Entrepreneurship, firms creation and regional performance

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Abstract

Purpose – The purpose of this paper is to analyse if the divergences in the economic growth of the Spanish regions are a result of sectoral differences, company size or technological level of the new firms that emerge in the market.

Design/methodology/approach – For this purpose, a model is specified and estimated in which the total factor productivity of Spanish regions is explained by business dynamics, innovation, human capital and the level of entrepreneurship in each region.

Findings – The results obtained lead the authors to conclude that entrepreneurship understood as both the creation of new firms and entrepreneurial activity, have a positive effect on productive efficiency and can explain the differences in the economic growth of the regions. In addition, the stock of human capital and the promotion of innovation act as catalysts for the productive efficiency of the regions. However, the results show that it is not enough to generate new firms to boost economic growth; these businesses must also be oriented towards sectors that promote technological innovation and with the objective to reach an adequate size.

Originality/value – Empirical studies use either the creation of new firms or the index of entrepreneurial activity as alternative measures of entrepreneurship. In this research, however, both variables are considered together. Specifically, the creation of new companies is used as a measure of regional business dynamics, and the entrepreneurial activity index, provided by the Global Entrepreneurship Monitor, as a measure of regional entrepreneurship. The main novelty of this paper's approach is that it considers different types of entrepreneurial capital in considering productive sector, size and technological level of the new companies.

Keywords Innovation, Entrepreneurship, Human capital, Total factor productivity, Creation of firms, Productive efficiency

Paper type Research paper

1. Introduction

It is a proven fact that there is a strong relationship between regional economic growth and the level of knowledge and innovation, demonstrated by the fact that the regions with the highest level of technological development and innovation present higher growth. However, knowledge by itself does not generate economic growth; there needs to be a channel to transform this knowledge into economic growth. In this sense, Braunerhjelm *et al.* (2010) point out that for innovations in new products or processes to generate growth they require an entrepreneur willing to assume the risk involved in launching new products or processes onto the market. Therefore, entrepreneurial capital is one of the factors that generate externalities that contribute to economic growth[1].

Entrepreneurship is understood as not only the creation of new firms but also the activity of introducing new products or new productive processes onto the market. In the empirical studies, no clear agreement has been reached on how to collect the entrepreneurship. It is true that the activity of entrepreneurs involves, in most cases, the creation of firms, thus establishing a link between entrepreneurship and firm's creation.

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In this sense, Acs (2006) considers that the creation of firms generates jobs, intensifies competitiveness and promotes innovation. Therefore, it is usual to use the creation of new firms as an indicator of entrepreneurship (OECD, 2008; Carree and Thurik, 2008; Koellinger and Thurik, 2012; Van Praag and Van Stel, 2013; Erken *et al.*, 2016). However, acknowledging the creation of firms as the only entrepreneurial would overlook other important entrepreneurship contributions. Empirical studies use either the creation of new firms or the index of entrepreneurship activity as alternative measures of entrepreneurship. In this research, however, both variables are considered together. Our main contribution is that we consider both entrepreneurship and creation of firms in explaining cross-regional differences in economic growth. Specifically, the creation of new companies is used as a measure of regional business dynamics, and the total entrepreneurial activity (TEA) index, provided by the Global Entrepreneurship Monitor (GEM), as a measure of regional entrepreneurship. Moreover, the main novelty of this paper's approach is that it considers different types of entrepreneurial capital in considering productive sector, size and technological level of the new companies.

As Acs *et al.* (2018) pointed out Baumol (1990, 1993) argued that, even if all countries had similar supplies of entrepreneurs, the institutional structure would determine the allocation to productive, unproductive and destructive forms of activity. This leads to empirical literature consider whether entrepreneurship and institutions are pivotal in explaining cross-country differences in economic growth (Braunerhjelm *et al.*, 2010; Bjørnskov and Foss, 2016; Acs *et al.*, 2017; Sussan and Acs, 2017). In order to ignore the institutional structure, this paper focuses on Spanish regional data that provide data from only one country.

We analyse the impact of the creation of new firms and the entrepreneurship activity on the inequalities in the level of growth in the different Spanish regions. In addition, another contribution of the paper is that it also focuses on analysing whether the effect of business dynamics on regional economic growth differs according to the productive sector, the firm size and the technological level of the new firms that emerge in the market.

This paper is divided into six sections. Following the introduction, the second section presents the theoretical framework. The third section presents the methodology used and the fourth section analyses the data used in the research. The fifth section shows the empirical results obtained and, finally, the last section includes the main conclusions of the paper.

2. Theoretical framework

In his seminal article, Solow (1956) proposed a model in which production was a function of two explicit factors, physical capital and labour, and an implicit factor, technological advance, the residual factor. Solow acknowledged that growth was influenced by technological change, but in the formalization of its production function he considered it exogenous. In fact, Solow considered that productive factors, capital and labour, did not necessarily explain the growth variation given that most of its variation was explained by the residual contained in technological progress.

Subsequently, the models of endogenous growth of Romer (1986) and Lucas (1988, 1993) explicitly introduced technological progress, considering that knowledge is transmitted through externalities and generates effects of drag on the economy. However, knowledge by itself does not generate economic growth; the externalities assumed to exist by Romer and Lucas need to be produced. Entrepreneurship is one of the channels of knowledge transmission that contributes to economic growth. In this sense, Audretsch (2007) considered that the policy of promoting entrepreneurial activity promotes economic growth.

As indicated by Acs *et al.* (2018), the theory that there is a positive relationship between entrepreneurship and growth goes back to Schumpeter (1934). The literature attempting to show the existence of this positive relationship has been prolific since then. Wennekers and Thurik (1999) and, more recently, Carree and Thurik (2010) provide a review of the literature that includes the relationship between entrepreneurship and economic growth. From the empirical evidence obtained in the literature, it can be concluded that entrepreneurial capital, understood as both the creation of new firms and entrepreneurial activity, are key factors in achieving an improvement in productivity and, therefore, generating economic growth (Callejón and Segarra, 1999; Holtz-Eakin and Kao, 2003; Audretsch and Keilbach, 2004, 2008; Van Stel *et al.*, 2005; Audretsch *et al.*, 2006; Van Praag and Versloot, 2007; Thurik *et al.*, 2008; Bjørnskov and Foss, 2013; Van Praag and Van Stel, 2013; Aubry *et al.*, 2015; Huggins and Thompson, 2015; González-Pernía and Peña-Legazkue, 2015; Prieger *et al.*, 2016; Erken *et al.*, 2016; Acs *et al.*, 2018).

Based on the evidence that there is a positive relationship between entrepreneurial capital and economic growth, our contribution is to verify whether the differences in productive sector, size and the technological level of the new companies generated can explain the inequalities in productivity growth in the regions of Spain. Fritsch (2008) and Fritsch and Schroeter (2011) indicate that the effect of new firms creation is different between regions. On the other hand, Aubry *et al.* (2015) consider that entrepreneurial capital contributes in varying intensity to the growth of regions in industrialised countries.

3. Methodology

The total factor productivity (TFP) is a fundamental variable to measure the growth and development of an economy as it reflects the productive efficiency with which its economic system works. For Krugman (1994) "productivity is not everything, but in the long term it is almost everything". The growth of productivity generates economic growth since technical progress leads to an increase in the yields of all productive factors, especially those of labour. Therefore, the growth capacity of an economy depends, fundamentally, on technical progress and this capacity is reflected in the rate of growth of the TFP.

There are different approaches for obtaining TFP and one of them is based on growth accounting. According to this methodology, the growth of TFP is obtained as part of the endogenous growth of the production of an economy that is not explained by the variations of all the inputs used to obtain production. Specifically, the methodology of growth accounting decomposes the growth of production into three sources: the growth of the labour factor, the growth of the capital factor and the growth of the TFP[2] (Audretsch and Keilbach, 2004).

The accounting approach to the decomposition of growth sources begins from considering a production function. The most used production function is the Cobb-Douglas (1928), which is specified as follows:

$$Y_{it} = A_{it} K_{it}^{\alpha} L_{it}^{\beta}, \tag{1}$$

where Y_{it} is the output level or production in real terms, A_{it} measures the technological advance or productivity efficiency, K_{it} is the physical capital stock, L_{it} is the employment level, whilst α is the elasticity of production for the factor labour and β the elasticity of production for the factor capital.

Taking logarithms from Equation (1), and assuming constant returns to scale, $\alpha + \beta = 1$, we obtain:

$$\ln Y_{it} = \ln A_{it} + \alpha \ln K_{it} + (1-\alpha) \ln L_{it}. \tag{2}$$

When taking first differences, the following relationship is obtained:

$$\Delta \ln Y_{it} = \Delta \ln A_{it} + \alpha \Delta \ln K_{it} + (1-\alpha) \Delta \ln L_{it}. \tag{3}$$

Equation (3) indicates that the growth rate of production is determined by the growth of physical capital, employment and the improvement of efficiency or increase in TFP. In this way, the increase of the TFP would be obtained as follows:

$$\Delta \ln A_{it} = \Delta \ln Y_{it} - \alpha \Delta \ln K_{it} - (1-\alpha) \Delta \ln L_{it}. \quad (4)$$

According to Cuadrado and Moral (2016), the coefficient α refers to the arithmetic mean of the share of labour income in production in period t and t–1. As indicated by Cuadrado and Moral (2016), the temporal variability of the elasticity of production to the labour factor is usually ignored and assumed to be a constant elasticity equal to 0.65. In our case, the elasticity of the labour factor is calculated over the sample period and for each of the regions. From this calculation, the growth of the TFP for each region is obtained.

In this research we consider the creation of new firms and entrepreneurship as indicators of entrepreneurial capital. In addition, there are other variables or exogenous factors that influence the growth of TFP, such as human capital and R&D expenditures in each region. In literature, both theoretical and empirical, the contribution of investment in R&D in economic growth is evidenced (Griliches and Lichtenberg, 1984; Aghion and Howitt, 1992; Coe and Helpman, 1995; Griliches, 1998; Jacobs *et al.*, 2002; Guellec and Van Pottelsberghe de la Potterie, 2004; Aghion, 2017). With respect to human capital, it should be noted that this is one of the most used factors in growth models, as cited in the contributions by Becker (1975), Mincer (1984), Romer (1986), Barro and Lee (1993), Barro and Sala-i-Martin (1995) and Barro (2001), among others. Another school of economic thought relates human capital with the creation of firms and technological diffusion, as indicated in the contributions of Sevilir (2010), Kato and Honjo (2015) and Vila *et al.* (2015), among others.

Thus, in the model finally specified, the following explanatory variables for the growth of the TFP are used; the increase of TEA, the R&D expenses and the stock of human capital as well as the creation of new companies[3]:

$$\Delta TFP_{it} = \alpha_1 + \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta F_{it} + u_{it}. \quad (5a)$$

However, in general, the behaviour of an economy is subject to a strong tendency usually captured by an inertial term. In the present case, the regressor ΔTFP_{it-1} has been included in Equation (5a), so that the behaviour equation is defined by:

$$\Delta TFP_{it} = \alpha_1 + \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta TFP_{it-1} + \alpha_6 \Delta F_{it} + u_{it}. \quad (5b)$$

Given the characteristics of the data used, the possible existence of fixed effects in the behaviour Equation (5b) is contrasted. For this purpose, the following alternative model is specified:

$$\Delta TFP_{it} = \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta TFP_{it-1} + \alpha_6 \Delta F_{it} + \sum_{j=1}^{17} \beta_j \text{Dummy}_{jit} + u_{it}, \quad (5c)$$

The variable Dummy takes value 1 for region j and 0 for the rest of the regions.

Using Equation (5c) four hypotheses can be tested empirically:

H1. Regions with higher levels of entrepreneurial activity will grow faster.

H2. Regions with higher levels R&D expenditure will have faster growth rates.

H3. Regions with higher levels human capital endowment will have faster growth rates.

H4. Regions with higher levels of creation of new companies will have faster growth rates.

Then, through a sensitivity analysis, the importance of the different characteristics of the new companies and their influence on the productive efficiency of the regions is analysed.

In the first place, the importance of the size of the firm is analysed, second, the production sector to which it belongs and, third, the technological level of the company.

In order to study the contribution of the size of the firm in the explanation of the TFP, and taking Equation (5b) as reference, we propose the following equation. This model analyses the importance of the size of new companies when explaining the behaviour of productive efficiency:

$$\Delta TFP_{it} = \alpha_1 + \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta TFP_{it-1} + \beta_j \Delta FG_{jit} + u_{it}, \quad (6)$$

where the variable ΔFG_{jit} is a variable that measures the creation of new companies, according to size ($j = 1, 2, 3, \ldots, 6$) and the parameter β_j quantifies the elasticity of the size of the company in productive efficiency.

Likewise, the analysis of the importance of the production sector is carried out through the following model:

$$\Delta TFP_{it} = \alpha_1 + \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta TFP_{it-1} + \gamma_j \Delta FS_{jit} + u_{it}, \quad (7)$$

where the variable ΔFS_{jit} measures the creation of new firms according to the productive sector ($j = 1, 2, 3, \ldots, 6$) and the parameter γ_j, of Equation (7), quantifies the elasticity of the production sector j to which the new firm in region i belongs.

Finally, the analysis of the importance of the level of technology used by new firms is done through the following model:

$$\Delta TFP_{it} = \alpha_1 + \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta TFP_{it-1} + \beta_j \Delta FS_{jit} + u_{it} \Delta HK_{it-1} + \delta_j \Delta FT_{jit} + u_{it}, \quad (8)$$

where the variable ΔFT_{jit} measures the degree of technological development of the new companies ($j = 1, 2$), while the parameter δ_j quantifies the elasticity of the technological level of the new companies in the TFP.

Equations (6)–(8) allow testing empirically the following hypothesis:

H5. There are differences in regional economic growth by the size of the new companies.

H6. There are differences in the regional economic growth by the productive sector of the new companies.

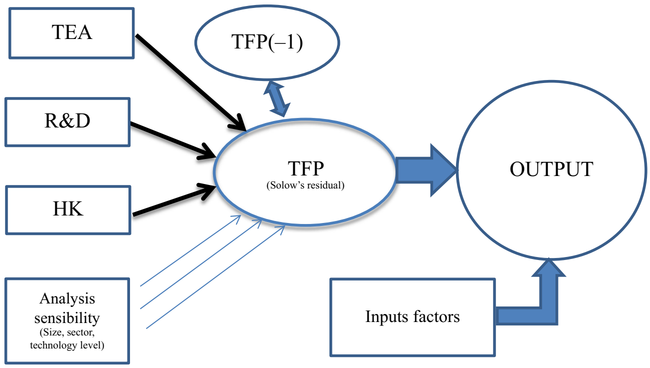
H7. There are differences in the regional economic growth by the technological level of the new companies.

Figure 1 shows in a schematic way the relationship between the variables of the proposed model that determine the output of the regional economies through the TFP.

4. Data and the variables selected

The data used in this analysis come from different institutions, both public and private. Thus, the National Institute of Statistics (INE) has provided information on the level of output, quantified through the gross domestic product (GDP) in constant euros for each of the regions or autonomous communities, expressed in thousands of euros. The same source has been used to obtain information on the number of inhabitants of each region over the period 2000–2016. In addition, the 17 Spanish regions have been considered as study units. This statistical information incorporates a data panel of 268 observations.

The information on the labour production factor is obtained from the INE, using as its measurement the number of workers expressed in thousands, while the data used for the other basic production factor, the stock of physical capital, come from the BBVA Foundation–IVIE. The source of the stock of human capital comes from the estimates made



Source: Compiled by the authors

Figure 1.
Diagram of the model

by the BBVA Foundation–IVIE, while the R&D expenses per inhabitant of each region for each year of the sample period have been obtained from the INE.

The number of firms for each year has been obtained from the Central Companies Directory (DIRCE). The difference in the number of firms between two consecutive years is considered as the net creation of firms for each region. To take into account the size of the region, this variable has been divided by the population, obtaining the new firm creation per inhabitant, as proposed by Audretsch and Keilbach (2008). With regard to the production sectors considered, the European Classification of Economic Activities 2009 uses a two-digit numerical code. The production sectors are classified, in line with DIRCE, as: industry, construction, commerce, transport/storage, tourism and other services. With regard to firm size, in line with DIRCE, firms are grouped into those without employees, those with 1–2 workers, with 3–5 workers, 6–9 workers, 10–19 workers and more than 20 workers.

Furthermore, depending on the degree of technology used, the production sectors can be classified into: technological and non-technological. In this way, the INE considers the following sectors as high and medium-high technology sectors:

- Sectors qualified as high technology: pharmaceutical industry (21), manufacturers of computer, electronic and optical products (26), aeronautical and space construction and machinery (303), motion picture, video and television programme activities, recording of sound and music publishing (59), programming activities and broadcasting of radio and television (60), telecommunications (61), programming, consulting and other activities related to computer science (62), information services (63) and, finally, research and development (72).
- Sectors of medium-high technology: chemical industry (20), manufacturers of weapons and ammunition (254), manufacturers of electrical equipment and equipment (27), manufacturers of machinery and equipment not specified elsewhere (28), manufacturers of motor vehicles, trailers and semi-trailers (29), manufacturers of other transport equipment (30) except shipbuilding (301) and aeronautical and space construction and machinery (303) and manufacturers of instruments and supplies medical and dental (325).
- The other sectors, not considered in the two previous categories, are classified as non-technological sectors.

The indicator of entrepreneurship activity has been obtained from the GEM. The GEM prepares the TEA annually based on a survey of the adult population to obtain the percentage of entrepreneurial activity of the region or country. The data for the 17 regions cover the period 2003–2016, which means that the sampling period of this research covers the same period and in this way a data panel of 221 observations is specified.

In relation to productivity, as indicated in the previous section, first the elasticity of the labour factor over time and for each of the regions is calculated. Second, the results of the elasticity of the labour factor are applied to the calculation of the growth of the TFP, for each region, through Equation (4). In summary, Table I presents the definitions and sources of the variables used.

Table II shows the descriptive statistics of the variables. On the one hand, Figure 2 shows the average TEA of each region for the period 2003–2016. On the other hand, Figure 3 shows the average growth rates of each region for the following three sub-periods: before the economic and financial crisis (2001–2007), during the crisis period (2008–2012) and recovery period of the economy (2013–2016).

From Figures 2 and 3 it can be concluded that Catalonia is the region with the highest level of entrepreneurship while Asturias is the Autonomous Community with the lowest TEA. When comparing this graph with the average growth of GDP (see Figure 3), it can be seen that regions with lower TEA, such as Asturias, have lower growth rates and also, after the financial crisis, their economy recovers with less intensity compared to regions such as Catalonia or the Balearic Islands which present higher rates of entrepreneurial activity.

Finally, Figure 4 graphically analyses the relationships between the variables that intervene in the model. In general, it shows that those regions which have greater provision in physical capital per head, of human capital, a higher rate of business activity and allocate more resources to R&D are those that have a higher GDP per capita. Therefore, the most innovative regions, with the highest level of entrepreneurship and business dynamism, present higher rates of economic growth.

5. Empirical results

Once the TFP_{it} figures of the Spanish regions are obtained from Equation (4), we estimate the econometric models specified in Section 3, which enables us to analyse the productive efficiency of each region, quantified through the TFP. In the proposed model, the rate of entrepreneurial activity, R&D expenditure per capita, human capital and the creation of new firms per capita are used as explanatory variables of the growth of the TFP of each region.

Subsequently, the sensitivity of the results is analysed taking into account the production sector to which the new company belong, as well as their size and technological level.

Table I. Definition and sources of the variables used

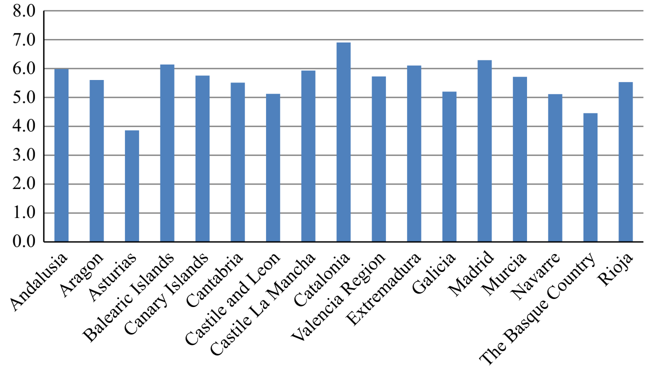
F_{it}	Number of firms divided by population, by region and year (Source: DIRCE and INE)
FG_{jit}	Number of firms according to size *i* divided by population, by region and year (Source: DIRCE and INE)
FS_{jit}	Number of firms according to production sector *i* divided by population, by region and year (Source: DIRCE and INE)
FT_{ijt}	Number of firms according to level of technology *i* divided by population, by region and year (Source: DIRCE and INE)
HK_{it}	Human capital stock. Percentage of workers who have completed their studies at different levels of education, by region and year (Source: IVIE)
K_{it}	Stock of physical capital, by region and year (Source: BBVA Foundation–IVIE)
L_{it}	Labour. Number of workers, in thousands, of people by region and year (Source: INE)
$TFP_{it} = \ln A_{it}$	Productive efficiency. Total productivity of factors, by region and year (Source: INE and BBVA Foundation–IVIE. Compiled by authors from Equation (4))
$R\&D_{it}$	Investment in knowledge. R&D expenditure per inhabitant, by region and year (Source: INE)
TEA_{it}	Total entrepreneurial activity, by region and year (Source: GEM)
Y_{it}	Output. Gross domestic product, in thousands of constant euros, by region and year (Source: INE)

Source: Compiled by the authors

Table II. Descriptive statistics

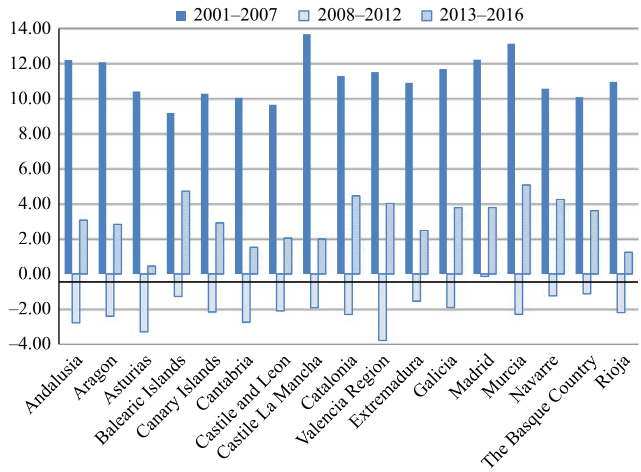
	Growth TFP		No. of firms		Variation firms		R&D		Human capital		TEA	
	Avge	Deviation	Avge	Deviation	Avge	Deviation	Avge	Deviation	Avge	Deviation	Avge	Deviation
Andalusia	0.017	0.046	486,172	21,987	5,565	15,100	1,424.9	263.1	10.51	0.51	5.97	0.75
Aragon	0.025	0.052	90,207	2,496	583	2,335	298.3	63.8	11.23	0.43	5.45	1.75
Asturias	0.011	0.058	69,240	2,223	201	1,434	184.2	43.3	11.36	0.59	3.72	1.74
Balearic Island	0.019	0.039	88,081	2,829	1,030	3,217	86.7	17.5	10.48	0.45	6.14	1.85
Canary Island	0.016	0.034	133,154	6,079	1,388	4,131	225.6	34.2	10.58	0.47	5.63	1.70
Cantabria	0.015	0.048	38,031	1,389	283	962	108.0	34.9	11.31	0.51	5.43	1.35
Castile and Leon	0.017	0.043	164,369	5,339	763	3,295	553.9	96.5	11.02	0.55	5.08	1.04
Castile La Mancha	0.023	0.057	127,018	6,555	1,471	4,238	207.2	58.4	10.33	0.57	5.84	1.40
Catalonia	0.025	0.047	591,440	22,953	5,434	14,735	2,942.2	444.4	10.98	0.40	6.84	1.18
Valencian Region	0.019	0.052	345,898	16,696	3,470	11,639	996.7	129.2	10.83	0.42	5.61	1.57
Extremadura	0.026	0.048	64,108	3,086	552	2,351	121.9	30.3	10.41	0.44	5.98	1.75
Galicia	0.025	0.053	194,677	6,233	1,805	3,942	486.7	78.8	10.86	0.47	5.10	1.39
Madrid	0.027	0.038	494,182	24,098	8,366	13,149	3,537.8	558.7	12.23	0.57	6.16	1.62
Murcia	0.021	0.055	90,692	4,936	1,233	3,739	226.1	44.4	10.36	0.44	5.65	1.18
Navarre	0.034	0.045	42,034	1,335	382	924	326.5	49.3	11.51	0.40	5.01	1.33
The Basque Country	0.032	0.047	160,269	8,742	−268	4,806	1,211.5	233.5	12.05	0.45	4.35	1.42
Rioja	0.017	0.051	22,698	784	229	536	69.5	17.2	11.12	0.60	5.42	1.75
Total	0.025	0.047	186,704	172,023	2,206	7,312	741.8	989.9	10.95	0.75	5.59	1.58

Source: Compiled by the authors from the INE, DIRCE and IVIE



Source: Compiled by the authors from the GEM

Figure 2.
TEA average for the period 2003–2016



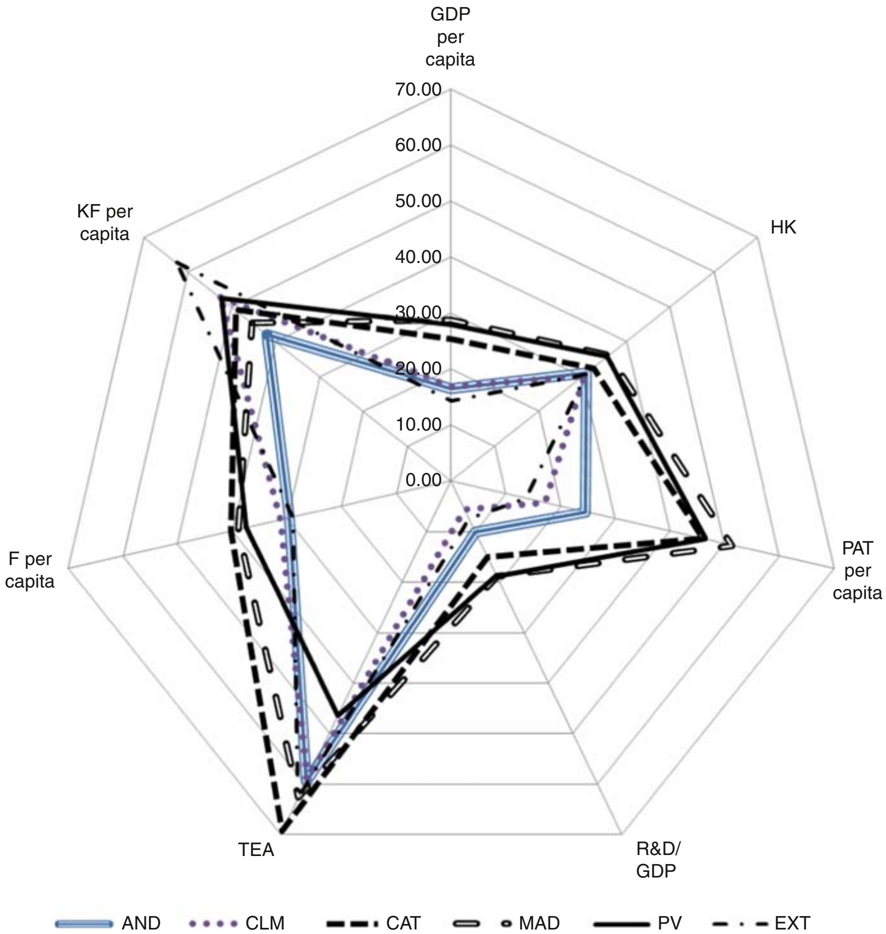
Source: Compiled by the authors from the INE

Figure 3.
Average growth of GDP

The model proposed in Equation (5a) is estimated, initially, by OLS as the Hausman endogeneity test, for the variables TEA and the net creation of firms F_{it}, permits verification that both variables can be considered exogenous.

The results obtained from the estimates presented in Table III, Model (1), show that the growth of TFP in each region is driven by entrepreneurship activity, by the promotion of knowledge, measured through increases in R&D expenditure per capita, by increases in human capital endowment and by the creation of new companies. These results show the fulfilment of the *H1*–*H4* of the previous section, and they endorse the evidence of literature about that the entrepreneurial capital, R&D expenditure and human capital endowment have a positive effect on regional growth.

The estimates obtained from Equation (5a) show that the regional productive efficiency presents inertia. In order to model the trend in productive efficiency, Equation (5b) is formulated. The results of the estimation of this model are presented in Table III, Model (2). From their analysis, it can be deduced that the TFP has a marked dynamism that is captured empirically through its own past value, TFP_{it-1}. In effect, the estimations obtained



Notes: PAT, Patents; AND, Andalusia; CLM, Castile La Mancha; CAT, Catalonia; MAD, Madrid; PV, The Basque country; EXT, Extremadura. The data used are the average of the sample
Source: Compiled by the authors

Figure 4. Relationship between the variables of the model

(see Table III, Model (2)) confirm that the variable TFP_{it-1} is significant and contributes to improving the goodness of fit, since the model as a whole is more adequate than the model without inertial term, corroborated by the AIC statistic.

Since the sample used in the study configures a data panel, Equation (5c) has been specified and estimated in order to capture the possible existence of fixed effects. The results of the estimation are presented in Table III, Model (3). These results confirm the non-existence of fixed effects since both the individual significance of the dummies variables and the joint significance confirm this. In this way, the one specified by Equation (5b), which includes the inertial term and excludes fixed effects, is considered as the basic model of the study.

When differentiating by the size of the company (see Table IV), it is clear that the effect of the creation of firms on the growth of the TFP increases with the size. These results allow conclude that *H5* is satisfied and there are differences in regional economic growth by the size of the new companies. As can be seen, there is a substantial increase in the elasticity of

Variables	Model (1) Coefficients	Model (2) Coefficients	Model (3) Coefficients
Constant	0.002	0.002	–
TEA	0.003**	0.003**	0.003**
R&D	0.491***	0.424***	0.407***
HK	0.054***	0.058***	0.060***
TFP(−1)	–	0.148**	0.120*
F	12.414***	10.527***	11.406***
Dummy region	No	No	Yes
R^2	0.629	0.640	0.652
AIC	−4.238	−4.258	−4.148
No. of observations	221	221	221

Notes: *,**,***Significant at 10, 5 and 1 per cent, respectively

Table III.
Results of the model

Variables	Model (1) Coefficients	Model (2) Coefficients	Model (3) Coefficients	Model (4) Coefficients	Model (5) Coefficients	Model (6) Coefficients
Constant	−0.002	0.000	0.008**	0.012***	0.012***	0.010**
TEA	0.003**	0.004***	0.002*	0.002**	0.002	0.003**
R&D	0.513***	0.541***	0.447**	0.507***	0.535***	0.831***
HK	0.061***	0.052***	0.041**	0.024	0.031*	0.039*
TFP(−1)	0.306***	0.357***	0.138**	0.231***	0.212***	0.006
Without employees	8.085***					
1–2 workers		9.395***				
3–5 workers			72.670***			
6–9 workers				115.740***		
10–19 workers					151.831***	
Over 20 workers						28.564***
R^2	0.573	0.564	0.655	0.643	0.659	0.454
AIC	−4.087	−4.068	−4.302	−4.265	−4.313	−3.842
No. of observations	221	221	221	221	221	221

Notes: *,**,***Significant at 10, 5 and 1 per cent, respectively

Table IV.
Results of the model for different size of firms

new firms with three to five workers compared to new companies without employees and smaller firms. This elasticity continues to grow in line with the size of the firms until it is seen to reduce significantly in larger companies, with more than 20 workers. These results highlight that the size of the firms affects the regional productive efficiency and, far from being linear, the effect presents an inverted U form.

By sectors, the industrial sector is the one that generates the greatest growth in productive efficiency of the region (see Table V), followed by the transport sector while the tourism sector has no effect on the productive efficiency. Therefore, those regions more industrialised and with greater presence of the logistics sector will be regions with greater productivity growth. These results evidence the compliance of *H6* so there are differences in the regional economic growth by the productive sector of the new companies.

Finally, from the estimation of Equation (6), where the technological level of the new firms is an explanatory factor, you can see that this variable is statistically significant (see Table VI). In addition, it can be provided that the effect on the growth of the TFP of new companies with a greater level of technology is substantially higher than in the rest.

Variables	Model (1) Coefficients	Model (2) Coefficients	Model (3) Coefficients	Model (4) Coefficients	Model (5) Coefficients	Model (6) Coefficients
Constant	0.007	0.020	0.005	0.004	0.001	−0.008
TEA	0.004***	0.003**	0.0037***	0.003**	0.004***	0.003**
R&D	0.584***	0.528***	0.557***	0.572***	0.577***	0.452***
HK	0.056***	0.059***	0.051***	0.055***	0.053***	0.045***
TFP(−1)	0.315***	0.295***	0.353***	0.315***	0.382***	0.305***
Industry	50.864**					
Construction		7.924***				
Commerce			26.642***			
Transport				44.827**		
Tourism					6.962	
Other services						15.754***
R^2	0.5527	0.559	0.591	0.550	0.543	0.614
AIC	−4.041	−4.055	−4.132	−4.036	−4.019	−4.189
No. of observations	221	221	221	221	221	221

Notes: **,***Significant at 5 and 1 per cent, respectively

Table V. Results of the model for different productive sector of firms

Variables	Model (1) Coefficients[a]	Model (2) Coefficients
Constant	0.008	0.000
TEA	0.007***	0.002**
R&D	0.076**	0.435***
HK	0.062**	0.056***
TFP(−1)	0.150**	0.147***
Technology	40.731***	
No technology		11.242***
R^2	0.208	0.640
AIC	−3.471	−4.283
No. of observations	221	221

Notes: [a]The variable R&D in this equation is the increase of R&D expenses over GDP. **,***Significant at 5 and 1 per cent, respectively

Table VI. Results of the model for different technology level of firms

This result shows that *H7* is true. Moreover, this result corroborates the evidence that technology catalyses growth in the productive efficiency of the regions and therefore regional economic growth. This result is similar to the result of Dejardin and Fritsch (2011), to whom the knowledge intensity of new companies explains differences in the effect of new business on regional growth.

6. Conclusions

The aim of this paper is to quantify the divergences in regional growth as a result of sectoral differences, firm size and technological level of new firms generated in the regions. For this, a model is specified and estimated in which the TFP of the regions is a function of the business dynamics of each region and its level of entrepreneurship. Likewise, investment in R&D and human capital are included as control variables.

The results obtained corroborate that both the entrepreneurial activity and the creation of new firms have a positive effect on the productive efficiency of the regions. In addition, the stock of human capital and the promotion of technological innovation act as catalysts that favourably influence economic activity overall and, in particular, productive efficiency. In fact, the great importance of the promotion of knowledge in economic growth and, in particular, in productive efficiency is confirmed. Likewise, it is noteworthy that the dynamic part of the model shows the existence of a high inertia in the productive efficiency of the regions.

The differences in the promotion of knowledge, in the quality of the workforce, in the entrepreneurial level and in the business fabric of the regions explain the divergences in the growth and economic development of the regions. Regional advances in efficiency require the promotion of knowledge, which depends on the local emphasis on R&D and education of the workforce. However, two regions with the same level of knowledge can continue to present divergences in their level of economic development if the knowledge is implemented in different productive sectors, such that the most industrialised regions with greater presence of sectors with high- and medium-level technology show a greater level of development.

Finally, the size of the companies can also explain the differences in regional growth, such that regions with a greater proportion of firms without employees or with only one or two workers show a lower level of growth than the regions with larger companies.

From the empirical evidence of the model, important implications for economic policy can be extracted. Thus, if an increase in productivity of a region is desired, the relevant authorities should encourage investment in R&D and investment in education to increase the quality of human capital. The promotion of entrepreneurship may also be important in reducing regional differences, but the results will be more effective when the volume of innovation and knowledge incorporated into new businesses is greater. However, it must be borne in mind that business dynamics are also a factor in regional divergence, such that two regions with the same policies for promoting knowledge can present different economic development. Thus, those regions with a business network not conducive to increasing economic productivity should compensate for this with greater encouragement of innovation and education. Likewise, an increase in the size of companies would be desirable, for which the fiscal, administrative and regulatory barriers that set thresholds for the growth of companies could be eliminated. In this sense, the World Bank Report (2015) identifies these obstacles in the regions of Spain and a future research could extend the analysis to the importance of these regulatory differences in explaining the differences in regional economic growth.

Notes

1. In the words of Audretsch (2007), entrepreneurial activity is the missing link between investment in new knowledge and economic growth.
2. As indicated in the previous section, under the neoclassical hypothesis, the growth of the TFP reflects unincorporated technological progress. However, in practice, the growth of TFP is obtained as a residual that also includes improvements in the efficiency of productivity inputs.
3. All the exogenous variables of the equation are in first differences since the endogenous variable is the rate of variation of the TFP.

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