THE FACTORS DETERMINING FIRM START-UPS AND THE HETEROGENEITY OF REGIONAL LABOR MARKETS

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ABSTRACT: This paper investigates regional differences in the determinants of business start-ups in the 22 French regions. The main innovation of the paper is to 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 refugee effect only concerns 10 regions out of 22 and the effect of public R&D remains insignificant for 17 of the 22 regions. But R&D encourages business start-ups in three of them and discourages the formation of new firms in two other regions. Population ageing and firm size have the same negative effect but in *Île-de-France* only. Finally, we find evidence consistent with Anselin's (1990) hypothesis that the presence of spatial heterogeneity casts doubt upon the generality of theories in regional science.

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Keywords: Firm start-ups, spatial heterogeneity, dynamic panel data, refugee effect, public R&D, French regions.

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1. INTRODUCTION

As mentioned by the European Commission, entrepreneurship is a major issue for regional performance. There is a considerable body of literature concerning the relationship between entrepreneurial dynamics and local development (Audretsch and Keilbach 2005; Facchini 2007; Fritsch 2008; Dejardin and Fritsch 2011). The seminal works by Knight (1921), Schumpeter (1934), and Kirzner (1973) developed the concept of entrepreneurs as 'disequilibrators' (Schumpeter) or 'equilibrators' (Kirzner). Following Evans and Leighton (1989), who examined the process of selection into self-employment using survey data, a rich literature has thus emerged identifying the individual entrepreneurial ability (see also Parker (2005a) for an overview of the economics of entrepreneurship).

At the regional level, based on the Krugman's theory of economic geography, Audretsch and Fritsch (1994) explain why firm start-ups vary across regions. The determinants of entrepreneurship are shaped by a number of economic, social, and region-specific influences. But, as mentioned in Section 2 below, there is still controversy in the literature, especially about the relation between entrepreneurship, unemployment and R&D respectively. And recently, aside from a few articles (Levratto et al. 2013; Binet et al. 2010; Bonnet 2010; Boutillier 2010), empirical studies on the determinants of business start-ups in the French regions are scarce.

In this context, this article is an original contribution to the empirical regional science literature. The goal is to explain entrepreneurship in the French regions over the period 1993–2004. Therefore, those data are ideally suited for the analysis of the determinants of entrepreneurship including spatial heterogeneity and dynamic patterns. Indeed, France has a relatively low average rate of entrepreneurship compared to other developed countries. However, there are important differences across the 22 administrative regions (Dejardin 2010). Therefore, we estimate a spatial regimes model including specific regional values for the coefficients.

More precisely, in a first step, we estimate a simple dynamic panel data specification to explain entrepreneurship rates across the French regions. The results show that the start-up activities depend positively upon an autoregressive term (Holcombe effect 1998), the regional unemployment rate (refugee effect), and the level of regional income. We also point out, on the one hand, the absence of an effect of Research & Development (R&D) and, on the other hand, the negative effect of age and the size of firms on business start-ups in the French regions.

However, one of the limitations of this first analysis is that it only highlights average effects. Therefore, these results must be interpreted with caution. However, the relationship between entrepreneurship and its explanatory variables is likely to be different from one region to another (see Parker (2005b) who develops a model explaining regional differences in the start-up activity). If that is the case, it might explain the lack of significance or the low coefficient values we have obtained. A dynamic panel model explicitly integrating spatial heterogeneity is thus used in a second step. The results show that: 1) population ageing and firm size have the same negative effect but in *Île-de-France* only; 2) the refugee effect only concerns 10 regions out of 22; 3) the effect of public R&D remains insignificant for 17 of the 22 regions, but becomes positive for three of them and negative for two only. Anselin's (1990) hypothesis is thus partly confirmed.

This paper proceeds as follows. In Section 2, we outline the theoretical background on the main determinants of entrepreneurship at the regional level. Section 3 describes the data used in our empirical analyses. Section 4 is devoted to the presentation of the results of estimates of a dynamic panel model to explain the dynamics of business start-ups without integrating spatial heterogeneity in the specification. Section 5 first addresses comparison tests of the regional averages of the main variables in the study, then presents the results obtained by differentiating the effects of the determinants of business start-ups by groups of regions. Section 6 concludes.

2. MAIN DETERMINANTS OF ENTREPRENEURSHIP AT THE REGIONAL LEVEL

In this section, we provide the theoretical background on the variables that drive entrepreneurship in our econometric model.

First of all, the main focus of the paper is on investigating regional heterogeneity with respect to new firm foundation. Indeed, the French regions do not all register the same rate of business start-ups. As mentioned by Audretsch et al. (2010), the regional context should be a particularly important determinant of entrepreneurship. More precisely, Audretsch and Keilbach (2004, 2005) highlight the positive influence of entrepreneurship capital on business start-ups and Audretsch et al. (2010) show the role played by cultural diversity. Entrepreneurship capital involves the existence of a regional milieu that favors business start-ups i.e. "*the existence of formal or informal networks, but also the general acceptance of entrepreneurial activity and the positive influence of bankers willing to share risks and benefit involved*".

Second, according to Kirzner (1973), entrepreneurial opportunities and the capacity of individuals to perceive them are central determinants of entrepreneurial activity. The Holcombe (1998) effect stipulates that entrepreneurship creates opportunities for further entrepreneurial activity, i.e. that there is a virtuous effect of the entrepreneurial dynamic. Therefore Holcombe makes Kirzner's model more complete by explaining one origin of entrepreneurship opportunities.

Third, the role played by employment conditions in explaining entrepreneurial activity is the relationship most often tested in the literature. But two contrasting effects may be at work in this relationship. First, the rate of regional unemployment evaluates the existence of a refugee effect (or a push effect), i.e. the positive effect of unemployment on business start-ups[3]. 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). Second, a high rate of unemployment may be associated with relatively low levels of demand for the output of the self-employed, and therefore a negative relationship may be observed between unemployment and entrepreneurship (see Audretsch and Fritsch (1994) in Germany).

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[3] The Schumpeter effect predicts a negative effect of entrepreneurial activity on unemployment through the reverse causality relation. The use of lagged unemployment values as instruments to implement the GMM estimator chosen in our study therefore corrects this simultaneity problem.

Indeed, the relationship between new firms and unemployment is a complex one. And the results of tests vary greatly according to the country studied and the period of observation. At the national level, we observe the lack of a clear relationship across countries between aggregate unemployment and self-employment stocks (Meager 1992). At the regional level, Carree (2002) finds no refugee effect for US States; conversely, the refugee effect is sometimes observed (Binet et al. (2010) in France). Furthermore, Storey (1991) concludes that unemployment is positively associated to business start-ups in times series analyses whereas cross-sectional studies indicate the opposite. Finally, Parker and Robson (2004) predict a positive effect when one control for aggregate income in the econometric specification, which is the case in our study.

Next, knowledge variables including R&D are other variables driving entrepreneurship, especially in technologically developing industries, Audretsch et al. (2010). Schumpeter (1934) considers innovation as one of the primary factors that initiate the entrepreneurial process, rather than an entrepreneurial discovery process. The relationship between R&D and entrepreneurship has been studied by Audretsch et al. (2006). They suggest that a high regional R&D activity increases regional opportunities to favor new knowledge-based businesses. But a lack of entrepreneurial capital in an economy may cancel the positive effect of R&D activity on entrepreneurship. This is the case if no entrepreneur is able to accelerate the diffusion and application of innovative ideas and new business opportunities. Moreover, Acs and Audretsch (1989) argue that technologically developing industries have inherent scale barriers which deter new firm formation. Finally, R&D effect on business start-ups is indeterminate.

Next, the disposable regional income measures a demand effect on the dynamic of profit opportunities operating in a territory. More precisely, we use a measure of regional income to proxy the level of general economic opportunities. High regional income implies increasing market size, and therefore increasing general opportunities for new firms.

The last variables concern the proportion of firms of over 500 employees and the percentage of population who is 65 years or more. First, the share of firms of over than 500 employees, which may be viewed as a proxy for the barriers of entry, might be an important start-up determinant. Indeed, entry barriers constrain business start-ups by prohibiting new firms from taking advantage of available opportunities (Dean and Meyer 1996). Lastly, an ageing population is also a key factor in explaining entrepreneurship. On one hand, as an ageing population is more risk averse than a younger population, we expect a negative effect on entrepreneurial activity. On the other hand, population ageing may favor the rise of a 'silver economy' i.e. innovative products and services aimed at elderly consumers (Kurek and Rachwal 2011).

In the next section, we present the data selected for empirical analysis.

3. 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, groups of municipalities, 100 departments, and 22 metropolitan administrative regions which correspond to the European division at the NUTS 2 level. The French regions, which were created by decentralization laws in 1982 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

Variables	***Symbols***	***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 > 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

In Table 2, we observe that the average number of start-ups for 1000 inhabitants, which reflects the propensity of inhabitants of a region to start a new firm, is 4.2. However, we observe in Table 3 a great dispersion with minimum values equal to 2.63 in *Nord-Pas-de-Calais or* 2.81 in *Picardie* 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[4] 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

[4] Private R&D has been included in preliminary specifications but large insignificant estimates have been obtained. In a similar way, government policy variables as regional taxes are dismissed as their corresponding values are very low.

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.

4. EMPIRICAL MODELLING OF ENTREPRENEURSHIP DETERMINANTS WITHOUT SPATIAL HETEROGENEITY

In this section, we first describe the empirical methodology, then the estimation results are discussed.

4.1 EMPIRICAL METHODOLOGY

We consider the following dynamic panel data model, including regional fixed effects α_i :

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

where *i=1,..,22* French regions and *t=1993–2004* (12 years). $START_{it-1}$ is the number of start-ups for 1,000 inhabitants 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 (Holcombe effect).

Considering the availability of data, X_{it} is a matrix of 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 (RDPUB). The inclusion of time invariant individual specific effects controls for geographical, cultural and regional specificities.

There are two different estimators available to estimate such a dynamic panel data model to deal with simultaneity issues: the difference GMM (Generalized Method of Moment) estimator (Arellano and Bond 1991) or the system GMM (Blundell and Bond 1998) estimator. The Blundell and Bond (1998) system GMM estimator is chosen as it offers higher efficiency and less finite sample bias compared with the difference GMM estimator. 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 corresponding to $t-2$ and $t-3$ and by collapsing the instruments.[5] We also apply a Least Square Dummy Variable estimator (LSDV) to the model, omitting the lagged term, to check for the robustness of our empirical results.

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. Second, the Hansen difference test checks the validity of extra moment conditions over that of weak exogeneity. 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.

4.2 EMPIRICAL RESULTS WITHOUT SPATIAL HETEROGENEITY

In specification (1), parameters are assumed to be constant across regions. 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.

The validity of the lagged instruments in the first-differenced equations is clearly checked by the Hansen test of over-identifying restrictions (p-value equals to 0.232). The difference in the Hansen statistic that especially tests the additional moment conditions used in the level equation accepts their validity. The Arellano and Bond tests show that the first order

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

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.

Furthermore, regional fixed effects are significant which shows that unobserved heterogeneity i.e. the role of the regional milieu is crucial in determining the level of entrepreneurial activity.

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

Model specification	***Static panel data specification***		***Dynamic panel data specification***	
Explanatory variables	Coefficient	p-value	Coefficient	p-value
Lagged dependent 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	0.004	0.24
Breusch-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 first point of interest is that GMM estimates give the autoregressive coefficient equal to 0.65 and statistically significant. Therefore, regions with high start-up rates in one year are likely to have high rates in the following year. Indeed, this result highlights the Holcombe effect. The policy conclusion implied is that policies that foster entrepreneurship promote growth.

The second point 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. Indeed, the decision to start a new business is therefore a response to 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.

Two other empirical results are statistically significant for the static model only. In regions with a high percentage of inhabitants aged more than 65 years, 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, measured by the percentage of firms with more than 500 employees. 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. This is consistent with Dean and Meyer (1996) and supports the view that concentration acts as a barrier to entry. We conclude that competition policy may favour the development of new business activity. Finally, the coefficient related to public research spending per capita is never statistically significant, which suggests that this variable might not influence firm start-ups.

However, these results must be interpreted with care as they rely on a global specification of entrepreneurship determinants. 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.

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. Indeed, the Breusch 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 account for spatial heterogeneity. To address this issue in the next section, we first implement spatial ANOVA tests. This preliminary investigation will help to introduce spatial heterogeneity into the empirical specification in the form of spatial regimes for further analysis of the entrepreneurship determinants.

5. EMPIRICAL MODELING OF ENTREPRENEURSHIP DETERMINANTS WITH SPATIAL HETEROGENEITY

Spatial ANOVA methodology and corresponding results are described in the two following subsections. In the third subsection, we present and discuss the estimation results for the two spatial regimes models considered.

5.1 SPATIAL ANOVA METHODOLOGY

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

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

with $d_r = 1$ if the region is *r*, *0* otherwise. α_1 is the average value of *Y* in the omitted region. Other coefficients α_r can be interpreted as the difference between the average value of *Y* for region *r* and α_1. If this coefficient is statistically different from zero, then the average value for region r is statistically different from the average value for region 1. *Île-de-France*, which includes Paris, is the region omitted as this region is characterized by a high regional growth rate, high population density, and high education level (see Facchini and Koning (2010) for further discussion).

5.2 SPATIAL ANOVA RESULTS

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

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

Dummy Variable	***START per 1,000***	***UNEMP %***	***RDPUB €***	***P500 %***	***P65 %***	***INC €***
Constant (Île-de-France)	5.94	9.11	170.36	0.2	11.59	17,763
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Champagne-Ardennes	-3.08	+1.17	-167.88	-0.14	+3.34	-4,110
	(0.000)***	(0.005)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Picardie	-3.13	+1.61	-164.97	-0.14	+1.95	-4,033
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Haute-Normandie	-2.88	+1.45	-166.24	-0.12	+2.28	-3,772
	(0.000)***	(0.003)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Centre	-2.72	-0.61	-138.51	-0.14	+5.43	-3,370
	(0.000)***	(0.120)NS	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Basse-Normandie	-2.43	-0.15	-160.83	-0.15	+4.86	-4,340
	(0.000)***	(0.727)NS	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Bourgogne	-2.70	-0.72	-153.97	-0.15	+6.50	-3,426
	(0.000)***	(0.061)*	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Nord-Pas-de-Calais	-3.31	+4.47	-161.50	-0.09	+1.69	-5,845
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Lorraine	-2.97	-0.17	-152.24	-0.11	+2.99	-4,180
	(0.000)***	(0.687)NS	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Alsace	-2.50	-2.61	-155.86	-0.08	+1.68	-3,148
	(0.000)**	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Franche-Comté	-2.73	-1.50	-167.56	-0.16	+3.50	-3,837
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Pays de Loire	-2.36	-0.275	-146.51	-0.13	+4.07	-4,204
	(0.000)***	(0.517)NS	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Bretagne	-2.21	-1.4	-119.65	-0.14	+5.56	-4,276
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Poitou-Charentes	-2.10	-0.19	-157.11	-0.16	+7.40	-4,217

	(0.000)***	(0.580)NS	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Aquitaine	-0.77	1.125	-151.50	-0.17	+6.68	-3,749
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Midi-Pyrénées	-1.03	-0.008	+42.79	-0.17	+6.82	-4,145
	(0.000)***	(0.98)NS	(0.001)***	(0.000)***	(0.000)***	(0.000)***
Limousin	-2.67	-1.50	-168.68	-0.17	+10.47	-3,663
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Rhône-Alpes	-1.06	-0.741	-103.74	-0.12	+2.67	-3,120
	(0.000)***	(0.028)**	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Auvergne	-2.45	-0.58	-132.40	-0.17	+7.08	-3,742
	(0.000)***	(0.139)NS	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Languedoc-	+1.26	+5.20	-28.92	-0.18	+6.88	-4,798
Roussillon	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Provence-Alpes-Côte	+1.21	+3.85	-80.75	-0.17	+6.06	-3,507
d'Azur	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Corse	+2.32	+4.75	-152.38	-0.19	+6.26	-5,184
	(0.000)***	(0.001)***	(0.000)***	(0.000)***	(0.000)***	(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 reveal significant coefficients associated with the 21 dummy variables. We conclude that entrepreneurship rates in those regions are statistically 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.* 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, comparison tests reveal spatial disparities across the regions. More precisely, seven regions have a similar average unemployment rate that in *Île-de-France* 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 the 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, 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 remaining 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. 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 the 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.

5.3 SPATIAL REGIMES ESTIMATION RESULTS

To introduce spatial heterogeneity in the specification (1), we use a spatial regimes model (Anselin 1992) 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. the same for all other regions. Table 6 reports the one-step system GMM estimates for the corresponding dynamic panel data model.

Table 6. Estimation results with spatial regimes Île-de-France versus 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 %.*

The Hansen 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.

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 observe 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 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 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. More precisely, 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 critical level, it might create a ripple effect on business start-ups. This finding is in accordance with Dean and Mayer (1996) who conclude that technological entrepreneurs may be overcoming technology barriers to entry by the knowledge they have.

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*). In these regions, a lack of entrepreneurial capital in the economy may cancel the positive effect of R&D activity on entrepreneurship.

6. CONCLUSION

The main purpose of this article is to assess the importance of spatial heterogeneity in the analysis of the determinants of entrepreneurship. 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 firm births in each region. First, we assume the stability of regression coefficients over the observation set and estimate a model without including regional heterogeneity. The results reveal persistence in entrepreneurship rates through the Holcombe effect, 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. But, we wonder if the low or poorly significant results obtained could be explained by the existence of regional heterogeneity.

Thus, in a second step, 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. We also point to regional differences between the effects of R&D on business start-ups. It appears that per capita public R&D spending is statistically significant in five regions but encourages business start-ups in three regions only, which exhibit the highest per capita public R&D expenditure levels. We therefore conclude that this variable has a complementary effect on entrepreneurship. Indeed, we observe a ripple effect on business start-ups when public spending on R&D reaches a critical level.

Finally, we conclude that factors driving start-ups differ across regions. Our results therefore 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 and in promoting regional R&D investments and entrepreneurship capital specific to each region.

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