillon* and *Provence-Alpes-Côte d'Azur*, which exhibit high per capita public R&D expenditure levels, additional Euros will generate an increase in the number of start-ups per 1,000 inhabitants. Finally, our results show that when public spending on R&D reaches a sufficient level, it might create a ripple effect on business start-ups.

5. **CONCLUSION**

The main purpose of this article is to assess the importance of spatial heterogeneity in the analysis of the determinants of entrepreneurship. In our study, we use panel data from 1993 to 2004 that covers all the 22 French regions, the highest level of local government in France. We then estimate dynamic panel data models to explain the number of firms created in each region. First, we assume the stability of regression coefficients over the observation set and estimate a simple dynamic panel data model, without including regional heterogeneity. The results reveal persistence in entrepreneurship rates, a low but statistically significant refugee effect, and a low positive income effect. Other explanatory variables considered are not statistically significant if we consider GMM estimates. Therefore, we wonder if the low or poorly significant results obtained could be explained by the existence of spatial heterogeneity over the French territory. Thus, in a second step, we estimate the entrepreneurship specification after controlling for spatial heterogeneity. Two different spatial regimes models are estimated based on interregional differences in France and the models are then compared. We then assess the importance of spatial heterogeneity in the analysis of the determinants of regional entrepreneurship. In particular, the results reveal a robust refugee effect which concerns 10 French regions only. From the perspective of policy analysis, our results suggest that in regions where the refugee effect does not appear, local authorities must find alternative measures to support their job creation dynamic in periods of recession. It also appears that per capita public R&D spending is statistically significant in five regions but has a positive effect in three regions only, these being those which exhibit the highest per capita public R&D expenditure levels. We therefore conclude that this variable has a complementary effect on entrepreneurship. Finally, we observe a ripple effect on business start-ups when public spending on R&D reaches a sufficient level.

Our results suggest that any attempt to reduce regional unemployment must address regional labour market specificities. Our findings highlight the role played by decentralized regional authorities in implementing specific regional policies.

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